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Trauma System Report FY2011

Minnesota Department of Health

November 2012



Protecting, maintaining and improving the health of all Minnesotans

November 26, 2012

Minnesota Statute 144.6071 requires the Commissioner of Health to publish an annual report on the state's voluntary trauma system, including comparative demographic and risk-adjusted epidemiological data on designated trauma hospitals. I enclose the first such annual report.

This report has been produced by the Minnesota Department of Health in conjunction with the Statewide Trauma Advisory Council. Trauma admissions data in the report cover all of fiscal year 2011. As the report describes, virtually all trauma care in Minnesota (99 percent of trauma admissions) now occurs at hospitals participating in the statewide trauma system. With this high participation in place, efforts are under way to develop more advanced reporting capabilities through the statewide trauma registry (MNTRAUMA) and to use that data to improve quality and reduce patient morbidity and mortality.

Questions and comments on the report may be directed to the Office of Rural Health and Primary Care at (651) 201-3838.

Sincerely,

A handwritten signature in black ink, appearing to read "Edward P. Ehlinger", is written over a horizontal line.

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Trauma System Report FY2011

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As requested by Minnesota Statute 3.197: This report cost approximately \$1,500 to prepare, including staff time, printing and mailing expenses.

Upon request, this material will be made available in an alternative format such as large print, Braille or cassette tape. Printed on recycled paper.

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Executive Summary

Minnesota established its statewide trauma system in 2005. An inclusive state trauma system reduces death and disability by ensuring the necessary infrastructure to deliver trauma patients to the right hospital, and by coordinating emergency medical and hospital resources to optimize the delivery of trauma care and outcomes. Minnesota's system includes multiple components, including criteria for transport, triage and inter-hospital transfers; designation of hospitals as trauma centers; and a trauma system governance system.

As part of this system, Minnesota Statute 144.6071 also provides that the commissioner of health establish and maintain a central registry of persons who sustain major trauma. Designated trauma hospitals are required to submit information to this statewide registry for all trauma patients. The registry information is used, in part, to publish an annual report. This is the first such report. It has been produced by the Minnesota Department of Health in conjunction with the Statewide Trauma Advisory Council (STAC). Trauma admissions data in the report cover all of fiscal year 2011 (FY2011), but only include data from hospitals designated as of July 1, 2010.

Key findings for Minnesota's trauma patients in FY2011 are as follows:

- **The trauma system has grown from six designated hospitals in August 2005 to 123 as of January 2012.** Only 7 hospitals in Minnesota were undesignated as of January 2012. Of those designated, over half (82 hospitals) are Level IV trauma centers and roughly a quarter (32 hospitals) are Level III. There are four Level I centers and 5 Level II hospitals. **Virtually all trauma care in Minnesota (99 percent of trauma admissions) now occurs at hospitals participating in the statewide trauma system.**
- Now that most hospitals in the state are participating and reporting trauma cases to the state trauma registry, MNTRAUMA, the process of improving data reporting and quality is underway. In the future, the state trauma registry will provide a rich source of information that will enable the evaluation of system performance, and the development of outcomes based clinical guidelines.

Introduction

A system approach to trauma care is the best means to protect the public from premature death and prolonged disability from severe injury. For a severely injured person, the time between sustaining an injury and receiving definitive care is the most important predictor of survival—the “golden hour.” A trauma system ensures that the necessary infrastructure is in place to deliver the right patient to the right hospital, and emergency medical and hospital resources are effectively coordinated to optimize the delivery of trauma care and outcomes. Trauma systems reduce death and disability by identifying the causes of injury, promoting prevention initiatives, and by ensuring that the resources required for optimal trauma care are available when and where they are needed.

The Minnesota Legislature and Governor established the state’s voluntary trauma system with the passage of legislation in 2005. Framers of the Minnesota Trauma System envisioned a phased approach to building the system, beginning with a solid system infrastructure, progressing to data-driven quality improvement, and resulting in outcome-based clinical guidelines and significant statewide reduction in trauma deaths. Specifically, Minnesota Statutes 144.603 and 144.605 provide, in part, that the Commissioner of Health:

- Adopt criteria to ensure that severely injured people are promptly transported and treated at trauma hospitals appropriate to the severity of injury;
- Adopt minimum criteria to address emergency medical service trauma triage and transportation guidelines as approved under Minnesota Statutes 144E.101, subdivision 14, as well as designation of hospitals as trauma hospitals, inter-hospital transfers, a trauma registry, and a trauma system governance structure;
- Adapt and modify the standards as appropriate to accommodate Minnesota’s unique geography and the state’s hospital and health professional distribution and verify that the criteria are met by each hospital voluntarily participating in the statewide trauma system;
- Establish a state trauma advisory council (STAC) to advise, consult with, and make recommendations on the development, maintenance and improvement of the statewide trauma system; and
- Appoint, as needed, up to eight regional trauma advisory councils (RTACs) to advise, consult with, and make recommendations to the STAC on regional modifications to the statewide trauma criteria that will improve patient care and accommodate specific regional needs.

In addition, Minnesota Statute 144.6071 provides that the commissioner establish and maintain a central registry of persons who sustain major trauma. Trauma hospitals are required to submit information to this statewide registry for all trauma patients. The registry information is used, in part, to publish an annual report, as follows:

The commissioner shall use the registry to annually publish a report that includes comparative demographic and risk-adjusted epidemiological data on designated trauma hospitals. Any analyses or reports that identify providers may only be published after the provider has been provided the opportunity by the commissioner to review the underlying data and submit comments. The provider shall have 21 days to review the data for accuracy.

This is the first such annual report. It has been produced by the Minnesota Department of Health in conjunction with the Statewide Trauma Advisory Council (STAC). Trauma admissions data in the report cover all of fiscal year 2011 (FY2011), but only include data from hospitals designated as of July 1, 2010.

This report relies primarily on billing data from the Minnesota Hospital Association (MHA). Subsequent reports will benefit from more detailed data from the statewide trauma registry, also known as MNTRAUMA. When fully developed, MNTRAUMA will provide a rich source of data for clinical and system quality improvement, injury prevention, treatment, and rehabilitation programs. Because most designated trauma hospitals have only recently begun reporting to MNTRAUMA, however, that dataset does not currently serve as a complete source for reporting on trauma on a statewide basis. Therefore, for this initial annual report, trauma is identified in the MHA billing data by applying the MNTRAUMA inclusion criteria described in Appendix 3. These data allow for a broad picture of the statewide trauma burden, but without the clinical specificity that will be possible with the further development of the MNTRAUMA system and quality improvement resources dedicated to its analysis and reporting.

Growth of the Trauma System

The statewide trauma system in Minnesota has grown exponentially since its inception, from six hospitals officially designated in August 2005 to a total of 101 designated trauma hospitals at the beginning of FY2011 and 123 as of December 2011 (Table 1). A full list of these hospitals is located in Appendix 1.

Table 1: Hospitals designated as trauma centers

| Designation Level | As of July 01, 2010 | As of January 1, 2012 |
|-------------------|---------------------|-----------------------|
| Level 1 | 4 | 4 |
| Level 2 | 5 | 5 |
| Level 3 | 31 | 32 |
| Level 4 | 61 | 82 |
| Undesignated | 29 | 7 |
| Total | 130 | 130 |

Below is a brief summary of the designation levels; see Appendix for a more detailed description:

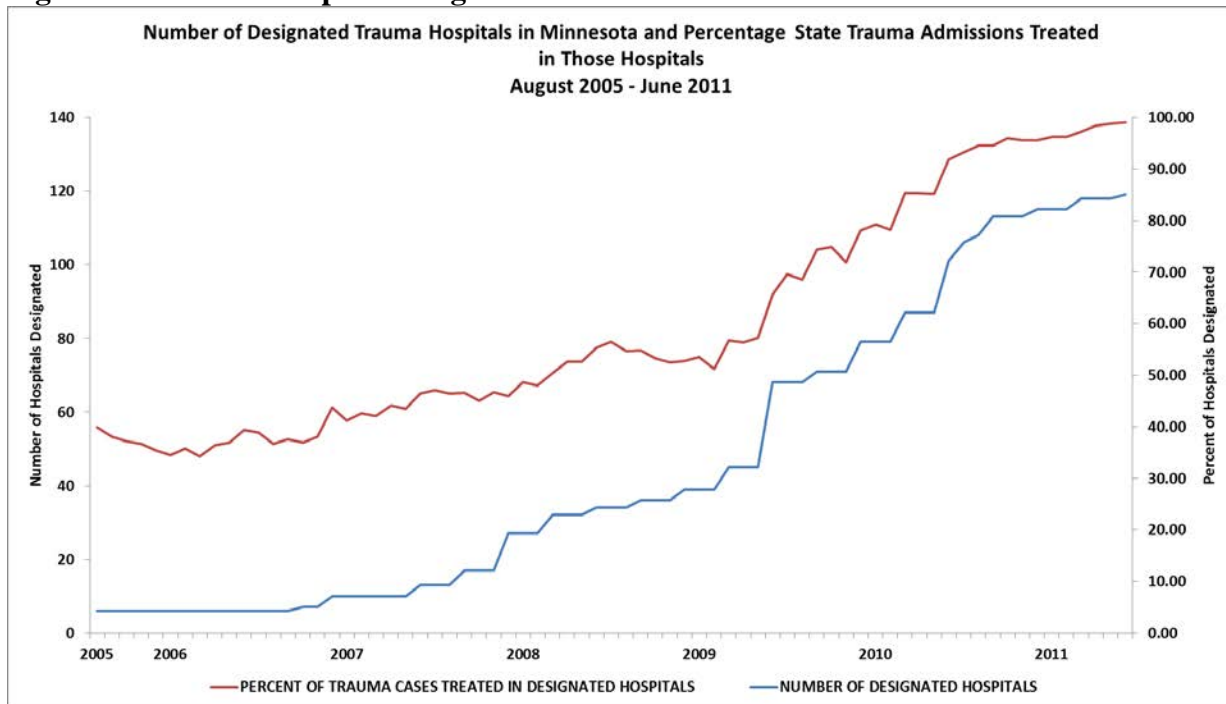
- **Level I:** A level I trauma hospital can provide definitive care for any trauma patient. It provides the injured patient with access to the most comprehensive resources for their treatment. The trauma critical care service, also known as the intensive care unit, is under the direction of a surgeon. Level I trauma hospitals often receive severely injured patients referred from lower level trauma centers.
- **Level II:** A level II trauma hospital provides definitive care for many complex and severely injured patients. Like the level I trauma hospital, the emergency physician and general surgeon are immediately available to the trauma patient. While several specialists

and surgical subspecialists are available, fewer are required for a level II designation than for level I.

- **Level III:** A level III trauma center can provide initial resuscitation and stabilization of the trauma patient. A general surgeon is available within 30 minutes to assist with the resuscitation and to provide surgical intervention. Since the level III trauma hospital provides some degree of orthopedic surgery and has a fully-prepared intensive care unit, it may admit some trauma patients and care for them definitively; however, complex patients and those requiring surgical subspecialties must be transferred to level I or II trauma hospitals.
- **Level IV:** A level IV trauma hospital provides initial resuscitation and stabilization to the severely injured patient. Surgical services are not immediately available so patients are typically transferred to a higher level facility for definitive care. Emergency department personnel have trauma-specific training and protocols are in place to facilitate the rapid management of the patient.

There are significant differences in the patient populations served by each designation level. *Because of these differences in patient load, severity and circumstances, and because patients can be seen at multiple hospitals of different designation levels for the same traumatic incident, direct comparisons of outcome or performance measures between designation levels cannot be made using these data.*

Figure 1: Trend in Hospital Designation 2005-2011



*Source: Uniform billing data provided by the Minnesota Hospital Association (MHA).

In August of 2005, only 40 percent of trauma admissions occurred in designated trauma centers. Since then, this percentage has steadily increased, and by June 2011, 99 percent of trauma admissions were to designated hospitals (Figure 1).

Virtually all trauma care in Minnesota (99%) now occurs at participating trauma system hospitals. These designated hospitals have organizational commitment from all levels of management and staff to provide trauma care commensurate to their capabilities, and to appropriately transfer patients who need higher levels of care. Designated trauma hospitals must also collect and analyze data on all trauma patients who are treated and transferred to or from their facility, and must identify strategies to improve patient care.

This increase in trauma admissions to designated hospitals is important because patients treated at hospitals participating in inclusive statewide trauma systems have significantly greater odds of survival compared to hospitals not participating in inclusive statewide trauma systems.¹

It must be noted that designations are only the first step to achieving a mature trauma system that ultimately improves statewide survival results. Focused quality measurement, analysis, and reporting on trauma care and outcomes will be necessary to realize the full benefits of a trauma system.

Historical Trends in Trauma in Minnesota: January 2004 – June 2011

To provide historical context, this section provides information on Minnesota trauma admissions from calendar year 2004 through June 2011. This represents the earliest time period for which sufficient statewide trauma data is available, and covers the entire time the statewide trauma system has been in place (since August 2005) as well the year before its inception.

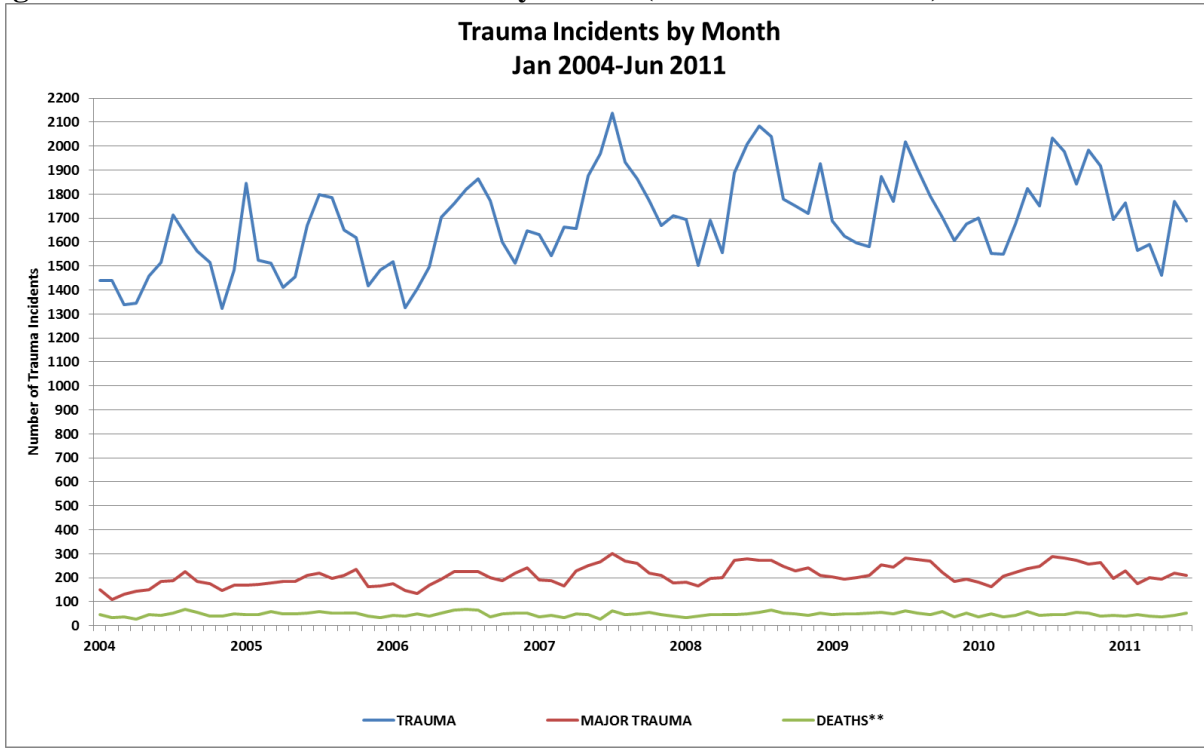
Figure 2 depicts monthly counts of trauma incidents resulting in a hospital admission from January 2004 through June 2011. It includes all trauma cases that satisfy MNTRAUMA inclusion criteria, as well the subsets of major trauma (defined as a medically treated injury with an Injury Severity Score (ISS) greater than 15)² and trauma deaths. The overall monthly average for trauma incidents was 1,684, with a minimum of 1,324 in November 2004 and a maximum of 2,137 in July 2007. Major trauma incidents had a much lower monthly average, at 210 per month, with a minimum of 108 in February 2004 and a maximum of 300 in July 2007. The average number of trauma deaths per month was 47, with a minimum of 28 in April 2004 and June 2007, and a maximum of 68 in August 2004. All trauma types exhibited seasonal variation, with peaks in mid-summer and low points in mid- to late-winter.

¹Utter GH, Maier RV, Rivara FP, Mock CN, Jurkovich GJ, Nathens AB. Inclusive trauma systems: do they improve triage or outcomes of the severely injured? *J Trauma* 2006 Mar; 60(3): 529-35.

² Injury Severity Score (ISS) > 15. The Injury Severity Score is a summary measure used to characterize the condition of patients with multiple injuries. The definition of Major Trauma as having ISS > 15 is an industry standard, which makes it useful for comparison to other datasets, but the clinical significance of that definition is a question still being debated in the academic community. For further information see:

- Baker SP et al, "The Injury Severity Score: a method for describing patients with multiple injuries and evaluating emergency care", *J Trauma* 14:187-196; 1974.
- Palmer. "Major Trauma and the Injury Severity Score – Where Should We Set the Bar?" *Annu Proc Assoc Adv Automot Med.* 51:13-29; 2007.

Figure 2: Trend in Trauma Incidents by Month (Jan 2004 – Jun 2011)*



*Includes only trauma resulting in a hospital admission to hospitals designated before July 1, 2010

** Excludes deaths occurring at the scene and deaths resulting from latent effects of injury and occurring after discharge from the final acute care hospital.

Current Trends in Trauma in Minnesota: July 2010 – June 2011

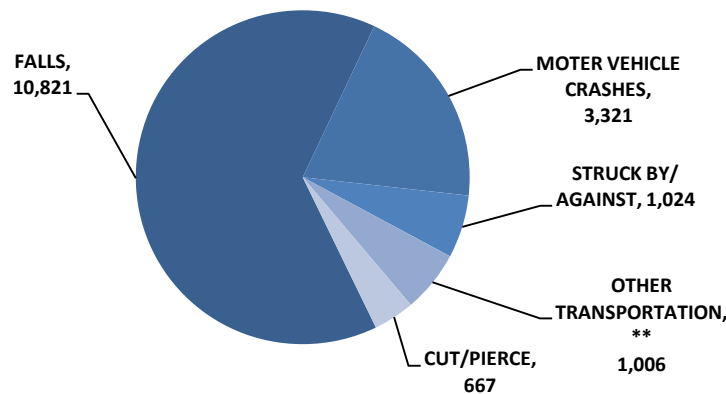
During fiscal year 2011, Minnesota had 22,802 trauma hospital admissions. Of these, 3,157 (14 percent) were classified as major trauma and 549 (2.4 percent) resulted in death. Of all trauma admissions, 1,801 (8 percent) occurred among children under 15, and 10,050 (44 percent) occurred among patients 65 and older. Table 2 shows overall admissions by severity level, according to the Injury Severity Score (ISS) system. “Major Trauma” includes all trauma with an ISS score greater than 15. The higher the ISS score, the more severe the injury.³

| Table 2: Statewide Trauma Admissions by ISS Category – FY2011 Statewide | | | | |
|--|------------------------------------|--------------------------------------|-------------------------------------|--------------|
| SELECTED VARIABLES | Severity Level I (ISS 0-15) | Severity Level II (ISS 16-24) | Severity Level III (ISS 25+) | TOTAL |
| Trauma counts July 1, 2010 through June 30, 2011 | | | | |
| TRAUMA (STATE INCLUSION CRITERIA) | 19,645 | 2,472 | 685 | 22,802 |
| TRAUMA DEATHS | 249 | 182 | 118 | 549 |
| TRAUMA AGES 14 AND UNDER | 1,640 | 130 | 31 | 1,801 |
| TRAUMA AGES 65 AND OVER | 8,763 | 1,110 | 177 | 10,050 |
| TRANSFER TYPE | | | | |
| TRANSFERRED IN | 2,710 | 559 | 115 | 3,384 |
| TRANSFERRED OUT | 4,084 | 439 | 86 | 4,609 |
| BOTH | 49 | 6 | 1 | 56 |
| NOT TRANSFERRED | 12,802 | 1,468 | 483 | 14,753 |
| TOP FIVE OVERALL INJURY CAUSES | | | | |
| FALLS | 9,436 | 1,217 | 168 | 10,821 |
| MOTER VEHICLE CRASHES | 2,497 | 529 | 295 | 3,321 |
| STRUCK BY/ AGAINST | 882 | 120 | 22 | 1,024 |
| OTHER TRANSPORTATION | 838 | 130 | 38 | 1,006 |
| CUT/PIERCE | 640 | 8 | 19 | 667 |
| TOP FIVE OVERALL INJURY TYPES | | | | |
| HIP FRACTURE | 2,613 | 26 | 10 | 2,649 |
| LOWER LEG/ANKLE FRACTURE | 2,168 | 32 | 9 | 2,209 |
| TYPE 1 TBI (INTERNAL) | 692 | 1,216 | 109 | 2,017 |
| SHOULDER/UPPER ARM FRACTURE | 1,208 | 31 | 7 | 1,246 |
| PELVIS/UROGENITAL FRACTURE | 970 | 54 | 20 | 1,044 |
| DISCHARGE DISPOSITIONS | | | | |
| UNKNOWN | 150 | 28 | 7 | 185 |
| TRANSFER - CRITICAL ACCESS HOSPITAL | 276 | 11 | 6 | 293 |
| SWING BED | 339 | 28 | 8 | 375 |
| EXPIRED | 249 | 182 | 118 | 549 |
| OTHER | 479 | 93 | 67 | 639 |
| INPATIENT REHABILITATION FACILITY | 392 | 260 | 82 | 734 |
| TRANSFER - HOME HEALTH | 836 | 116 | 17 | 969 |
| TRANSFER - ACUTE CARE HOSPITAL | 3,857 | 434 | 81 | 4,372 |
| TRANSFER - SKILLED NURSING FACILITY | 5,170 | 412 | 89 | 5,671 |
| HOME | 7,897 | 908 | 210 | 9,015 |

³For this report, Major Trauma is further divided into two categories (16-24 and 25+) based on recommendations of the STAC. These subcategories are for reporting purposes only, as ISS exists on a continuum and treatment modalities and outcomes are dependent on the specifics of any given injury.

Falls were the most common primary cause of trauma, resulting in 10,821 admissions (64 percent). The second most common cause was motor vehicle crashes with 3,321 admissions (20 percent), followed by incidents involving an individual being struck by or against something, other transportation, and incidents involving an individual being cut or pierced by something (Figure 3).

Figure 3: Top Five Primary Causes of Trauma⁴

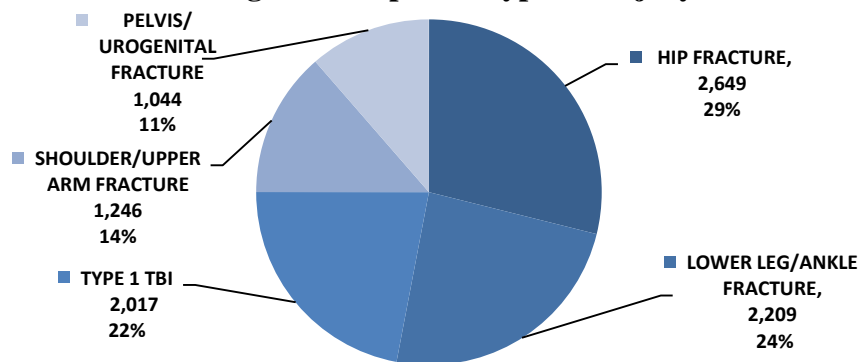


*Injury cause was determined using ICD-9-CM external cause codes as categorized by the CDC: http://www.cdc.gov/injury/wisqars/ecode_matrix.html

***"Other transportation" includes accidents involving trains, snowmobiles, off-road vehicles, bicycle collisions, watercraft and riding animals.

A substantial majority of trauma admissions are caused by falls and motor vehicle crashes, but injury locations and types vary according to the specific injury circumstances. The most common types of injuries were hip fractures, with 2,649 admissions (29 percent), followed by lower leg/ankle fractures with 2,209 admissions (24 percent), Type I Traumatic Brain Injuries (TBIs) with 2,017 admissions (22 percent), shoulder/upper arm fractures with 1,246 admissions (14 percent), and pelvis/urogenital fractures with 1,044 admissions (11 percent).⁵ Falls accounted for over 60% of each of the top five injury types, and for 54% of all injury types combined.

Figure 4: Top Five Types of Injury



⁴ For a complete definition of the types of injury included in each category, see the ICD-9-CM external cause codes as categorized by the Centers for Disease Control (CDC): http://www.cdc.gov/injury/wisqars/ecode_matrix.html.

⁵ For a complete definition of injury types please see the [Barell Injury Diagnosis Matrix](http://www.cdc.gov/nchs/data/ice/final_matrix_post_ice.pdf) used by the Centers for Disease Control. http://www.cdc.gov/nchs/data/ice/final_matrix_post_ice.pdf

Trauma admissions were distributed differently according to age group and gender. There were more trauma admissions for male patients under the age of 70 than for female patients, while there were more trauma admissions for female patients 70 and older than for males. The spike in trauma admissions for older females can be partially explained by the fact that there are more females than males in the general population of people 70 and over. For females, trauma admissions peaked substantially in the 80-to-89 age group (Figure 5), a trend largely driven by trauma admissions resulting from falls (Figure 6). Trauma admissions resulting from motor vehicle traffic peaked for both males and females in the 20-29 age group, with more admissions among males than females for patients under 70 years of age (Figure 7).

Figure 5: Trauma by Age and Sex

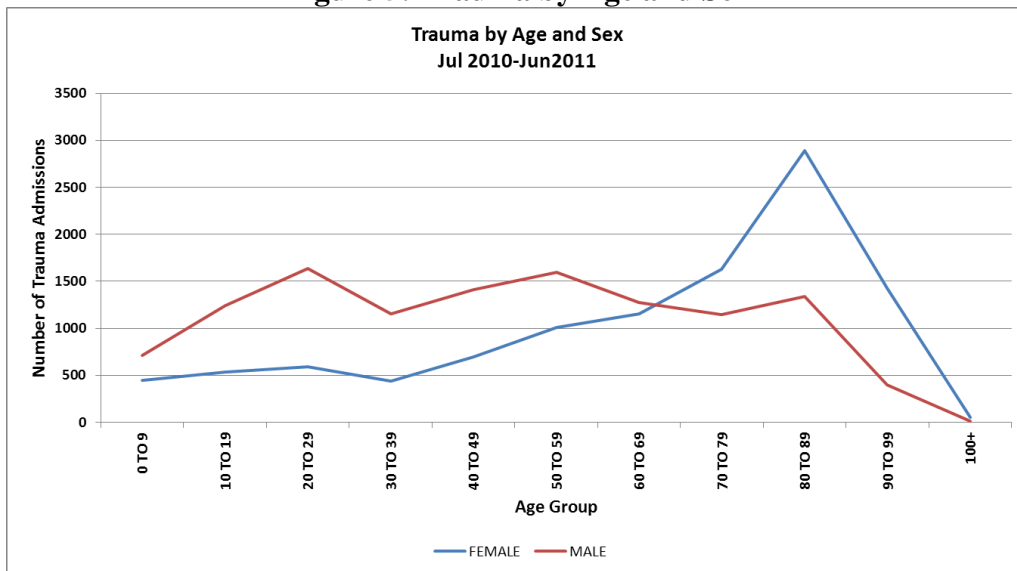


Figure 6: Trauma Caused by Falls

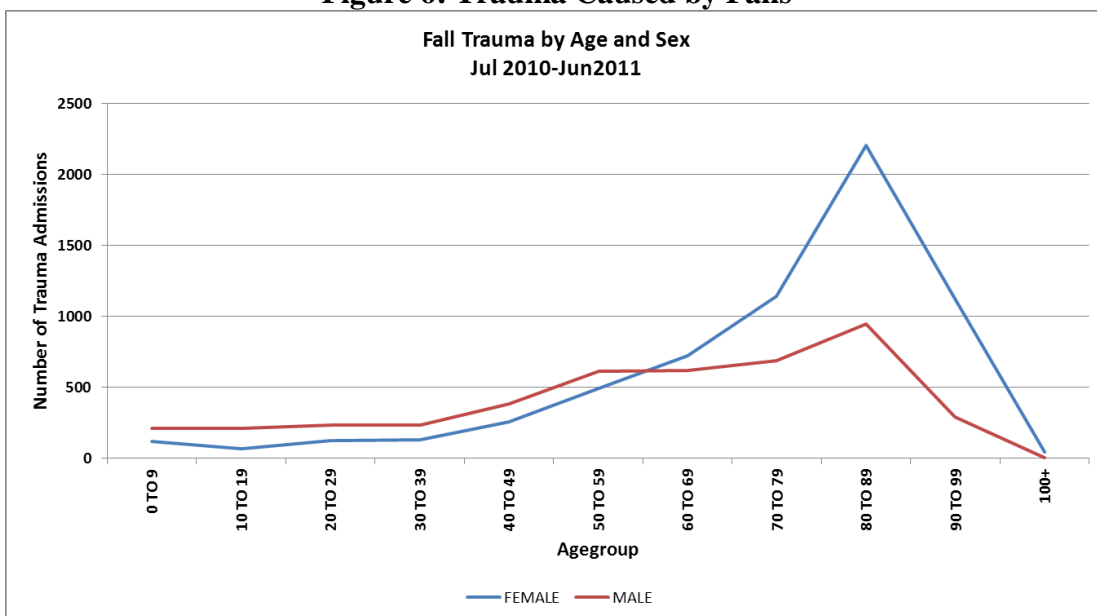
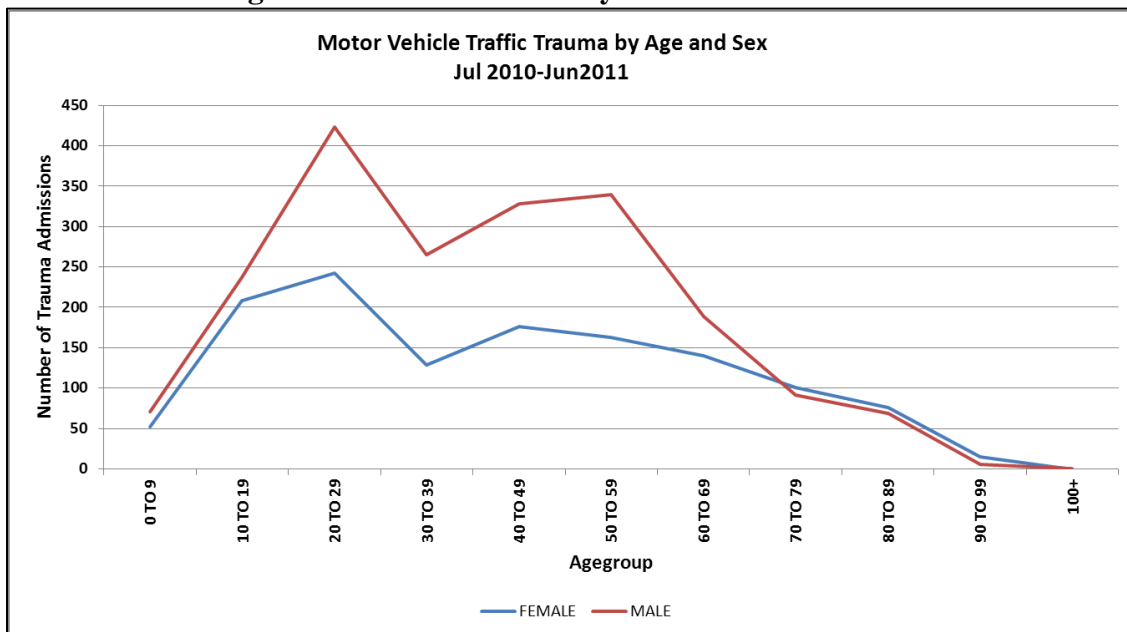
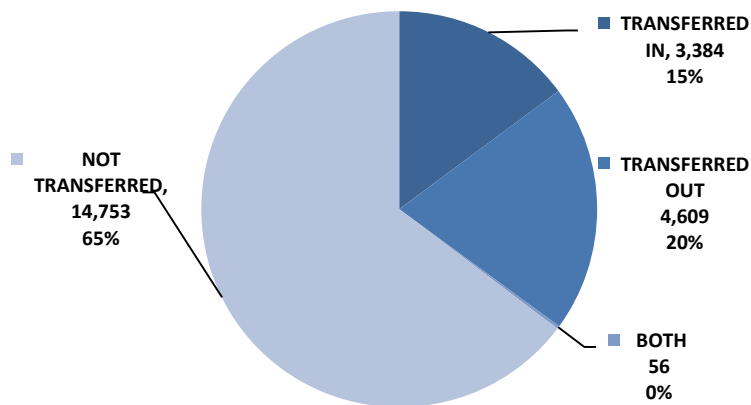


Figure 7: Trauma Caused by Motor Vehicle Traffic



Trauma transfers can involve both “transfers in” to an acute care hospital and “transfers out” to another acute care hospital. Additionally, a patient could be both transferred in and transferred out of a facility. In FY2011, the majority of trauma admissions (65 percent) did not involve a transfer (either in or out of the acute care hospital from which the record was generated). A total of 4,609 (20 percent) trauma admissions were transferred out; 3,384 (15 percent) were transferred in; and 56 (<1 percent) were both transferred in and transferred out (Figure 8).⁶

Figure 8: Trauma Transfers



***Transfers out include patients transferred to any acute care hospital, including Critical Access Hospitals.**

⁶There is not a direct correlation in the total number of transfers in and transfers out because some patients are transferred to out-of-state trauma centers (e.g., to Level II trauma centers in Sioux Falls SD, Fargo ND, and Grand Forks ND). Comparable patient data for these out-of-state transfers is not available.

Injury cause is an important measure to consider when retrospectively evaluating trauma transfer and treatment decisions because it may indicate effective intervention strategies. As noted earlier, falls were the most common primary cause of trauma in FY2011, resulting in 10,821 admissions (64 percent). The second most common cause was motor vehicle crashes with 3,321 admissions (20 percent), followed by incidents involving an individual being struck by or against something, other transportation incidents, and incidents involving an individual being cut or pierced by something (Figure 8).

In the MHA data set, only short-term outcome indicators exist in the form of discharge location, providing limited indication of the care needed after acute injury. These data indicate that in FY2011, the most common discharge was to home (40 percent). One quarter (5,671) of admissions resulted in transfer to a skilled nursing facility, 4,372 (19 percent) resulted in transfer to an acute care hospital (see also Figure 9, which addresses transfers out from Critical Access Hospitals specifically). The remaining discharge dispositions each represented less than 5 percent of all trauma admissions (Figure 9). As the Trauma System and MNTRAUMA continues to mature, patient outcomes will be better reported using longitudinally representative samples of trauma cases to improve long-term outcomes.

Figure 9: Discharge Dispositions

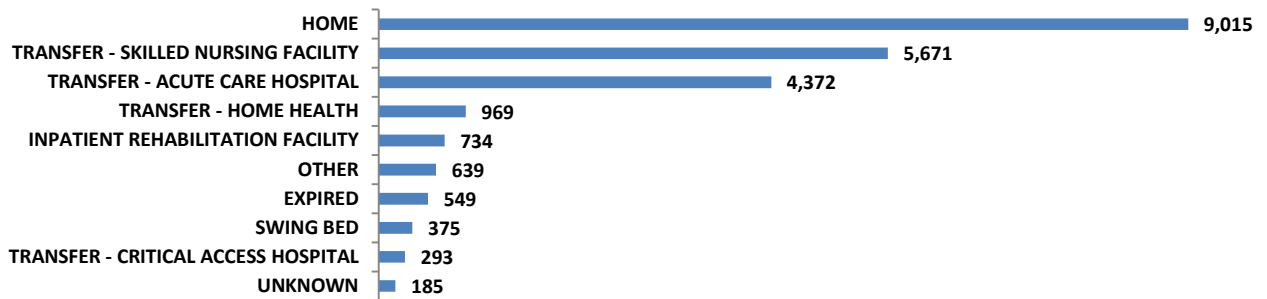
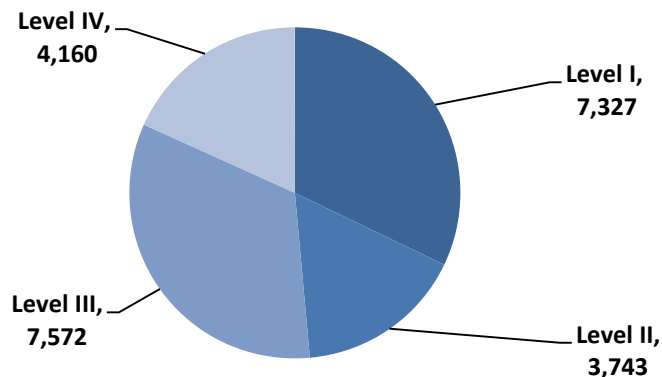


Figure 10 shows the number of trauma admissions at each designation level. Trauma hospitals in Minnesota are designated as levels I, II, III or IV. These designations are based on the availability of resources needed to resuscitate and care for an injured patient. The levels refer only to resources and do not suggest a ranking of the quality of care. Rather, all designated trauma hospitals are expected to provide high quality trauma care consistent with currently-accepted standards of practice.

Figure 10: Trauma Admissions by Designation Level



Level I Trauma Admissions

There were four level I trauma centers designated in Minnesota at the beginning of FY2011, with a total of 7,327 trauma admissions, representing 32 percent of the total trauma admissions to all designated hospitals. Of those, 5,762 (79 percent) were not classified as major trauma (ISS score 0-15), 1,125 (15 percent) were classified as major trauma with an ISS severity score of 16-24, and 440 (6 percent) had a major trauma ISS severity score over 25. There were 1,478 admissions that were transferred into level I designated hospitals, while only 141 admissions were transferred out of level I hospitals.

Overall, falls were the most common cause of injury among level I trauma admissions, followed by motor vehicle crashes. Motor vehicle crashes were the most common cause of admissions in the ISS 25+ category. The most common injury type was internal Type I TBIs, followed by lower leg/ankle fractures. Of the admissions to level I facilities, 4,283 admissions (58 percent) resulted in discharges to the patient's home.

Table 3: Level I Trauma Admissions by ISS Category – FY2011

| Level I | | | | |
|---|------------------------------------|--------------------------------------|-------------------------------------|--------------|
| SELECTED VARIABLES | Severity Level I (ISS 0-15) | Severity Level II (ISS 16-24) | Severity Level III (ISS 25+) | TOTAL |
| Trauma counts for July 1, 2010 through June 30, 2011 | | | | |
| TRAUMA (STATE INCLUSION CRITERIA) | 5,762 | 1,125 | 440 | 7,327 |
| TRAUMA DEATHS | 88 | 102 | 98 | 288 |
| TRAUMA AGES 14 AND UNDER | 506 | 64 | 24 | 594 |
| TRAUMA AGES 65 AND OVER | 1,664 | 393 | 87 | 2,144 |
| TRANSFER TYPE | | | | |
| TRANSFERRED IN | 1,119 | 281 | 78 | 1,478 |
| TRANSFERRED OUT | 124 | 11 | 6 | 141 |
| BOTH | 9 | 3 | 1 | 13 |
| NOT TRANSFERRED | 4,510 | 830 | 355 | 5,695 |
| TOP FIVE OVERALL INJURY CAUSES | | | | |
| FALLS | 2,252 | 464 | 90 | 2,806 |
| MOTER VEHICLE CRASHES | 983 | 345 | 241 | 1,569 |
| STRUCK BY/ AGAINST | 311 | 58 | 13 | 382 |
| OTHER TRANSPORTATION | 288 | 64 | 23 | 375 |
| FIRE/BURN | 333 | 8 | 1 | 342 |
| TOP FIVE OVERALL INJURY TYPES | | | | |
| TYPE 1 TBI (INTERNAL) | 390 | 399 | 79 | 868 |
| LOWER LEG/ANKLE FRACTURE | 660 | 25 | 9 | 694 |
| TYPE 1 TBI (FRACTURE) | 224 | 149 | 89 | 462 |
| HIP FRACTURE | 378 | 10 | 10 | 398 |
| THORAX (INTERNAL) | 183 | 78 | 38 | 299 |
| DISCHARGE DISPOSITIONS | | | | |
| HOME | 3,613 | 527 | 143 | 4,283 |
| TRANSFER - ACUTE CARE HOSPITAL | 132 | 14 | 6 | 152 |
| TRANSFER - SKILLED NURSING FACILITY | 1,269 | 183 | 54 | 1,506 |
| TRANSFER - HOME HEALTH | 295 | 49 | 11 | 355 |
| TRANSFER - CRITICAL ACCESS HOSPITAL | 1 | 0 | 1 | 2 |
| SWING BED | 45 | 11 | 3 | 59 |
| INPATIENT REHABILITATION FACILITY | 145 | 162 | 67 | 374 |
| EXPIRED | 88 | 102 | 98 | 288 |
| OTHER | 120 | 64 | 52 | 236 |
| UNKNOWN | 54 | 13 | 5 | 72 |

Level II Trauma Admissions

There were five level II trauma centers at the beginning of FY2011, with a total of 3,743 trauma admissions, representing 16 percent of the total trauma admissions to all designated facilities. Of those, 3,213 (89 percent) were not classified as major trauma (ISS severity score 0-15), 540 (14 percent) were major trauma with an ISS severity score of 16-24, and 80 (2 percent) had a major trauma ISS severity score over 25. There were 1,249 admissions that were transferred into level II designated hospitals, while only 155 admissions were transferred out of level II hospitals.

Overall, falls were the most common cause of injury among level II trauma admissions, followed by motor vehicle crashes. The most common injury type at level II hospitals was hip fractures, followed by lower leg/ankle fractures. Of the admissions to level II facilities, 1,835 (49 percent) admissions resulted in discharges to the patient's home.

Table 4: Level II Trauma Admissions by ISS Category – FY2011

| SELECTED VARIABLES | Severity Level I (ISS 0-15) | Severity Level II (ISS 16-24) | Severity Level III (ISS 25+) | TOTAL |
|---|------------------------------------|--------------------------------------|-------------------------------------|--------------|
| Trauma counts for July 1, 2010 through June 30, 2011 | | | | |
| TRAUMA (STATE INCLUSION CRITERIA) | 3,213 | 540 | 80 | 3,743 |
| TRAUMA DEATHS | 48 | 40 | 11 | 99 |
| TRAUMA AGES 14 AND UNDER | 224 | 17 | 2 | 243 |
| TRAUMA AGES 65 AND OVER | 1,382 | 216 | 26 | 1,624 |
| TRANSFER TYPE | | | | |
| TRANSFERRED IN | 1,031 | 188 | 30 | 1,249 |
| TRANSFERRED OUT | 138 | 15 | 2 | 155 |
| BOTH | 19 | 2 | 0 | 21 |
| NOT TRANSFERRED | 2,025 | 245 | 48 | 2,318 |
| TOP FIVE OVERALL INJURY CAUSES | | | | |
| FALLS | 1,425 | 207 | 21 | 1,653 |
| MOTER VEHICLE CRASHES | 361 | 63 | 20 | 444 |
| OTHER TRANSPORTATION | 150 | 31 | 4 | 185 |
| STRUCK BY/AGAINST | 133 | 17 | 1 | 151 |
| CUT/PIERCE | 108 | 0 | 0 | 108 |
| TOP FIVE OVERALL INJURY TYPES | | | | |
| HIP FRACTURE | 412 | 4 | 0 | 416 |
| LOWER LEG/ANKLE FRACTURE | 373 | 5 | 0 | 378 |
| TYPE I TBI (INTERNAL) | 101 | 237 | 16 | 354 |
| SHOULDER/UPPER ARM FRACTURE | 210 | 4 | 2 | 216 |
| THORAX (FRACTURE) | 105 | 26 | 2 | 133 |
| DISCHARGE DISPOSITIONS | | | | |
| HOME | 1,625 | 183 | 27 | 1,835 |
| TRANSFER - ACUTE CARE HOSPITAL | 155 | 17 | 2 | 174 |
| TRANSFER - SKILLED NURSING FACILITY | 900 | 84 | 17 | 1,001 |
| TRANSFER - HOME HEALTH | 149 | 24 | 1 | 174 |
| TRANSFER - CRITICAL ACCESS HOSPITAL | 2 | 0 | 0 | 2 |
| SWING BED | 67 | 7 | 2 | 76 |
| INPATIENT REHABILITATION FACILITY | 160 | 75 | 15 | 250 |
| EXPIRED | 48 | 40 | 11 | 99 |
| OTHER | 78 | 11 | 3 | 92 |
| UNKNOWN | 29 | 9 | 2 | 40 |

Level III Trauma Admissions

Minnesota had 31 designated level III trauma centers at the beginning of FY2011, with a total of 7,572 trauma admissions, representing 33 percent of the total trauma admissions to all designated facilities. Of those, 6,840 (90 percent) were in the 0-15 ISS category, 648 (9 percent) were in the 16-24 ISS category, and 84 (1 percent) were in the 25+ ISS category. There were 498 admissions

that were transferred into level III designated hospitals, and 1,473 admissions were transferred out of level III hospitals.

Overall, falls were the most common cause of injury among level III trauma admissions, followed by motor vehicle crashes. The most common injury type was hip fractures, followed by lower leg/ankle fractures. Of the admissions to level III facilities, 2,595 (34 percent) resulted in discharges to skilled nursing facilities, 2,242 (30 percent) resulted in discharges to home, and 1,708 (23 percent) were discharged to another acute care hospital.

Table 5: Level III Trauma Admissions by ISS Category – FY2011

| SELECTED VARIABLES | Severity Level I (ISS 0-15) | Severity Level II (ISS 16-24) | Severity Level III (ISS 25+) | TOTAL |
|---|------------------------------------|--------------------------------------|-------------------------------------|--------------|
| Trauma counts for July 1, 2010 through June 30, 2011 | | | | |
| TRAUMA (STATE INCLUSION CRITERIA) | 6,840 | 648 | 84 | 7,572 |
| TRAUMA DEATHS | 82 | 36 | 4 | 122 |
| TRAUMA AGES 14 AND UNDER | 583 | 36 | 3 | 622 |
| TRAUMA AGES 65 AND OVER | 3,794 | 382 | 35 | 4,211 |
| TRANSFER TYPE | | | | |
| TRANSFERRED IN | 498 | 88 | 7 | 593 |
| TRANSFERRED OUT | 1,473 | 215 | 30 | 1,718 |
| BOTH | 8 | 1 | 0 | 9 |
| NOT TRANSFERRED | 4,861 | 344 | 47 | 5,252 |
| TOP FIVE OVERALL INJURY CAUSES | | | | |
| FALLS | 3,855 | 401 | 33 | 4,289 |
| MOTER VEHICLE CRASHES | 639 | 71 | 19 | 729 |
| STRUCK BY/ AGAINST | 236 | 30 | 3 | 269 |
| OTHER TRANSPORTATION | 240 | 24 | 2 | 266 |
| CUT/PIERCE | 113 | 0 | 6 | 119 |
| TOP FIVE OVERALL INJURY TYPES | | | | |
| HIP FRACTURE | 1,242 | 9 | 0 | 1,251 |
| LOWER LEG/ANKLE FRACTURE | 766 | 2 | 0 | 768 |
| TYPE 1 TBI (INTERNAL) | 139 | 438 | 9 | 586 |
| SHOULDER/UPPER ARM FRACTURE | 518 | 4 | 0 | 522 |
| PELVIS/UROGENITAL FRACTURE | 386 | 6 | 0 | 392 |
| DISCHARGE DISPOSITIONS | | | | |
| HOME | 2,037 | 178 | 27 | 2,242 |
| TRANSFER - ACUTE CARE HOSPITAL | 1,463 | 216 | 29 | 1,708 |
| TRANSFER - SKILLED NURSING FACILITY | 2,456 | 129 | 10 | 2,595 |
| TRANSFER - HOME HEALTH | 347 | 40 | 2 | 389 |
| TRANSFER - CRITICAL ACCESS HOSPITAL | 18 | 0 | 1 | 19 |
| SWING BED | 94 | 5 | 0 | 99 |
| INPATIENT REHABILITATION FACILITY | 59 | 21 | 0 | 80 |
| EXPIRED | 82 | 36 | 4 | 122 |
| OTHER | 228 | 17 | 11 | 256 |
| UNKNOWN | 56 | 6 | 0 | 62 |

Level IV Trauma Admissions

Minnesota had 61 level IV trauma centers at the start of FY2011, 59 of which reported data to MHA. These hospitals had 4,160 trauma admissions, representing 18 percent of trauma admissions to designated facilities. Of those, 3,830 (92 percent) were non-major trauma (ISS severity score 0-15), 249 (6 percent) were major trauma with an ISS severity score between 16-24, and 81 (2 percent) were major trauma with an ISS score over 25. There were 64 admissions transferred into level IV designated hospitals, and 2,595 admissions were transferred out.

Overall, falls were the most common cause of injury, followed by motor vehicle crashes. The most common injury type was hip fractures, followed by lower leg/ankle fractures. Of the admissions, 2,338 (56 percent) resulted in discharges to another acute care hospital.

Table 6: Level IV Trauma Admissions by ISS Category – FY2011

| SELECTED VARIABLES | Severity Level I (ISS 0-15) | Severity Level II (ISS 16-24) | Severity Level III (ISS 25+) | TOTAL |
|---|-----------------------------|-------------------------------|------------------------------|-------|
| Trauma counts July 1, 2010 through June 30, 2011 | | | | |
| TRAUMA (STATE INCLUSION CRITERIA) | 3,830 | 249 | 81 | 4,160 |
| TRAUMA DEATHS | 31 | 4 | 5 | 40 |
| TRAUMA AGES 14 AND UNDER | 327 | 13 | 2 | 342 |
| TRAUMA AGES 65 AND OVER | 1,923 | 119 | 29 | 2,071 |
| TRANSFER TYPE | | | | |
| TRANSFERRED IN | 62 | 2 | 0 | 64 |
| TRANSFERRED OUT | 2,349 | 198 | 48 | 2,595 |
| BOTH | 13 | 0 | 0 | 13 |
| NOT TRANSFERRED | 1,406 | 49 | 33 | 1,488 |
| TOP FIVE OVERALL INJURY CAUSES | | | | |
| FALLS | 1,904 | 145 | 24 | 2,073 |
| MOTER VEHICLE CRASHES | 514 | 50 | 15 | 579 |
| STRUCK BY/ AGAINST | 202 | 15 | 5 | 222 |
| OTHER TRANSPORTATION | 160 | 11 | 9 | 180 |
| CUT/PIERCE | 127 | 0 | 4 | 131 |
| TOP FIVE OVERALL INJURY TYPES | | | | |
| HIP FRACTURE | 581 | 3 | 0 | 584 |
| LOWER LEG/ANKLE FRACTURE | 369 | 0 | 0 | 369 |
| PELVIS/UROGENITAL FRACTURE | 247 | 2 | 0 | 249 |
| SHOULDER/UPPER ARM FRACTURE | 216 | 1 | 0 | 217 |
| TYPE 1 TBI (INTERNAL) | 62 | 142 | 5 | 209 |
| DISCHARGE DISPOSITIONS | | | | |
| HOME | 622 | 20 | 13 | 655 |
| TRANSFER - ACUTE CARE HOSPITAL | 2,107 | 187 | 44 | 2,338 |
| TRANSFER - SKILLED NURSING FACILITY | 545 | 16 | 8 | 569 |
| TRANSFER - HOME HEALTH | 45 | 3 | 3 | 51 |
| TRANSFER - CRITICAL ACCESS HOSPITAL | 255 | 11 | 4 | 270 |
| SWING BED | 133 | 5 | 3 | 141 |
| INPATIENT REHABILITATION FACILITY | 28 | 2 | 0 | 30 |
| EXPIRED | 31 | 4 | 5 | 40 |
| OTHER | 53 | 1 | 1 | 55 |
| UNKNOWN | 11 | 0 | 0 | 11 |

Status of the Minnesota Trauma Registry

The data presented in the previous sections of this report came from hospital billing data collected by the Minnesota Hospital Association (MHA); however, this dataset does not contain enough information to answer many important questions related to the performance of a trauma system, such as length of time to secure an airway and other lifesaving procedures, role of surgeon at resuscitation, and the appropriate use and non-use of diagnostic equipment and medical helicopters. In order to answer these questions in the future, the quality and completeness of the data in the state trauma registry (MNTRAUMA) must be evaluated and improved before reliably using it for robust quality assessment and improvement activities.

All trauma hospitals are required to participate in MNTRAUMA, which is a central web-based registry. Designated trauma hospitals must electronically submit information on all major trauma patients. MDH provides and manages the registry for hospitals. MNTRAUMA data includes a) individual patient demographics such as name and date of birth; b) case data such as injury type, procedures, and final disposition; and c) institutional data such as the hospital, whether or not a trained provider led the resuscitation team, and surgeon response time to the emergency department. It also includes key Quality Improvement (QI) measures, such as Emergency Medical Services (EMS) transport times, transfer times, provider response times and vital signs.

The data is used to: a) link to other data bases to follow the continuity of care from pre-hospital through final discharge; b) produce public reports; c) monitor compliance with system requirements such as physician response times; c) conduct local, regional and state level quality improvement efforts; and d) conduct epidemiological studies of injury for prevention and resource allocation.

During FY2011, MDH staff in conjunction with members of the State Trauma Advisory Council (STAC)⁷ and Regional Trauma Advisory Committee (RTAC)⁸ leadership developed a methodology to assess the validity of MNTRAUMA data at the state, regional and hospital level. Concerted efforts to address identified shortcomings are now being implemented by trauma system staff, RTAC members, trauma managers and trauma registrars around the state, and these improvements will be reflected in subsequent reports to the Legislature.

⁷The [State Trauma Advisory Council \(STAC\)](#) was established by legislation to advise, consult with and make recommendations to the Commissioner of the Minnesota Department of Health regarding the development, maintenance and improvement of the statewide trauma system.

⁸ [Regional Trauma Advisory Committees \(RTACs\)](#) were developed to advise, consult with and make recommendations to the STAC for regional modifications to the statewide trauma system that will improve patient care and accommodate specific regional needs.

Conclusion

Severely injured patients treated in hospitals that participate in an inclusive state trauma system like the one in Minnesota have lower mortality than patients treated in hospitals that do not⁹. From its implementation in 2005, Minnesota's Statewide Trauma System has grown from a small uncoordinated system of only six designated trauma hospitals to a robust, inclusive and active network of 124 designated in-state hospitals, as well as six partner hospitals in neighbor states. **By the first six months of 2011, 99% of all trauma patients in the state were treated at designated trauma hospitals** (Figure 1).

This first report establishes a baseline for evaluating Minnesota's trauma system. As the MNTRAUMA registry system is more fully developed – particularly through more complete data reporting into the system and ongoing validation of the data – it will be possible to better report and analyze trauma outcomes more specifically for Minnesota's system. Efforts are now under way to achieve that more advanced reporting capacity. In addition, as validation of the MNTRAUMA registry continues, evaluation of trauma outcomes will become a larger focus of Quality Improvement (QI) work with designated trauma centers, with an initial focus on reducing patient morbidity and mortality through identification, standardization and evaluation of best practices in the treatment of trauma.

⁹⁹Utter GH, Maier RV, Rivara FP, Mock CN, Jurkovich GJ, Nathens AB. Inclusive trauma systems: Do they improve triage or outcomes of the severely injured? *J Trauma* 2006 Mar; 60(3): 529-35.

Appendix 1

Hospitals designated before July 1, 2010

Level I

Hennepin County Medical Center -
Minneapolis
Mayo, St. Mary's Hospital/ Eugenio
Children's Hospital - Rochester
North Memorial Medical Center -
Robbinsdale
Regions Hospital - St. Paul

Level II

Essentia Health, St. Mary's Medical Center
- Duluth
Mercy Hospital - Coon Rapids
St. Cloud Hospital - St. Cloud
St. Luke's Hospital - Duluth
University of Minnesota Medical Center,
Fairview - Minneapolis

Level III

Abbott-Northwestern Hospital -
Minneapolis
Avera Marshall Regional Medical Center -
Marshall
Buffalo Hospital - Buffalo
Children's Hospitals and Clinics -
Minneapolis
Children's Hospitals and Clinics - St. Paul
Cuyuna Regional Medical Center - Crosby
Douglas County Hospital - Alexandria
Essentia Health St. Joseph's Medical
Center - Brainerd
Essentia Health St. Mary's Hospital -
Detroit Lakes
Fairview Lakes Medical Center -Wyoming
Fairview Red Wing Medical Center -Red
Wing
Fairview Ridges Hospital - Burnsville
Fairview Southdale Hospital - Edina

Fairview University Medical Center,
Mesabi -Hibbing
Grand Itasca Clinic and Hospital - Grand
Rapids
Hutchinson Area Health Care - Hutchinson
Lake Region Healthcare -Fergus Falls
Lakewood Health System -Staples
Mayo Clinic Health System - Mankato
Mayo Clinic Health System - New Prague
Methodist Hospital - St. Louis Park
Rice Memorial Hospital - Willmar
Ridgeview Medical Center - Waconia
Riverwood Healthcare Center - Aitkin
Sanford - Worthington
St. Francis Regional Medical Center -
Shakopee
St. Joseph's Hospital - St. Paul
Unity Hospital - Fridley
Woodwinds Health Campus -Woodbury

Level IV

Albany Area Hospital -Albany
Cambridge Medical Center - Cambridge
CentraCare Health System - Long Prairie
CentraCare Health Systems - Melrose
Chippewa County-Montevideo Hospital -
Montevideo
Cook County North Shore Hospital -Grand
Marais
District One Hospital - Faribault
Essentia Health - Ada
Level IV cont...
Essentia Health - Fosston
Essentia Health - Graceville
Essentia Health - Sandstone
Fairview Northland Medical Center -
Princeton
FirstLight Health System - Mora
Glacial Ridge Health System - Glenwood
Granite Falls Municipal Hospital - Granite
Falls
Johnson Memorial Health Services -
Dawson
Madelia Community Hospital - Madelia
Madison Hospital - Madison
Mahnomen Health Center - Mahnomen
Mayo Clinic Health System - Austin
Mayo Clinic Health System - Cannon Falls
Mayo Clinic Health System - Springfield
Mayo Clinic Health System - St. James
Mayo Clinic Health System - Waseca
Meeker Memorial Hospital - Litchfield
Mille Lacs Health System - Onamia
Minnesota Valley Health Center - Le Sueur
Murray County Medical Center - Slayton
New River Medical Center - Monticello
New Ulm Medical Center - New Ulm
Northfield Hospital - Northfield

Olmsted Medical Center - Rochester
Ortonville Area Health Services -
Ortonville
Owatonna Hospital - Owatonna
Paynesville Area Health Care System -
Paynesville
Perham Memorial Hospital - Perham
Pipestone County Medical Center -
Pipestone
Prairie Ridge Hospital and Health Services
- Elbow Lake
RC Hospital - Olivia
Redwood Area Hospital -Redwood Falls
River's Edge Hospital - Saint Peter
RiverView Health - Crookston
Sanford Medical Center - Bemidji
Sanford Medical Center - Luverne
Sanford Medical Center - Canby
Sanford Medical Center - Jackson
Sanford Medical Center - Thief River Falls
Sanford Medical Center - Tracy
Sanford Medical Center - Westbrook
Sanford Medical Center - Wheaton
Sibley Medical Center - Gaylord
Sleepy Eye Medical Center - Sleepy Eye
St. Francis Healthcare Campus -
Breckenridge
St. Gabriel's Hospital - Little Falls
St. Joseph's Area Health Services - Park
Rapids
St. Michael's Hospital - Sauk Centre
Stevens Community Medical Center -
Morris
Tri-County Hospital - Wadena
Tyler Healthcare Center -Tyler
Windom Area Hospital - Windom
Winona Health Services - Winona

Appendix 2: Trauma Hospital Level Distinctions

Trauma hospitals in Minnesota are designated as levels I, II, III or IV. These designations are based on the availability of resources needed to resuscitate and care for an injured patient. The levels refer only to resources and do not suggest a ranking of the quality of care. Rather, all designated trauma hospitals are expected to provide high quality trauma care consistent with currently accepted standards of practice.

In Minnesota, level I and II trauma hospitals undergo a verification process by the American College of Surgeons to confirm the presence of specific resources. Most level III and all level IV trauma hospitals undergo a verification process administered by the Minnesota Department of Health. (Level IIIs may elect to verify via the American College of Surgeons; however, most use the state pathway.) Once a hospital's resources are verified, the Minnesota commissioner of health will designate it as a trauma hospital.

Level I

A level I trauma hospital can provide definitive care for any trauma patient. It provides the injured patient with access to the most comprehensive resources for their treatment. Specialists, surgical subspecialists and equipment are available 24 hours a day, including anesthesiology, critical care, emergency medicine, internal medicine, neurosurgery, oral and maxillofacial surgery, orthopedic surgery, plastic surgery and radiology. An emergency physician and general surgeon are immediately available to the trauma patient while other specialties may be on call off site.

The trauma critical care service, also known as the intensive care unit, is under the direction of a surgeon.

Level Is often receive severely injured patients referred from lower level trauma centers.

A level I center must admit a minimum volume of severely injured patients annually in order to maintain its status.

Additionally, the level I hospital must participate in the training of resident physicians and conduct trauma-related research.

Level II

A level II trauma hospital provides definitive care for many complex and severely injured patients. Like the level I, the emergency physician and general surgeon are immediately available to the trauma patient. While several specialists and surgical subspecialists are available, fewer are required for level IIs than for level Is.

Since level II resource requirements are less than level I centers, some severely injured patients will be transferred to a level I. While level IIs may receive trauma patients referred from other facilities, some injured patients will be transferred preferentially to a level I depending on their injury.

Level II trauma hospitals are not required to participate in residency training programs or to engage in trauma research.

Level III

A level III trauma center can provide initial resuscitation and stabilization of the trauma patient. A general surgeon is available within 30 minutes to assist with the resuscitation and to provide surgical intervention.

Since the level III provides some degree of orthopedic surgery and has a fully-prepared intensive care unit; it may admit some trauma patients and care for them definitively; however, complex patients and those requiring surgical subspecialties must be transferred to level I or II trauma hospitals.

Level IV

A level IV trauma hospital provides initial resuscitation and stabilization to the severely injured patient. Surgical services are not immediately available so patients are typically transferred to a higher level facility for definitive care. Emergency department personnel have trauma-specific training and protocols are in place to facilitate the rapid management of the patient.

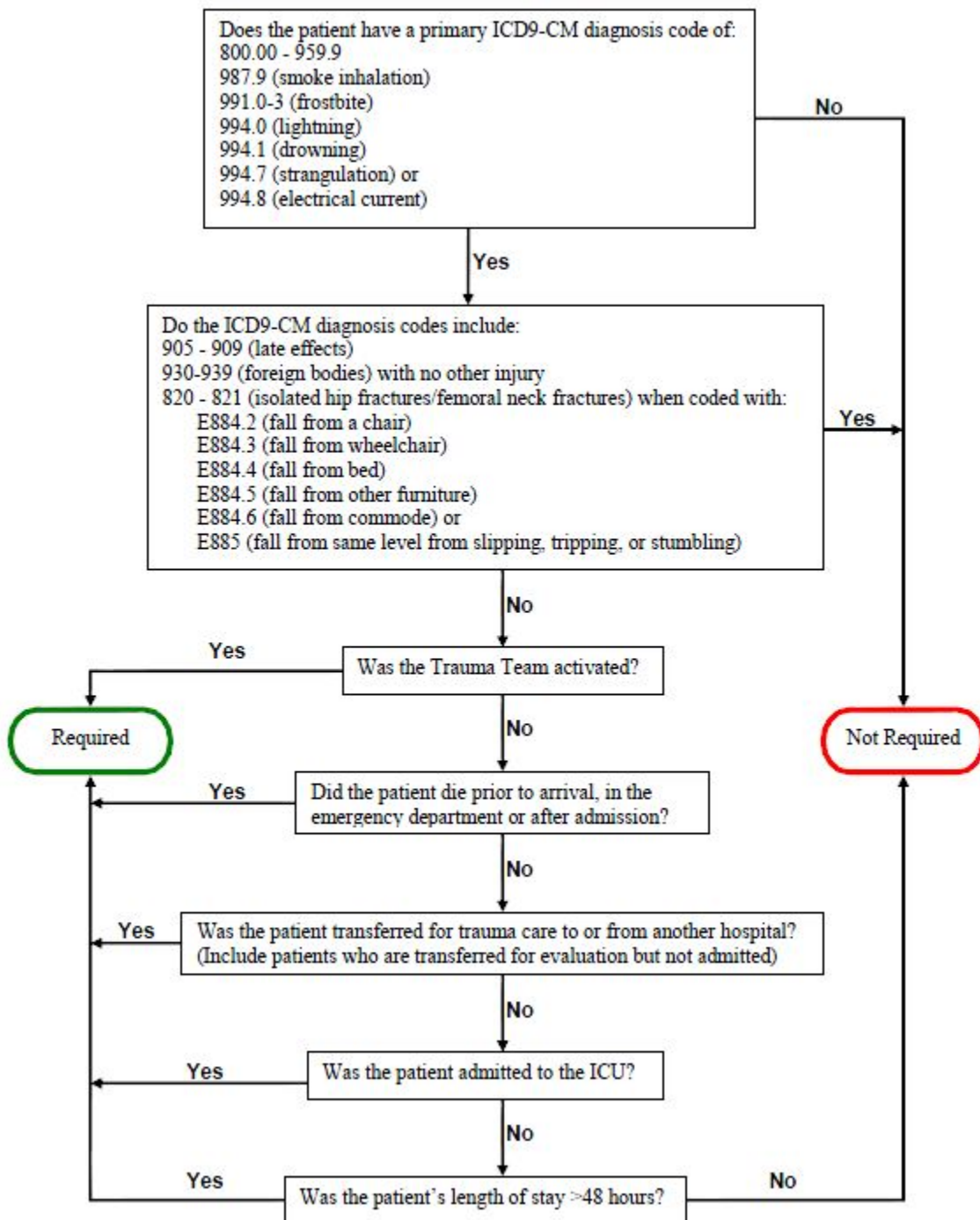
Trauma Centers

Level II, III and IV trauma hospitals may exceed the minimum required resources so the capabilities of hospitals can vary within any given level.

All trauma hospitals engage in performance improvement, actively seeking opportunities to improve the trauma care provided within its facility.

All designated trauma hospitals contribute injury data to the state trauma registry, which will be used for epidemiological analysis and continuous improvement of the system.

Appendix 3
Trauma Registry Inclusion Criteria



Appendix 4

Regional Trauma Advisory Committees

The **Western Minnesota Regional Trauma Advisory Committee (WESTAC)** includes Becker, Beltrami, Clay, Clearwater, Douglas, Grant, Hubbard, Kittson, Lake of the Woods, Mahnomen, Marshall, Norman, Otter Tail, Pennington, Polk, Pope, Red Lake, Roseau, Stevens, Traverse and Wilkin counties.

The **Minnesota Metropolitan Regional Trauma Advisory Committee** includes Anoka, Washington, Ramsey, Hennepin, Carver, Scott, and Dakota counties. It is not yet officially established.

The **Northeastern Minnesota Regional Trauma Advisory Committee (NERTAC)** includes Koochiching, Itasca, Aitkin, Carlton, St. Louis, Lake and Cook counties.

The **Central Minnesota Regional Trauma Advisory Committee (CENTRAC)** includes Benton, Cass, Chisago, Crow Wing, Isanti, Kanabec, Mille Lacs, Morrison, Pine, Sherburne, Stearns, Todd, Wadena, and Wright counties.

The **Southwestern Minnesota Regional Trauma Advisory Committee (SWRTAC)** includes Big Stone, Brown, Chippewa, Cottonwood, Jackson, Lac Qui Parle, Kandiyohi, Lincoln, Lyon, Meeker, Murray, Nobles, Pipestone, Redwood, Renville, Rock, Swift, Waseca and Yellow Medicine counties.

The **Southern Minnesota Regional Trauma Advisory Committee (SMRTAC)** includes Blue Earth, Brown, Dodge, Faribault, Fillmore, Freeborn, Goodhue, Houston, Le Seuer, Martin, Mower, Nicollet, Olmsted, Rice, Sibley, Steele, Wabasha, Waseca, Watonwan and Winona counties.

Trauma Regions Served by RTACs

