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Ontario Trauma Registry Analytic Bulletin

March 2004
Major Head and Spinal Cord Injury Hospitalizations in Ontario, 2001-2002

This report provides a descriptive analysis of hospitalizations and inhospital deaths with major spinal or head injuries in Ontario. The source of data for this bulletin is the Ontario Trauma Registry Comprehensive Data Set (OTR CDS). The OTR is managed by the Canadian Institute for Health Information (CIHI) and funded by the Ontario Ministry of Health and Long-Term Care.

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1. Methods

1.1 Data Source and Definitions

This report focuses on major injury hospitalizations in any of Ontario's 11 Lead Trauma Hospitals (LTHs) where an appropriate External Cause of Injury code (E Code) was recorded. Cases admitted to an LTH during fiscal year 2001-2002 (April 1, 2001 to March 31, 2002) with an Injury Severity Score (ISS)* greater than 12 and an injury type of head and/or spinal cord were the basis of analysis.

The N Code diagnosis used to define head and spinal cord injury types may be found in Table 1. If a hospitalization had N code diagnoses that fell into each of head and spinal cord injuries, each type was counted once, meaning that cases counted in head and spinal cord injury types are not mutually exclusive. However, if a case had multiple N code diagnoses that fell into only one type, the case was counted only once. There are 66 cases counted as both head and spinal cord injury types.

Table 1: Head and Spinal Cord Injury Type N Code Diagnoses

Injury Type	N Code	N Code Category	N Code Definition
Head Injury	800	Fractured skull	Fracture of vault of skull
	801	Fractured skull	Fracture of base of skull
	803	Fractured skull	Other and unqualified skull fractures
	804	Fractured skull	Multiple fractures involving skull or face with other bones
	850	Intracranial injury	Concussion
	851	Intracranial injury	Cerebral laceration and contusion
	852	Intracranial injury	Subarachnoid, subdural, and extradural hemorrhage
	853	Intracranial injury	Other and unspecified intracranial hemorrhage
	854	Intracranial injury	Intracranial injury of other and unspecified nature
Spinal Cord Injury	806	Fractured vertebrae with spinal cord injury	Fracture of vertebral column with mention of spinal cord
	952	Spinal cord injury with no bony abnormality	Spinal cord injury without evident of spinal bone injury

In the OTR, injuries are defined and classified using E Codes from the International Classification of Diseases (ICD) coding system, 9th Revision. The OTR defines trauma as that resulting from a transfer of energy, defined clinically. E Codes that meet this definition of trauma are listed in Appendix A.

The data presented in this bulletin are from the Ontario Trauma Registry Comprehensive Dataset (OTR CDS). The OTR CDS captures information on all major injury hospitalizations (ISS > 12) at LTHs in Ontario. These hospitalizations are submitted on a monthly basis to the OTR, and downloaded annually to the OTR central system. Note that cases in the OTR CDS database do not necessarily represent unique persons since a person can be admitted to hospital more than once within a fiscal year. Also note that percentages reported in this bulletin may not sum to 100% due to rounding. Finally, the denominators used to calculate the unadjusted rates in this bulletin are Statistics Canada population estimates for October 1, 2001.

* Note: *Injury Severity Score* (ISS) is an internationally recognized scoring system developed to assign a level of severity to injury. ISS scores range from 1 (minor) to 75 (major).

2. Results

2.1 Overview

In fiscal year 2001-2002, there were 3,692 major injury hospitalizations in Ontario. Of these cases, there were 2,494 (68%) with at least one head injury, and 191 (5%) with at least one spinal cord injury. This represents a head injury hospitalization rate of 2.1 per 10,000 and a spinal cord injury hospitalization rate of 0.16 per 10,000. Sixty-six per cent (37,832 days) of total days spent in a lead trauma hospital were due to head injuries, and 10% (5,956 days) were due to spinal cord injuries.

As shown in Table 2, major spinal cord injury cases were more likely to be male (81%) compared to head injury cases (71%), had a higher average injury severity score (ISS) (28.8 vs. 26.0, respectively) and double the average length of hospital stay (32 days vs. 16 days). Further, while the majority of spinal cord injury cases were discharged to rehabilitation (62%), few head injuries were similarly discharged (19%). Conversely, over half of head injury cases were discharged home (56%).

Table 2: Characteristics of all Head and Spinal Cord Major Injury Cases, 2001-2002

	Head Injury Cases	Spinal Injury Cases
Total Cases	2,494	191
Crude Rate per 10,000	2.1	0.16
Males (%)	1,772 (71%)	155 (81%)
Age (years)		
Mean (Std. Dev)	44 (24.8)	46 (21.7)
Median	41.0	44.0
Length of Stay (days)		
Mean (Std. Dev)	16 (22.3)	32 (52.8)
Median	8.0	20.0
ISS		
Mean (Std. Dev)	26.0 (10.6)	28.8 (13.7)
Median	25.0	25.0
Inhospital Deaths (%)	398 (16%)	25 (13%)
Discharge Disposition (% total discharged alive)**		
Home (incl with support)	1,171 (56%)	21 (13%)
Another acute care facility	376 (18%)	37 (22%)
Rehabilitation (General and Special)	398 (19%)	103 (62%)
All Other	147 (7%)	*

* Data suppressed due to small cell size.
** Denominator is number cases discharged alive within an injury type. There are 5 cases with missing with discharge disposition.

2.2 Overall Leading Causes of Injury

As shown in Figure 1, the leading cause of both head and spinal cord injuries were motor vehicle traffic incidents (46% and 38%, respectively). For both injury types, falls were the second leading cause of injury (35% and 37%, respectively). The majority of specific fall-related hospitalizations for head injuries were falls on or from stairs or steps (25%, n = 218), slipping, tripping or stumbling (17%, n = 145) and falls from one level to another (11%, n = 93). Similarly, leading specific causes of falls for spinal cord injuries were falls on or from stairs or steps, falls from one level to another, and falls on/from scaffolding (20%, n = 14 for each).

Important causes of injury in the "All Other" category for head injuries were *being struck against or unintentionally struck by an object or person* (2%, n = 58). Nearly half (43%, n = 25) of these were due to being struck in sports. Similarly, for spinal cord injuries, *being struck against or unintentionally struck by an object or person* and *being struck unintentionally by falling objects* (3%, n = 5 for each) were important causes of injury.

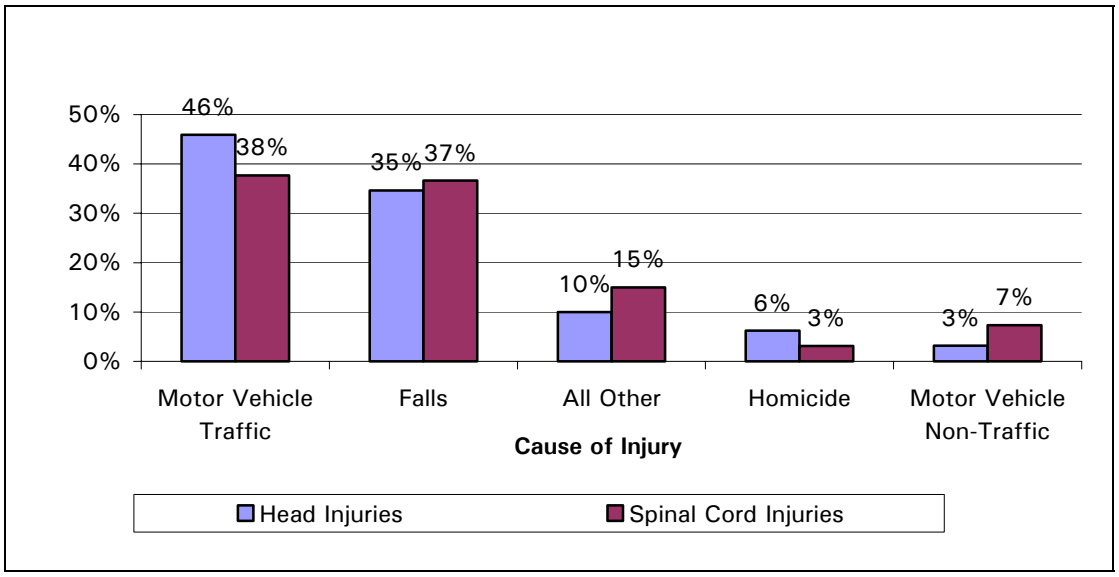

Figure 1: Causes of Major Head and Spinal Injuries in Ontario, 2001-2002

2.3 Overall Diagnoses (N Codes) by Cause of Injury

Tables showing the distribution of N Code diagnoses by cause of injury are shown below. Motor vehicle traffic incidents were the most common cause of injury across nearly all head injury diagnoses. The exception to this was *subarachnoid, subdural, and extradural hemorrhages* (N852), *other and unspecified intracranial hemorrhage* (N853) and *other and unqualified skull fractures* (N803) where falls were the most common cause of injury. Among spinal cord injuries, motor vehicle traffic incidents and unintentional falls were the most common causes of injury, occurring in nearly equal numbers in both N Code diagnosis categories.

Table 3: Head Injuries - Causes of Injury by N Code Diagnosis, 2001-2002

Cause of Injury	N Code Diagnosis**									
	N800	N801	N803	N804	N850	N851	N852	N853	N854	TOTAL
TOTAL (% +)	**345 (14%)**	**704 (28%)**	**26(1%)**	*	**680 (27%)**	**415 (16%)**	**1022 (41%)**	**511 (20%)**	**361(14%)**	**4,066**
Motor Vehicle Traffic	139	328	7	*	425	219	320	203	254	**1,896**
Motor Vehicle Non-Traffic	11	19	0	0	24	6	18	15	19	**112**
Pedal Cyclist	10	15	0	0	8	5	10	5	*	**54**
Unintentional Falls	87	205	10	*	164	131	545	213	40	**1,396**
Suicide	11	13	*	0	8	8	9	10	15	**75**
Homicide	44	71	6	0	19	28	62	34	10	**274**
All Other	43	53	*	0	32	18	58	31	22	**259**

* Data suppressed due to small cell size.
** Refer to Table 1 for definitions of N Code diagnoses
+ The denominator is the total number of cases with at least one head injury (n = 2494)

Table 4: Spinal Cord Injuries - Causes of Injury by N Code Diagnosis, 2001-2002

Cause of Injury	N Code Diagnosis**		
	N806	N952	TOTAL
Total (% +)	**129 (68%)**	**81 (42%)**	**210**
Motor Vehicle Traffic	48	35	83
Motor Vehicle Non Traffic	11	*	14
Unintentional Falls	43	33	76
Suicide and Self Inflicted Injuries (excl. poisoning)	6	*	9
Homicide and Injury Purposely Inflicted (excl. poisoning)	5	*	7
All Other	16	5	21

* Data suppressed due to small cell size.
** Refer to Table 1 for definitions of N Code diagnoses
+ The denominator is the total number of cases with at least one spinal injury (n = 191)

2.4 Injury Hospitalizations By Sex

Among head injuries, females had a higher average age (48 years) than males (42 years), and a slightly higher proportion of inhospital deaths (18%, n = 128 and 15%, n = 270, respectively). Further, a lower proportion of females (50%, n = 299) were discharged home, including with home support, than were males (58%, n = 872).

Females with spinal cord injuries had a similar average age, length of hospital stay, and average ISS as males. However, they had a higher proportion of inhospital deaths (17%, n = 6) than males (12%, n = 19) and a lower proportion were discharged to rehabilitation treatment (50%, n = 15 compared to 65%, n = 88, respectively).

Table 5: Characteristics by Sex, Head and Spinal Cord Major Injuries, 2001-2002

	Head Injuries		Spinal Injuries	
	Female	**Male**	**Female**	**Male**
Total (% of total**)	722 (29%)	1772 (71%)	36 (19%)	155 (81%)
Crude Rate per 10,000	1.2	3.0	0.06	0.26
Age (years)				
Mean (Std. Dev)	48 (27.0)	42 (23.6)	46 (25.1)	46 (20.9)
Median	47.0	39.0	38.0	44
Length of Stay (days)				
Mean (Std. Dev)	16 (21.1)	16 (22.8)	33 (33.3)	32 (56.5)
Median	9.0	8.0	22.0	19.0
ISS				
Mean (Std. Dev)	26.0 (10.4)	26.1 (10.7)	29.2 (12.6)	28.7 (14.0)
Median	25.0	25.0	26.0	25.0
Inhospital Deaths (%)	128 (18%)	270 (15%)	6 (17%)	19 (12%)
Discharge Disposition (%+)				
Home (incl with support)	299 (50%)	872 (58%)	*	17 (13%)
Another acute care facility	124 (21%)	252 (17%)	10 (33%)	27 (20%)
Rehabilitation (General or Special)	113 (19%)	285 (19%)	15 (50%)	88 (65%)
All Other	57 (10%)	90 (6%)	*	*

+ Denominator is total number injury types within a gender and injury type discharged alive. There are 5 cases with missing with discharge disposition.

* Data suppressed due to small cell size.

** Denominator is total number of cases with at least one documented spinal or head injury as appropriate

As shown in Figure 2, the leading cause of injury hospitalization among both male and female head injuries was motor vehicle traffic incidents, followed by falls and homicides. However, there was a higher proportion of female head injuries due to motor vehicle traffic collisions (52%) than males (43%).

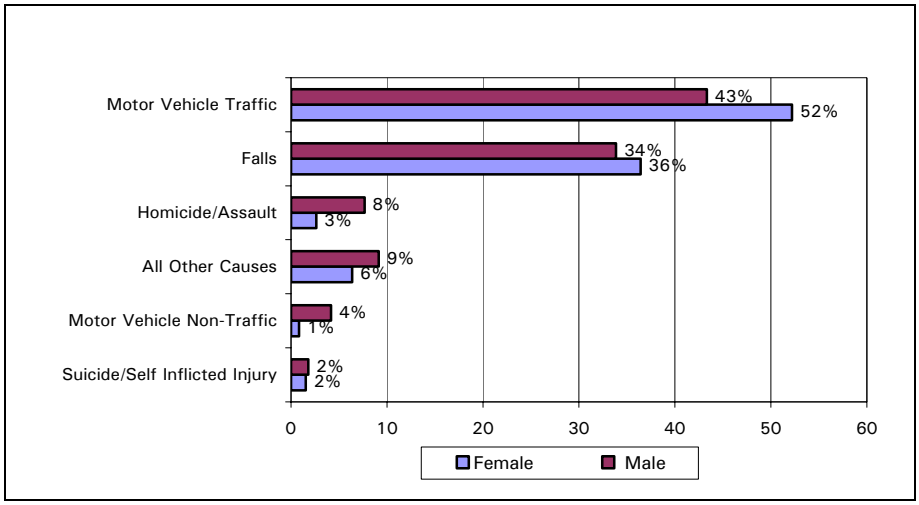

Figure 2: Leading Causes of Head Injury by Sex, 2001-2002

Among spinal cord injury hospitalizations, the leading cause of injury for females were falls (42%, n = 15) while the leading cause of injury for males were motor vehicle traffic collisions (38%, n = 59) (Figure 3).

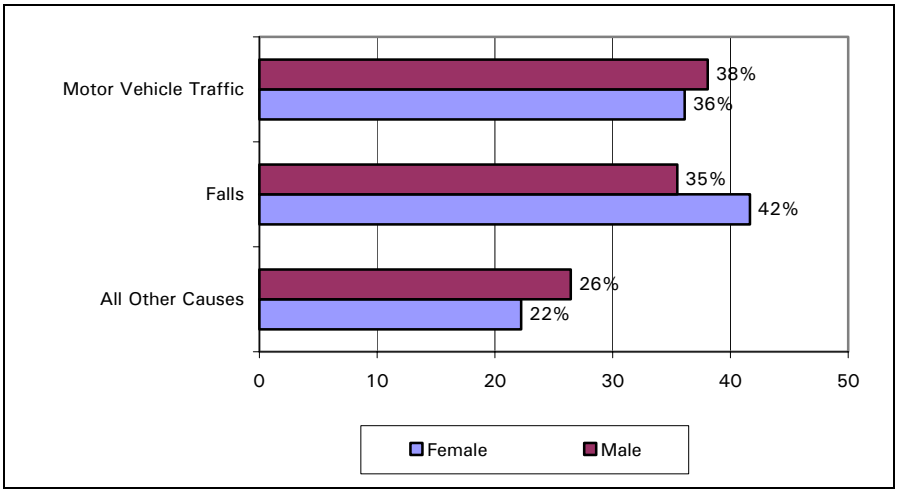

Figure 3: Leading Causes of Spinal Cord Injury by Sex, 2001-2002

2.5 Injury Hospitalizations By Age

Head Injuries

Table 6 shows that the proportion of head injury hospitalizations increased with age, peaking at the 35-64 year age group (32%, n=798), after which the number decreased. The proportion of male head injury cases across age groups peaked at 79% (n=429) in the 20-34 year age group. The average length of hospital stay also increased with age, ranging from 13 days among cases <20 years to 17 days among cases 35-64 years and 65+ years of age. The proportion of inhospital deaths increased with age. Further, of those cases discharged alive, the proportion of head injury cases discharged home decreased with age.

Table 6: Characteristics of Major Head Injuries, 2001-2002

Characteristics	Age Group				
	<20 yrs	20-34 yrs	35-64 yrs	65+ yrs	Total
Total Cases (% Total)	494 (20%)	540(22%)	798(32%)	661(27%)	2,493**
No. Male (%)	347 (70%)	429(79%)	588(74%)	407(62%)	1,771(71%)**
Length of Stay					
Mean (Std. Dev)	13 (20.2)	14 (17.7)	17 (25.3)	17 (23.0)	16(22.3)
Median	6	8	10	8	8.0
ISS					
Mean (Std. Dev)	25.4 (11.2)	27.4 (12.1)	26.8 (10.8)	24.6 (8.1)	26.0 (10.6)
Median	25	25	25	25	25.0
No. Deaths (%)	58 (12%)	59 (11%)	110(14%)	170 (26%)	397(16%)**
Discharge Disposition (% total discharged alive)*					
Home (incl. with support)	306 (70%)	292 (61%)	391 (57%)	182 (37%)	1,171 (56%)
Another Acute Care facility	32 (7%)	78 (16%)	123 (18%)	143 (29%)	376 (18%)
Rehabilitation (General or Special)	55 (13%)	96 (20%)	150 (22%)	97 (20%)	398 (19%)
All Other	42 (10%)	15 (3%)	24 (3%)	66 (13%)	147 (7%)

* Denominator is total number of injury types within an age group discharged alive. There are 4 cases with missing discharge disposition data

** 1 case with unknown age

Spinal Injuries

Similar to head injuries, the proportion of spinal injury hospitalizations and males increased with age, peaking at the 35-64 year age group (Table 7). The average length of hospital stay ranged from 21 to 40 days, and was higher across all age groups than head injury cases. The maximum number of inhospital deaths occurred among the 65+ year olds (36%, n=16). Finally, across all age groups, the majority of cases were discharged to rehabilitation.

Table 7: Characteristics of Major Spinal Cord Injuries, 2001-2002

Characteristics	Age Group				
	<20 yrs	20-34 yrs	35-64 yrs	65+ yrs	Total
Total Cases (% Total)	23 (12%)	42 (22%)	81 (42%)	45 (24%)	191
No. Male (%)	17 (74%)	33 (79%)	70 (86%)	35 (78%)	155 (81%)
Length of Stay					
Mean (Std. Dev)	21 (16.9)	28 (21.8)	40 (74.9)	26 (30.1)	32 (52.8)
Median	17.0	22.0	20.5	16.0	20.0
ISS					
Mean (Std. Dev)	32.0 (17.9)	28.9 (11.8)	28.6 (13.2)	27.3 (14.0)	28.8 (13.7)
Median	26.0	26.0	25.0	25.0	25.0
No. Deaths (%)	*	*	5 (6%)	16 (36%)	25 (13%)
Discharge Disposition (% total discharged alive)+					
Another Acute Care facility	*	9 (22%)	14 (19%)	11 (38%)	37 (22%)
Rehabilitation (General or Special)	13 (65%)	28 (68%)	50 (67%)	12 (41%)	103 (62%)
All Other	*	*	11 (15%)	6 (21%)	25 (15%)

* Data suppressed due to small cell size.

+ Denominator is total number of injury types within an age group discharged alive. There is 1 case with missing discharge disposition data.

2.6 Month of Injury Occurrence

The peak month of head injury occurrence was January (12%, n = 308), followed by July (10%, n = 251) (Figure 4). The greatest proportion of spinal cord injuries occurred during the summer months, with peaks occurring during July (12%, n = 22), August (13%, n = 24), and September (12%, n = 22).

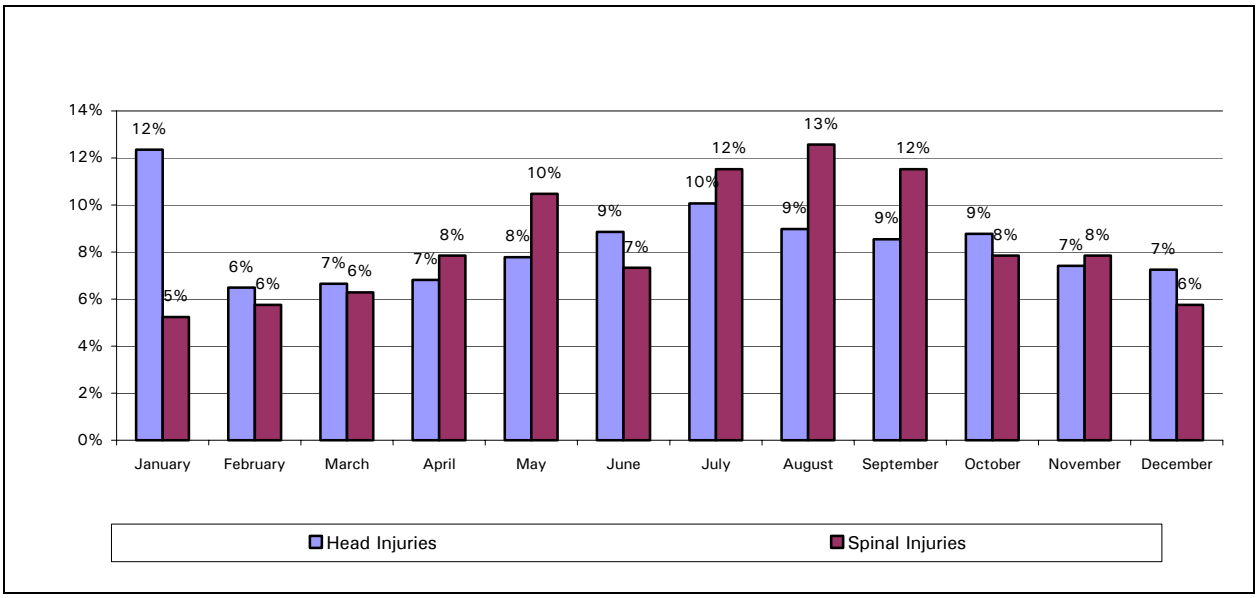

Figure 4: Month of Head and Spinal Cord Injury Occurrence, 2001-2002

2.7 Activity and Location of Injury

Place of Injury

There were 2,228 head injury cases and 176 spinal cord injury cases with valid documentation of place of injury occurrence. Of these, the majority of head (58%, n = 1,285) and spinal cord (45%, n = 79) injuries occurred on the street. In both head and spinal cord injury types, the second most common place of occurrence was the home (24%, n = 531, and 23%, n = 41, respectively).

Activity While Injured

There were 222 head injury and 31 spinal cord injury cases with documentation of the injury occurring during a sports and recreation activity. Among head injuries the leading sports and recreation activity was driving a pedal cycle (23%, n = 50). Other leading sports and recreation activities among head injuries included ATVs (15%, n = 33), snowmobiling (9%, n = 20), playing (running, jumping, skipping, general play) (8%, n = 18), and dirt biking/minibike/motocross (6%, n = 13). The leading sports and recreation activity among spinal cord injuries was all terrain vehicles (ATVs) (23%, n = 7).

Work Related

Of head injury cases with valid responses (n = 2,489), 4% (n = 111) had documentation that the injury was work-related. Further, of spinal cord injuries with valid responses (n = 190), 8% (n = 15) indicated that the injury was work-related.

3. Summary

In 2001-2002 there were 2,494 head and 191 spinal cord major injury hospitalizations in Ontario. This represented 37,832 hospital days for head injuries and 5,956 days for spinal cord injuries. Spinal cord injuries had a higher proportion of males, twice the average length of hospital stay, and a much higher proportion of cases discharged to rehabilitation compared to head injuries. The leading cause of injury for both injury types was motor vehicle traffic incidents followed by unintentional falls.

Among head injury type, females had a higher average age and higher proportion of inhospital deaths than males. Within spinal cord injury type the average age, length of hospital stay and average ISS were similar across genders. However, females had a higher proportion of inhospital deaths and a lower proportion discharged to rehabilitation than males.

For both head and spinal cord injury types, the number of injury hospitalizations increased with age, as did the proportion of males, average length of hospital stay, and proportion of inhospital deaths. Further, discharge to another acute care facility peaked in the 65 + age group for both injury types.

Peak month of injury occurrence differed for head (January) compared to spinal cord injury types (August). Of the valid responses, the leading sports and recreation activity for head injuries was driving a pedal cycle, while the for spinal cord injuries it was ATVs. Finally, for both injury types with a valid response, the majority of injuries occurred on the street.

Appendix A: Trauma Definition - E Code Inclusions and Exclusions

The definition of trauma as injury resulting from the transfer of energy has been approved by the Ontario Trauma Registry Advisory Committee.

The following lists the E Code categories used for reporting purposes based on the trauma definition. 'Incident' and 'unintentional' have been substituted for the term 'accident' used in the ICD definitions.

E Code Inclusions	
E Code Category	**Definition**
E800-E807	Railway incidents
E810-E819	Motor vehicle traffic incidents
E820-E825	Motor vehicle non-traffic incidents
E826	Pedal cycles
E827-E829	Other road vehicle incidents
E830-E838	Water transport incidents
E840-E845	Air and space transport incidents
E846-E848	Vehicle incidents not elsewhere classifiable
E880-E888	Unintentional falls
E890-E899	Incidents caused by fire and flame
E900-E902, E906-E909	Incidents due to natural and environmental factors
E910	Incidents caused by drowning
E913	Incidents caused by suffocation
E914-E915	Foreign bodies (excluding choking)
E916-E928	Other incidents
E953-E958	Suicide and self inflicted injury (excluding poisoning)
E960-E961, E963-E968	Homicide and injury purposely inflicted by other persons
E970-E976, E978	Legal intervention
E983-E988	Injury undetermined whether unintentionally or purposely inflicted
E990-E998	Injury resulting from operations of war

Appendix A: Trauma Definition: E Code Exclusions

The following lists the E Code categories that are excluded from the Ontario Trauma Registry definition of trauma.

E Code Exclusions	
E Codes	**Definition**
E850-E858	Poisonings by drugs
E860-E869	Poisoning by gases
E870-E876	Misadventures
E878-E879	Complications
E903	Travel and motion
E904	Hunger, thirst, exposure, neglect
E905	Venomous animals and plants
E911	Inhalation and ingestion of food causing obstruction
E912	Inhalation and ingestion of other objects causing obstruction
E929	Late effects
E930-E949	Drugs, medicinal and biological substances causing adverse effects
E950-E952	Suicide and self inflicted injury (poisonings)
E959	Late effects of self inflicted injury
E962	Assault by poisoning
E969	Late effects of injury purposely inflicted by other person
E977	Injury due to legal intervention
E980-E982	Poisoning undetermined whether unintentionally or purposely inflicted
E989	Late effects intentionality undetermined
E999	Late effects due to war