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Trauma System Report FY2012

Minnesota Department of Health
Report to the Minnesota Legislature 2014

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Trauma System Report FY2012

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I. 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 governance system.

As part of this system, Minnesota Statutes Section 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 trauma patients meeting the inclusion criteria. The registry information is used, in part, to publish an annual report. This is the second annual report. It has been produced by the Minnesota Department of Health in conjunction with the State Trauma Advisory Council (STAC). Trauma case admission data in the report cover all of state fiscal year 2012 (FY2012), but only include data from hospitals designated as of July 1, 2011.

Key findings for Minnesota's trauma patients in FY2012 are as follows:

- **Ninety-five percent of trauma admissions now occur at hospitals participating in the statewide trauma system.**
- **The trauma system has grown from six designated hospitals in August 2005 to 119 at the beginning of FY2012.**
- **Minnesota averaged 2,037 trauma incidents per month during FY2012**, with peaks in mid-summer and low points in mid- to late-winter.
- **Fourteen percent of the state's 22,802 trauma admissions were major trauma incidents and 2.3 percent resulted in death.**
- **Falls were the most common cause of trauma** (65 percent), followed by motor vehicle crashes (19 percent).
- **Hip fractures were the most common injury types** (31 percent).
- **Elderly patients represented a disproportionately high number of trauma patients (40 percent).** Trauma admissions from motor vehicle crashes peaked in the 20-29 age group.

Trauma hospitals in Minnesota are designated as Level I, II, III or IV. These designations are based on the availability of resources needed to resuscitate and care for an injured patient. The designations do not suggest a ranking of the quality of care. The following are overall findings regarding the number and type of trauma patients seen at each level:

- The four **level I** trauma centers in Minnesota were responsible for 32 percent of the state's trauma admissions in FY2012. Major trauma accounted for roughly one quarter (22 percent) of their trauma admissions.
- The five **level II** trauma centers in Minnesota were responsible for 13 percent of all trauma admissions in FY2012. Major trauma accounted for less than one-fifth (15 percent) of their trauma admissions.

- The 30 **level III** trauma hospitals were responsible for one-third (34 percent) of the state’s trauma admissions in FYI 2012. Major trauma accounted for 9 percent of their trauma admissions.
- The state had 80 **level IV** trauma centers in FY2012, 79 of which reported data used in this report. Level IV hospitals were responsible for 21 percent of the state’s trauma admissions. Major trauma accounted for 8 percent of their trauma admissions.

At all levels, falls were the most common cause of trauma injury, followed by motor vehicle crashes.

Direct comparisons of outcomes across designation levels cannot currently be made using available data, because of the many differences between hospital patient volumes and the severity of cases treated at the different designation levels. MNTRAUMA, the state’s trauma registry, will provide more quality measurement data for future annual reports. As a new data repository, it is currently undergoing analysis to ensure its data are complete and accurate, and to achieve 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.

II. 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 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 legislation passed 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 reduction in trauma deaths. Specifically, Minnesota Statutes 144.603 and 114.605 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 Statutes Section 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 meeting the inclusion criteria. 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 second such annual report. It has been produced by the Minnesota Department of Health in conjunction with the State Trauma Advisory Council (STAC). Trauma admission data in the report cover all of state fiscal year 2012 (FY2012), but only include data from hospitals designated as of July 1, 2011.

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. However, MNTRAUMA does not currently serve as a complete source for reporting on trauma on a statewide basis (see page 39 for further discussion). Therefore, this report was produced by applying the MNTRAUMA inclusion criteria described in Appendix 3 to MHA data. These data allow for a broad picture of the statewide trauma burden, but lack the clinical specificity that will be possible with the further development of the MNTRAUMA system and quality improvement resources dedicated to its use.

III. 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 119 designated trauma hospitals at the beginning of FY2012 (Table 1). A full list of these hospitals is located in Appendix 1.

Table 1: Hospitals designated as trauma centers

Designation Level	As of August 1, 2005	As of July 1, 2011
Level 1	3	4
Level 2	3	5
Level 3	0	30
Level 4	0	80
Undesignated	122	9
Total	128	128

Below is a brief summary of the designation levels; see Appendix 2 for a more detailed description.

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 (intensive care unit) is under the direction of a surgeon.

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

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 II than for level I facilities.

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.

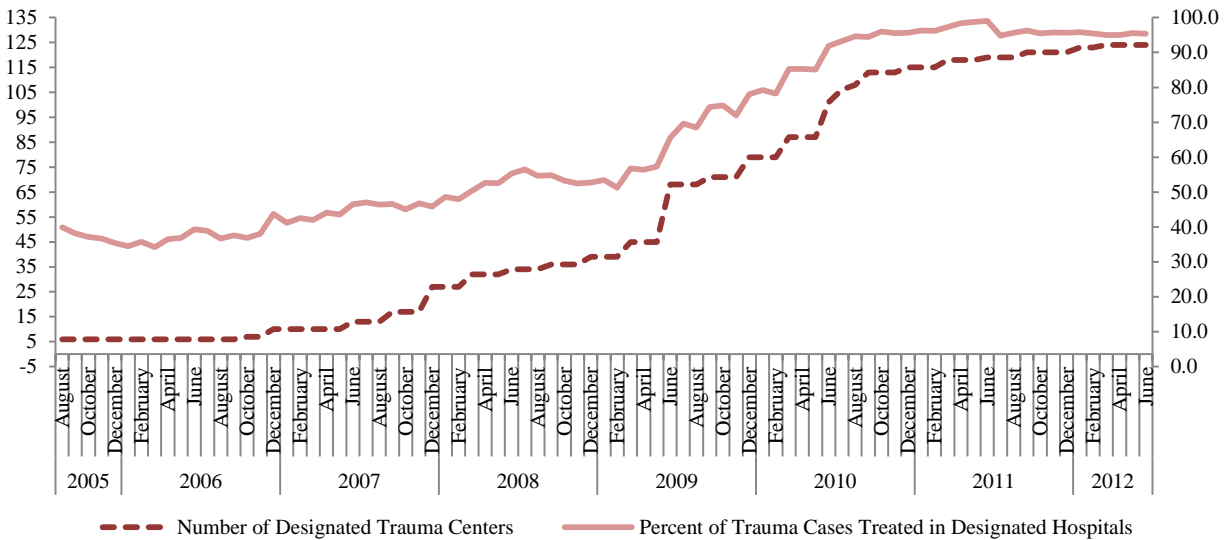
Since the level III provides some degree of orthopedic surgery and has an intensive care unit, it may admit some trauma patients and care for them definitively. However, complex patients and those requiring surgical subspecialties must be transferred to level I or II trauma hospitals.

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.

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 2005-2012

**Number of Designated Trauma Hospitals and Percent Trauma Treated
(August 2005 - July 2012)**



*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 2012, 95 percent of trauma admissions were to designated hospitals (Figure 1).

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 report 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

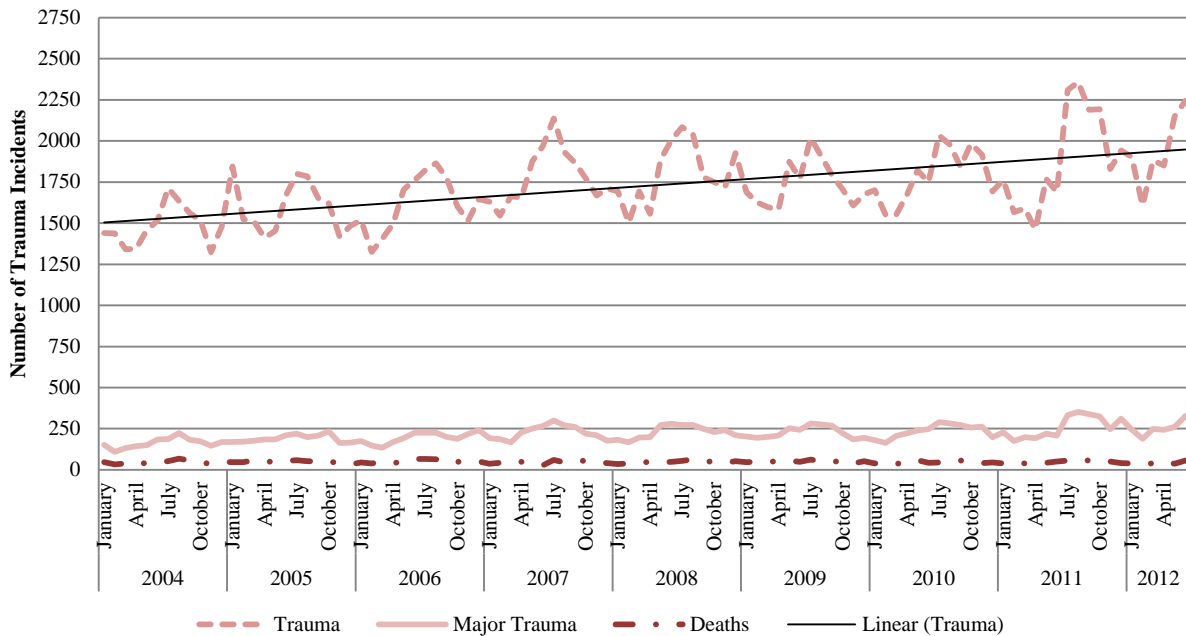
It must be noted that designations are only the first step to achieving a mature trauma system that ultimately improves statewide survival results. Focused quality measurement, analysis and reporting on trauma care and outcomes will be necessary to realize the full benefits of a trauma system.

IV. Historical Trends in Trauma in Minnesota: January 2004 – June 2012

To provide historical context, this section provides information on Minnesota trauma admissions from calendar year 2004 through June 2012. This represents the earliest time period for which sufficient statewide trauma data are 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 2012. 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 1,726, with a minimum of 1,324 in November 2004 and a maximum of 2,358 in August 2011. There were far fewer “major” trauma incidents averaging 219 per month, with a minimum of 108 in February 2004 and a maximum of 353 in August 2011. 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.

Figure 2: Trend in Trauma Incidents by Month (Jan 2004 – Jun 2012) *



*Includes only trauma resulting in admission to trauma hospitals designated before July 1, 2011. Excludes deaths occurring at the scene and deaths resulting from latent effects of injury and those occurring after discharge from the final acute care hospital.

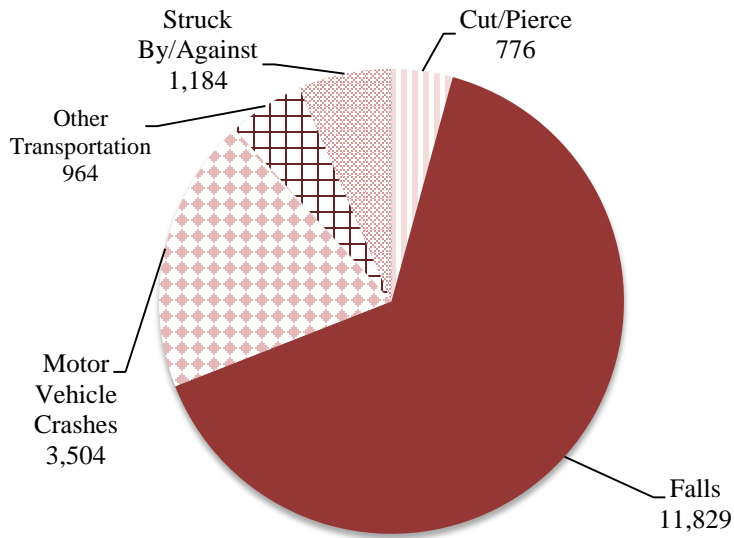
V. Current Trends in Trauma in Minnesota: July 2011 – June 2012

During fiscal year 2012, Minnesota had 24,454 trauma hospital admissions. Of these, 3,422 (14 percent) were classified as major trauma and 561 (2.3 percent) resulted in death. Of all trauma admissions, 1,880 (8 percent) occurred among children under 15, and 11,119 (45 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 – FY2012 Statewide

Selected Variables	ISS: 0-15	ISS: 16-24	ISS: 25+	TOTAL
Trauma Counts for July 1, 2011 through June 30, 2012				
Trauma (State Inclusion Criteria)	21,032	2,652	770	24,454
Trauma Ages < 15	1,712	139	29	1,880
Trauma Ages 65 and Older	9,687	1,217	215	11,119
Trauma Deaths	253	171	137	561
Transfer Type				
Transferred In	2,871	644	134	3,649
Transferred Out	4,579	467	130	5,176
Both	60	7	2	69
Not Transferred	13,522	1,534	504	15,560
Top 5 Overall Injury Causes				
Falls	10,345	1,286	198	11,829
Motor Vehicle Crashes	2,613	562	329	3,504
Struck By/Against	1,024	128	32	1,184
Other Transportation	800	128	36	964
Cut/Pierce	755	10	11	776
Top 5 Overall Injury Types				
Hip Fracture	3,073	32	7	3,112
Type 1 TBI (Internal)	869	1,312	123	2,304
Lower Leg/Ankle Fracture	2,170	29	14	2,213
Shoulder/Upper Arm Fracture	1,347	37	4	1,388
Pelvis/Urogenital Fracture	991	63	15	1,069
Discharge Dispositions				
Home	8,077	961	206	9,244
Transfer – Skilled Nursing Facility	5,714	489	87	6,290
Transfer – Acute Care Facility	4,272	453	121	4,846
Transfer – Home Health	886	106	10	1002
Inpatient Rehabilitation Facility	435	298	120	853
Expired	253	171	137	561
Transfer – Critical Access Hospital	367	21	11	399
Swing Bed	328	31	8	367
Transfer – Intermediate Care Facility	142	9	0	151
Admitted As Inpatient	15	0	2	17
Other	372	75	54	501
Unknown	171	38	14	223

Figure 3: Top Five Primary Causes of Trauma⁴

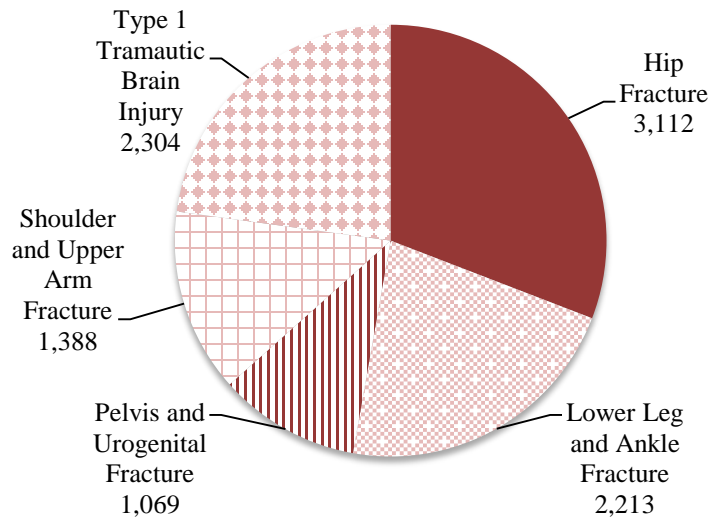


*Injury cause was determined using ICD-9-CM external cause codes as categorized by the CDC: http://www.cdc.gov/injury/wisqars/ecode_matrix.html

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

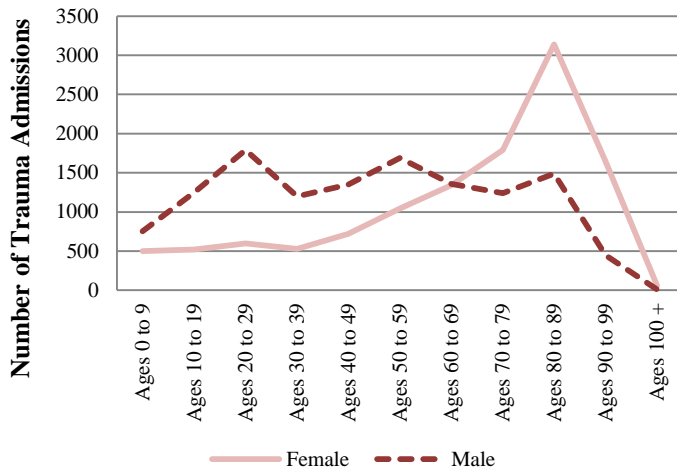
- Falls were the most common primary cause of trauma, resulting in 11,829 admissions (65 percent).
- The second most common cause was motor vehicle crashes with 3,504 admissions (19 percent), followed by incidents involving an individual being struck by or against something, other transportation, and incidents involving an individual being cut or pierced by something.

Figure 4: Top Five Types of Injury



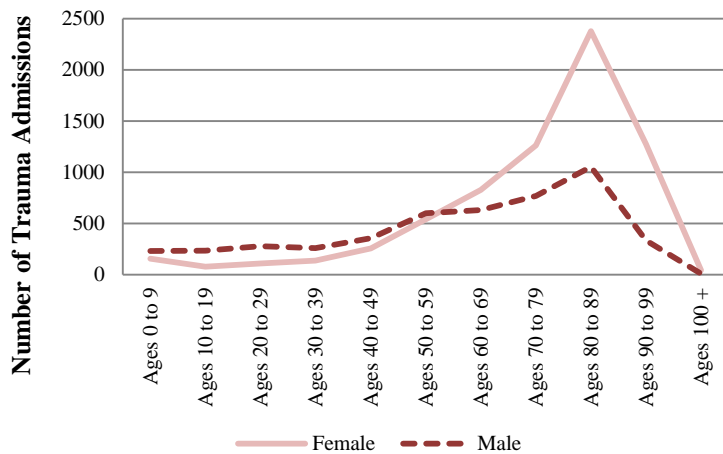
- A substantial majority of trauma admissions are caused by falls and motor vehicle crashes, but injury types vary according to the specific injury circumstances.
- The most common types of injuries were hip fractures (31 percent), followed by type I traumatic brain injuries (TBIs) (23 percent), lower leg/ankle fractures (22 percent), shoulder/upper arm fractures (14 percent), and pelvis/urogenital fractures (10 percent).⁵
- Falls were the cause for over 57 percent of each of the top five injury types, and for 48 percent of all injury types combined.

Figure 5: Trauma by Age and Sex



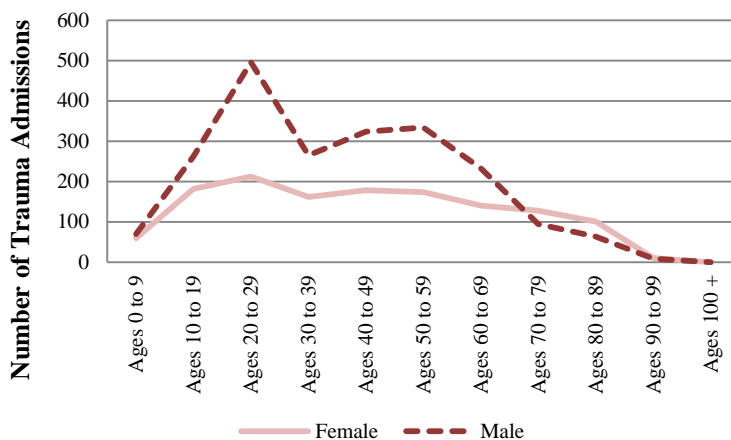
- Trauma admissions were distributed differently according to age group and gender (Figure 5).
- Male patients under the age of 60 had more trauma admissions than females, while female patients 70 and older had more trauma admissions than males.
- The spike for older females is partially explained by the the general population of people 70 and over having more females than males.

Figure 6: Trauma Caused by Falling



- 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).

Figure 7: Trauma Caused by Motor Vehicle Traffic by Age and Sex

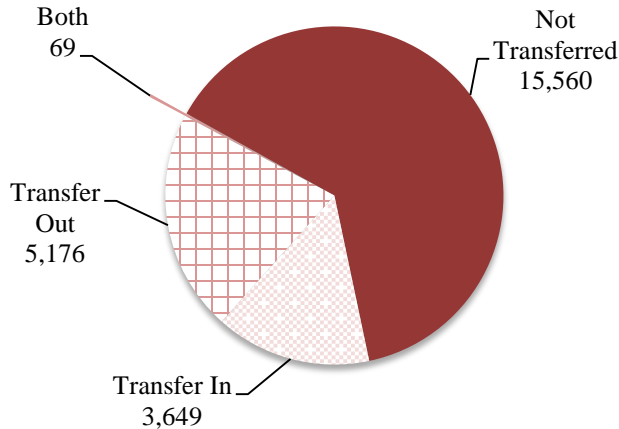


- Trauma admissions resulting from motor vehicle traffic peaked for both males and females in the 20-29 age group, with more admissions among males than females for patients under 70 years of age (Figure 7).

Trends in Interfacility Transfers

Trauma transfers can involve both “transfers in” to an acute care hospital and “transfers out” to another acute care hospital. Additionally, a patient can be both transferred in and transferred out of a facility.

Figure 8: Trauma Transfers



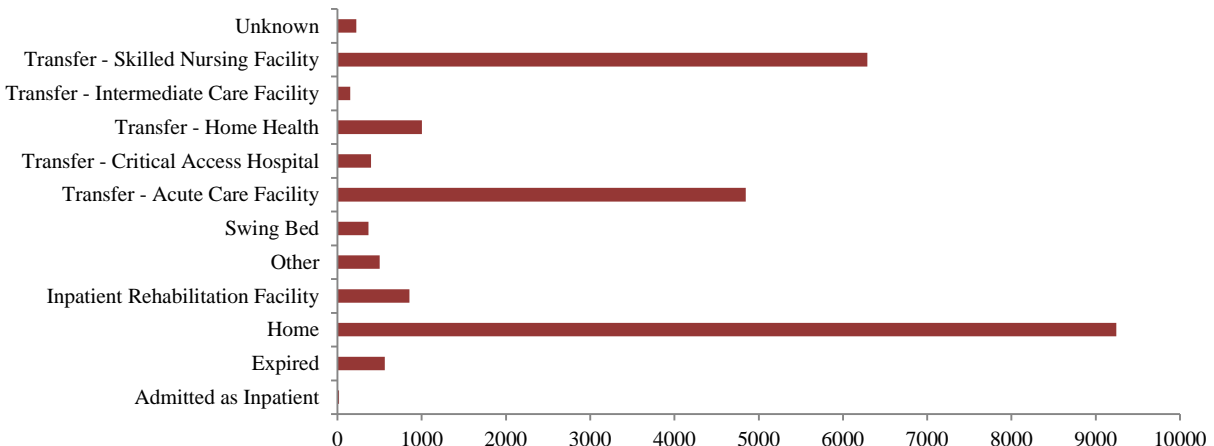
- In FY2012, the majority of trauma admissions (64 percent) did not involve a transfer (either in or out of the acute care hospital from which the record was generated). (Figure 8.)
- A total of 5,176 trauma admissions (21 percent) were transferred out; 15 percent were transferred in; and less than 1 percent were both transferred in and transferred out.⁶

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

Trends in Trauma Admission

In the MHA data set, only short-term outcome indicators exist in the form of discharge location, providing limited indication of care needed after acute injury. These data indicate that the most common discharge disposition was to home, which occurred in 9,244 (37 percent) of cases while 6,290 (26 percent) were transferred to a skilled nursing facility and 4,846 (20 percent) were transferred to another acute care facility (Figure 9). The remaining dispositions each represented less than 5 percent of all admissions. As the trauma system and MNTRAUMA continue to mature, patient outcomes will be better reported using longitudinally representative samples of trauma cases to improve long-term outcomes.

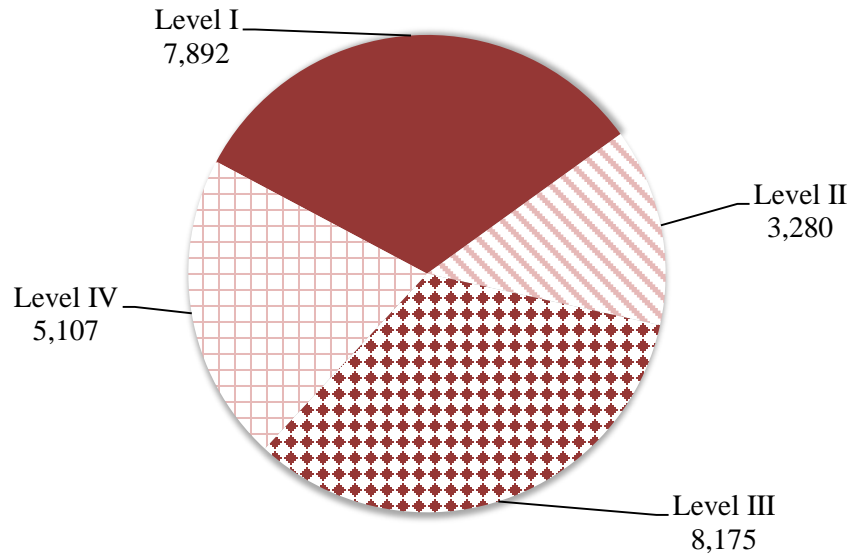
Figure 9: Discharge Dispositions



Trends in Trauma Cases by Designation Level

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 Cases by Designation Level



Level I Trauma Admissions

There were four level I trauma centers designated at the beginning of FY2012, with a total of 7,892 trauma admissions, representing 32 percent of trauma admissions to all designated hospitals. Of those, 78 percent were not classified as major trauma (ISS score 0-15), 16 percent were classified as major trauma with an ISS severity score of 16-24, and 6 percent had a major trauma ISS severity score over 24. There were 1,947 admissions transferred into level I hospitals, while only 150 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, 58 percent resulted in discharges to the patient's home.

Table 3: Level I Trauma Admissions by ISS Category – FY2012

Selected Variables	ISS: 0-15	ISS: 16-24	ISS: 25+	TOTAL
Trauma Counts for July 1, 2011 through June 30, 2012				
Trauma (State Inclusion Criteria)	6,149	1,269	474	7,892
Trauma < 15	634	81	23	738
Trauma Ages 65 and Older	1,786	413	103	2,302
Trauma Deaths	83	96	105	284
Transfer Type				
Transferred In	1,473	368	106	1,947
Transferred Out	113	23	14	150
Both	18	3	1	22
Not Transferred	4,545	875	353	5,773
Top 5 Overall Injury Causes				
Falls	2,395	476	97	2,968
Motor Vehicle Crashes	1,106	384	248	1,738
Struck By/Against	366	60	13	439
Other Transportation	258	65	19	342
Cut/Pierce	326	8	6	340
Top 5 Overall Injury Types				
Type 1 TBI (Internal)	506	461	93	1,060
Lower Leg/Ankle Fracture	653	22	12	687
Hip Fracture	437	17	4	458
Shoulder/Upper Arm Fracture	311	20	3	334
Pelvis/Urogenital Fracture	238	46	12	296
Discharge Dispositions				
Home	3,873	591	137	4,601
Transfer – Skilled Nursing Facility	1,379	251	55	1,685
Inpatient Rehabilitation Facility	178	177	99	454
Transfer – Home Health	283	58	7	348
Expired	83	96	105	284
Transfer – Acute Care Facility	131	25	15	171
Swing Bed	42	18	3	63
Transfer – Intermediate Care Facility	20	0	0	20
Transfer – Critical Access Hospital	0	1	0	1
Other	112	39	42	193
Unknown	48	13	11	72

Level II Trauma Admissions

There were five level II trauma centers at the beginning of FY2012, with a total of 3,280 trauma admissions, representing 13 percent of trauma admissions to all designated facilities. Of those, 85 percent were not classified as major trauma (ISS severity score 0-15), 13 percent were major trauma (ISS severity score 16-24), and 2 percent had an ISS severity score over 25. There were 922 admissions that were transferred into level II hospitals, while only 189 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 type I TBIs. Of the admissions to level II facilities, 48 percent of admissions resulted in discharges to the patient's home.

Table 4: Level II Trauma Admissions by ISS Category – FY2012

Selected Variables	ISS: 0-15	ISS: 16-24	ISS: 25+	TOTAL
Trauma Counts for July 1, 2011 through June 30, 2012				
Trauma (State Inclusion Criteria)	2,792	415	73	3,280
Trauma Ages < 15	199	11	2	206
Trauma Ages 65 and Older	1,225	213	23	1,461
Trauma Deaths	40	22	16	78
Transfer Type				
Transferred In	751	157	14	922
Transferred Out	172	13	4	189
Both	21	1	1	23
Not Transferred	1,848	244	54	2,146
Top 5 Overall Injury Causes				
Falls	1,425	231	21	1,677
Motor Vehicle Crashes	336	70	26	432
Other Transportation	142	27	7	176
Struck By/Against	147	23	3	173
Cut/Pierce	127	1	1	129
Top 5 Overall Injury Types				
Hip Fracture	354	5	2	361
Type 1 TBI (Internal)	119	218	12	349
Lower Leg/Ankle Fracture	297	3	2	302
Shoulder/Upper Arm Fracture	181	8	1	190
Pelvis/Urogenital Fracture	102	8	3	113
Discharge Dispositions				
Home	1,400	164	20	1,584
Transfer – Skilled Nursing Facility	759	69	8	836
Inpatient Rehabilitation Facility	147	93	19	259
Transfer – Acute Care Facility	188	14	5	207
Transfer – Home Health	97	15	0	112
Expired	40	22	16	78
Swing Bed	60	7	1	68
Transfer – Intermediate Care Facility	32	2	0	34
Transfer – Critical Access Hospital	5	0	0	5
Other	38	16	3	57
Unknown	26	13	1	40

Level III Trauma Admissions

Minnesota had 30 designated level III trauma centers at the beginning of FY2012, with a total of 8,175 trauma admissions, representing 34 percent of trauma admissions to all designated facilities. Of those, 90 percent were in the 0-15 ISS category, 8 percent were in the 16-24 ISS category, and 1 percent were in the 25+ ISS category. There were 598 admissions that were transferred into level III designated hospitals, and 1,671 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, 37 percent resulted in discharges to skilled nursing facilities, 28 percent resulted in discharges to home, and 19 percent were discharged to another acute care facility.

Table 5: Level III Trauma Admissions by ISS Category – FY2012

Selected Variables	ISS: 0-15	ISS: 16-24	ISS: 25+	TOTAL
Trauma Counts for July 1, 2011 through June 30, 2012				
Trauma (State Inclusion Criteria)	7,401	667	107	8,175
Trauma Ages < 15	523	32	2	557
Trauma Ages 65 and Older	4,328	425	42	4,795
Trauma Deaths	88	40	5	133
Transfer Type				
Transferred In	471	115	12	598
Transferred Out	1,440	197	34	1,671
Both	5	2	0	7
Not Transferred	5,485	353	61	5,899
Top 5 Overall Injury Causes				
Falls	4,134	411	33	4,578
Motor Vehicle Crashes	623	63	22	708
Struck By/Against	229	19	9	257
Other Transportation	208	21	4	233
Cut/Pierce	122	1	2	125
Top 5 Overall Injury Types				
Hip Fracture	1,526	8	0	1,534
Lower Leg/Ankle Fracture	822	3	0	825
Type 1 TBI (Internal)	166	453	13	632
Shoulder/Upper Arm Fracture	554	5	0	559
Pelvis/Urogenital Fracture	398	5	0	403
Discharge Dispositions				
Transfer – Skilled Nursing Facility	2,858	150	18	3,026
Home	2,084	182	33	2,299
Transfer – Acute Care Facility	1,402	193	33	1,628
Transfer – Home Health	442	29	3	474
Expired	88	40	5	133
Inpatient Rehabilitation Facility	74	27	1	102
Swing Bed	79	4	1	84
Transfer – Intermediate Care Facility	59	6	0	65
Transfer – Critical Access Hospital	43	6	1	50
Admitted as Inpatient	6	0	2	8
Other	186	18	9	213
Unknown	80	12	1	93

Level IV Trauma Admissions

Minnesota had 80 level IV trauma centers at the beginning of FY2012, 79 of which reported data to MHA. These hospitals had 5,107 trauma admissions, representing 21 percent of trauma admissions to designated facilities. Of those, 91 percent were non-major trauma (ISS severity score 0-15), 6 percent were major trauma with an ISS severity score between 16-24, and 2 percent had an ISS score over 25. There were 182 admissions transferred into level IV designated hospitals, and 3,166 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, 56 percent resulted in discharges to another acute care hospital.

Table 6: Level IV Trauma Admissions by ISS Category – FY2012

Selected Variables	ISS: 0-15	ISS: 16-24	ISS: 25+	TOTAL
Trauma Counts for July 1, 2011 through June 30, 2012				
Trauma (State Inclusion Criteria)	4,690	301	116	5,107
Trauma Ages < 15	362	15	2	379
Trauma Ages 65 and Older	2,348	166	47	2,561
Trauma Deaths	42	13	11	66
Transfer Type				
Transferred In	176	4	2	182
Transferred Out	2,854	234	78	3,166
Both	16	1	0	17
Not Transferred	1,644	62	36	1,742
Top 5 Overall Injury Causes				
Falls	2,391	168	47	2,606
Motor Vehicle Crashes	548	45	33	626
Struck By/Against	282	26	7	315
Other Transportation	192	15	6	213
Cut/Pierce	180	0	2	182
Top 5 Overall Injury Types				
Hip Fracture	756	2	1	759
Lower Leg/Ankle Fracture	398	1	0	399
Shoulder/Upper Arm Fracture	301	4	0	305
Type 1 TBI (Internal)	78	180	5	263
Pelvis/Urogenital Fracture	253	4	0	257
Discharge Dispositions				
Transfer – Acute Care Facility	2,551	221	68	2,840
Home	720	24	16	760
Transfer – Skilled Nursing Facility	718	19	6	743
Transfer – Critical Access Hospital	319	14	10	343
Swing Bed	147	2	3	152
Transfer – Home Health	64	4	0	68
Expired	42	13	11	66
Inpatient Rehabilitation Facility	36	1	1	38
Transfer – Intermediate Care Facility	31	1	0	32
Admitted as Inpatient	9	0	0	9
Other	36	2	0	38
Unknown	17	0	1	18

Current Trends in Pediatric Trauma in Minnesota: July 2011 – June 2012

Pediatric trauma patients are those younger than 15 years of age. During fiscal year 2012, Minnesota had 1,880 pediatric trauma hospital admissions. Of these, 9 percent were classified as major trauma and less than 1 percent resulted in death. Falls were the most common primary cause of trauma (28 percent). The second most common cause was motor vehicle crashes (12 percent), followed by incidents involving an individual being struck by or against something, other transportation, and burns or fire-related incidents.

A substantial majority were caused by falls and motor vehicle crashes, but injury types varied according to the specific injury circumstances. The most common were shoulder and upper arm fractures (11 percent), followed by internal TBIs (8 percent), forearm and elbow fractures (8 percent), upper leg and thigh fractures (7 percent) and fracture type I TBIs (7 percent).⁷

In FY2012, 28 percent of pediatric trauma admissions did not involve a transfer (either in or out of the acute care hospital from which the record was generated). A total of 662 trauma admissions (35 percent) were transferred out; 36 percent were transferred in; and less than 1 percent were both transferred in and transferred out.⁸ The most common discharge was to home (61 percent). About 35 percent of admissions resulted in transfer to an acute care facility. The remaining discharge dispositions each represented less than 2 percent of all trauma admissions.

Trauma Cases Among Designated Pediatric Trauma Facilities

In 2010, the Governor signed a law that paved the way for the designation of level I and II pediatric trauma centers. Five trauma centers were designated as pediatric trauma centers at the beginning of FY2012. While adult trauma centers may care for injured children, designated pediatric trauma centers must have resources specifically dedicated to the care of these patients.

There were three level I pediatric trauma centers and two level II pediatric trauma centers at the beginning of FY2012. Designated pediatric trauma centers admitted 674 pediatric trauma patients. Of these, 85 (13 percent) were classified as major trauma and 16 (2 percent) resulted in death. Falls were the most common primary cause of pediatric trauma, resulting in 216 admissions (32 percent), followed by motor vehicle crashes with 119 admissions (18 percent), incidents involving an individual being struck by or against something, other transportation, and burns or fire related incidents.

Causes of trauma admissions for the pediatric population included falls and motor vehicle crashes, but injury types varied according to the specific injury circumstances. The most common types of injuries were internal type I TBIs, with 86 admissions (13 percent), followed by fracture type I TBIs with 70 admissions (10 percent), shoulder and upper arm fractures with 64 admissions (9 percent), forearm and elbow fractures with 37 admissions (5 percent), and upper leg and thigh fracture with 23 admissions (3 percent).

About 43 percent of designated pediatric trauma hospital admissions did not involve a transfer (either in or out of the acute care hospital from which the record was generated). A total of 18 (3 percent) trauma admissions were transferred out; 363 (54 percent) were transferred in; and one (< 1 percent) was both transferred in and transferred out. The most common discharge disposition was to home (92 percent). About 3 percent (19) of admissions resulted in transfer to an acute care facility. The remaining discharge dispositions each represented 1 percent of all designated pediatric trauma admissions.

Table 7: Designated Level I and II Pediatric Trauma Center Admission by ISS Category

Selected Variables	ISS: 0-15	ISS: 16-24	ISS: 25+	TOTAL
Trauma Counts for July 1, 2011 through June 30, 2012				
Trauma (State Inclusion Criteria)	589	69	16	674
Trauma Deaths	2	4	2	8
Transfer Type				
Transferred In	319	38	6	363
Transferred Out	18	0	0	18
Both	1	0	0	1
Not Transferred	251	31	10	292
Top 5 Overall Injury Causes				
Falls	203	13	0	216
Motor Vehicle Crashes	88	19	12	119
Struck By/Against	58	9	1	68
Burn/Fire	62	2	0	64
Other Transportation	41	5	1	47
Top 5 Overall Injury Types				
Type 1 TBI (Internal)	57	21	8	86
Type 1 TBI (Fracture)	44	22	4	70
Shoulder/Upper Arm Fracture	63	1	0	64
Forearm and Elbow Fracture	36	1	0	37
Upper Leg and Thigh Fracture	23	0	0	23
Discharge Dispositions				
Home	551	59	8	618
Transfer – Acute Care Facility	19	0	0	19
Transfer – Home Health	12	0	0	12
Inpatient Rehabilitation Facility	3	4	3	10
Expired	2	4	2	8
Other	2	2	3	7

VI. 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. 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 are used to:

- Link to other databases to follow the continuity of care from pre-hospital through final discharge
- Produce public reports
- Monitor compliance with system requirements such as physician response times
- Conduct local, regional and state level quality improvement activities
- Conduct epidemiological studies of injury for prevention and resource allocation.

During FY2012, MDH staff in conjunction with members of the State Trauma Advisory Council (STAC)⁹ and regional trauma advisory committee (RTAC)¹⁰ leadership developed a methodology to assess the validity of MNTRAUMA data at the state, regional and hospital levels. 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.

VII. Conclusion

Severely injured patients treated in hospitals that participate in an inclusive state trauma system (such as Minnesota's) have lower mortality than patients treated in hospitals that do not.¹¹ 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 119 designated hospitals at the beginning of FY2012, as well as six partner hospitals in neighboring states. **By the first six months of 2012, 95 percent of all trauma patients in the state were treated at designated trauma hospitals** (Figure 1).

This report builds on the baseline for evaluating Minnesota's trauma system established by the FY2011 report. 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.

Appendix 1: Hospitals designated before July 1, 2012

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

Level I Pediatric

Gillette Children's Specialty Healthcare -
Saint Paul
Hennepin County Medical Children's
Hospital - Minneapolis
Mayo Eugenio Litta Children's Hospital -
Rochester

Level II Pediatric

Essentia Health St. Mary's Medical Center -
Duluth
North Memorial Medical Center -
Robbinsdale

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
University of Minnesota Amplatz Children's
Hospital - Minneapolis
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
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 levels are designations of 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 verify the presence of the required resources. Most level III and all level IV trauma hospitals undergo a verification process administered by the Minnesota Department of Health. (Level III hospitals 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 designates it as a trauma hospital.

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.

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 I facilities often receive severely injured patients referred from lower level trauma centers.

A level I center must admit a minimum number 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 II than for level I hospitals.

Since level II resource requirements are fewer than level I centers, some severely injured patients will be transferred to a level I. While level II hospitals 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

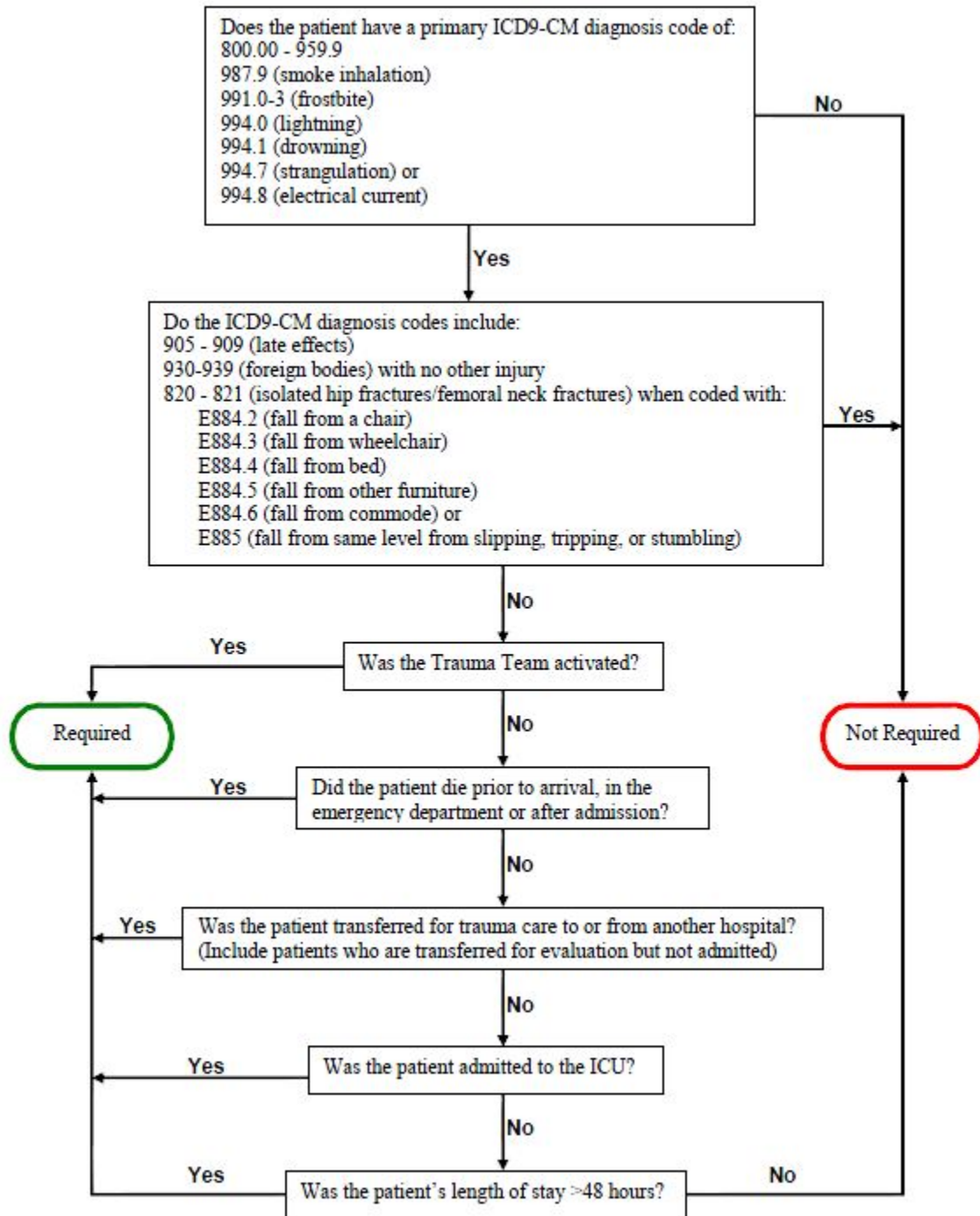
A level III trauma center can provide initial resuscitation and stabilization of the trauma patient. A general surgeon is available within 30 minutes to assist with the resuscitation and to provide surgical intervention.

Since the level III provides some degree of orthopedic surgery and has an 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.

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.

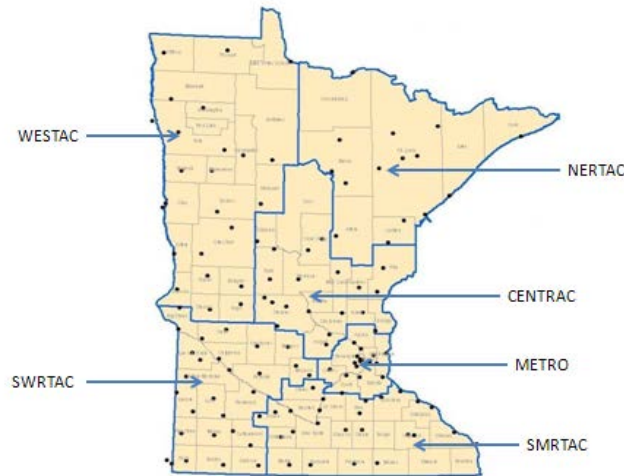
The **Northeastern Minnesota Regional Trauma Advisory Committee (NERTAC)** includes Koochiching, Itasca, Aitkin, Carlton, St. Louis, Lake and Cook counties.

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



Notes

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.

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.

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/encode_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.

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.

⁷ 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.

⁸There 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.

⁹The State Trauma Advisory Council (STAC)

(<http://www.health.state.mn.us/traumasystem/stac/index.html>) 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.

¹⁰ Regional Trauma Advisory Committees (RTACs)

(<http://www.health.state.mn.us/traumasystem/rtac/index.htm>) 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.

¹¹Utter 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.