spinal cord injury in wisconsin
1999

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Wisconsin Department of Health and Family Services
Division of Supportive Living
Bureau of Aging and Long Term Care Resources
Office for Persons with Physical Disabilities

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Alternate format versions of this report are available on request.

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preface

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introduction

The establishment of a statewide database and surveillance program was necessary to clearly identify factors and demographics of the population of individuals who sustain spinal cord injuries (SCIs).

This report represents an overview of spinal cord injuries in Wisconsin occurring in 1999 including incidence, prevalence and economic information. Data presented in this report are drawn from hospital discharge data with ICD-9-CM diagnostic codes 806.00-806.99 (fracture of vertebral column with spinal cord injury) and 952.00-952.99 (spinal cord injury without evidence of spinal bone injury). These codes were chosen based on Center for Disease Control and Prevention Guidelines.

With these data it is possible the same person could be hospitalized more than once during 1999. To avoid counting duplicate hospital visits, only the initial hospital visit data is included in the report, except for the "length of stay" and "cost of stay" data. These exceptions were figured from all hospital visits resulting from the original injury to give the actual length of stay and cost of stay data for each injury.

The discharge data presented here include all events occurring in Wisconsin during 1999 to Wisconsin residents only. Non-residents of Wisconsin were not included. Hospital discharge data were provided by the Wisconsin Bureau of Health Information under a confidentiality agreement with the Office for Persons with Physical Disabilities (OPPD).

Readers are encouraged to review the entire report and tables before drawing conclusions. Please contact the Office for Persons with Physical Disabilities for further explanation of data presented in this report or for additional copies.

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background

In 1995 the Medical College of Wisconsin received a five-year grant from the National Institute on Disability and Rehabilitation Research, Department of Education to become a federally designated Model Spinal Cord Injury Center. As an integral component of the grant, the Department of Health and Family Services, Office for Persons with Physical Disabilities received a subcontract to establish an SCI surveillance database. The database compiles statewide hospital discharge data about persons sustaining SCIs. These data will enable other investigators to design and implement prevention and service projects, to assist individuals with SCIs to live at their maximum levels of independence in their communities.

The objectives of the Spinal Cord Injury Surveillance include:

- identify and track the incidence of spinal cord injury in Wisconsin,
- provide data to facilitate the development and implementation of effective preventive programs, and
- identify and track the expenditure of treatment and service dollars for persons who are spinal cord injured.

The grant that funded the SCI registry expired in 2000. The Office for Persons with Physical Disabilities continues to provide information and assistance to people with SCI and people seeking information about SCI.

data sources

The 1987 Wisconsin Act 399 established the Bureau of Health Information (BHI), formerly known as the Office of Health Care Information (OHCI). BHI's responsibilities include collecting, analyzing and disseminating information on health care from inpatient hospital medical records. Under the statute and administrative rules, hospitals are required to submit specific data to BHI to construct an inpatient hospital database, using information currently being collected on the Uniform Billing forms (UB-92). Along with a patient's billing information, the diagnosis and treatment of the patient are recorded using standard International Classification of Disease-9th Revision-Clinical Modification (ICD-9-CM) codes.

Hospitals reporting spinal cord injuries in 1999 are shown in Table 1.2 and the diagnoses used are shown in Table 1.3, both in Appendix 1.1.

The case definition used for this analysis is consistent with current Centers for Disease Control (CDC) guidelines for SCI surveillance. These are the ICD-9-CM codes 806.0-806.9 (fracture of vertebral column with spinal cord injury) and 952.0-952.9 (spinal cord injury without evidence of spinal bone injury). This report does not include persons with SCI who died before reaching a hospital.

Data collected from BHI also includes external cause codes (E Codes) which classify causative agents and/or activities for disabling injuries. E-codes provide crucial information to guide, develop and evaluate interventions and initiate prevention activities. E-codes are in Table 1.4.

data security

The SCI database maintains confidential data on individuals. These data are only accessible to the subject of the data and to the data analyst. Measures to retain patient confidentiality are outlined in Wisconsin Statues Chapter 153.45 (Release of Data) and 153.50 (Protection of Patient Confidentiality). Only summary data are accessible to the public to protect individual identities.

All data are protected electronically through password measures. Copies of data on backup diskettes are kept under lock and key by the analyst at OPPD. An automatic virus-checking program safeguards against virus data corruption.

data quality

While analyzing these data, questions arose relevant to the validity of coding by hospitals of SCIs resulting in permanent neurological deficit necessitating an inpatient rehabilitation stay. An SCI with permanent neurological deficit is one in which the individual becomes paralyzed including tetraplegia, paraplegia or has paralysis of bowel and bladder functions.

In the American Journal of Epidemiology, Vol. 146, pp 266-272, 1997, Johnson et al. raised the issue of accuracy in reporting of SCI to a statewide database in Colorado. They report a positive predictive value of 0.55, implying that one can be only 55 percent certain that an identified case of SCI resulted in permanent neurological deficit. This affects the surveillance aspects of any database planning to record only SCIs with permanent neurological deficit.

While full medical chart review of all reported cases is not feasible due to cost, time and confidentiality, an attempt is underway to screen data using available codes via a validity screen developed by Dr. Dennis Maiman, a neurosurgeon at the Medical College of Wisconsin.

A study was recently conducted to test that effectiveness of the validity screen. It found that cases without permanent neurological deficit were identified 82 percent of the time while cases with permanent neurological deficit were identified 74 percent of the time. For a copy of this study, contact the SCI analyst.

wisconsin’s population

Table 1.7 in Appendix 1.3 summarizes Wisconsin's population by gender and age. From 1990 census data, Wisconsin's estimated 1999 population was approximately 49.1 percent male and 50.9 percent female. The largest population age group for both males and females was 18 - 44, comprising 39 percent of the general population. Ages 0-17 (26%), 45-64 (22%) and 65+ (13%) followed (Wisconsin Department of Health and Family Services, 2000).

Table 1.7 in Appendix 1.3 shows SCI events by county of residence in 1999. These data reflect the county in which the person lives, not necessarily the county in which the SCI occurred. As expected, counties with greater population rates had a higher number of injury events occurring to their residents.

introduction to spinal cord injury

The spinal cord is part of the nervous system and is the largest nerve in the body. It is approximately 18 inches long and extends from the base of the brain, down the middle of the back, to the waist. The spinal cord is surrounded by protective rings of bone called the vertebral column, or spinal column. The 33 vertebrae of the spine are divided into several regions.

The cervical spine in the neck area consists of seven vertebrae and eight nerve roots. They are smaller than other vertebrae, allowing for greater movement. The thoracic spine, at chest level, has 12 vertebrae and nerve roots. The spinal canal in the thoracic region is relatively smaller than the cervical or lumbar areas, putting the thoracic spinal cord at greater risk if there is a fracture (Maddox, 1993). The lumbar spine, in the low back region, has five vertebrae and nerve roots. The sacrum also has five fused vertebrae and nerve roots. The coccyx, or tailbone, has one vertebrae and nerve root. Vertebrae increase in size as they go down the column.

The central nervous system consists of the brain and spinal cord. The nerves in the spinal cord are upper motor neurons and their function is to carry the messages back and forth from the brain to the spinal nerves along the spinal tract. The peripheral nervous system consists of lower motor neurons, spinal nerves that branch out from the spinal cord to other parts of the body. These spinal nerves exit and enter at each vertebral level and communicate with specific areas of the body. The sympathetic nervous system is a system of nerves controlling involuntary functions such as blood pressure and temperature regulation.

Spinal cord injury (SCI) refers to any injury of the neural elements within the spinal column. SCI can occur from trauma or disease to the vertebral column or the spinal cord. Most SCIs result from trauma to the vertebral column. The spinal cord does not have to be severed for a loss of functioning to occur. Most people with SCI have an intact spinal cord, but the damage to it results in loss of functioning due to bruising or loss of blood supply. These injuries can affect the spinal cord's ability to send and receive messages from the brain to the body systems controlling sensory, motor and autonomic function below the level of injury.

Typically, the nerves above the injury site continue to function normally but the nerves below the site do not. A physician describes an individual as having a certain “level” injury by naming the region affected and the level that corresponds with that region. In general, the higher the level of injury, the greater the functional loss. Damage to the cervical region (C1-C8) usually results in a loss of function in the arms and legs, resulting in tetraplegia. Injury to the thoracic region (T1-T12) usually affects the chest and legs and results in paraplegia. Nationally, the most common types of injury are at the mid-to-low cervical vertebrae (C5-C6), followed by the thoracolumbar junction (T2-L1). Both spots are the spine’s areas of greatest flexibility and vulnerability.

report

Executive Summary
Incidence of Spinal Cord Injury
Hospitalization and Cost Information
Causes of Injury
Level and Severity of Injury
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executive summary

In 1999, there were 246 SCI events in Wisconsin with falls and motor vehicle accidents as the predominant causes of hospitalization. Males disproportionately represent 76.8 percent of SCI events.

- The average age at time of injury was 44.2 (males 43.2 and females 47.6), with the most frequent age at 20.6 for males and 16 for females.
- Males ages 18-44 represent the overall largest group of injury with 88 (35.8% overall) injuries, followed by men in the 65+ age group with 38 (15.4% overall) injuries.
- Females ages 18-44 represent the largest group of women with 21 (8.5%) injuries and women 65+ represent the next largest group with 17 (6.9% overall) injuries.
- Overall, 109 (44.3%) injuries (both men and women) occurred between the ages of 18-44.
- Of all injuries, 55 (22.4%) occurred to individuals age 65+.

SCI can result in paraplegia or tetraplegia. One hundred twelve injuries (45.5%) resulted in tetraplegia, 83 (33.7%) to men and 29 (11.8%) to women. Eighty-one injuries (32.9%) resulted in paraplegia, 64 (26%) to men and 17 (6.9%) to women. See Graph 1.10, page 28.

Although age and gender are significant risk factors for spinal cord injury, there are other risk factors that contribute such as race, time of year and demographic area. The majority of individuals admitted for SCIs during 1999 were white (182 or 74%), followed by African Americans with 26 (10.6%) injuries. Although whites sustain the majority of spinal cord injuries, members of minority groups sustain a disproportionate percentage relative to their numbers. African Americans comprise approximately 5.7% of Wisconsin's population (2000 Census).

Summer and winter had the highest number of spinal cord injury events, with 28 in July and 27 in November. Thursday and Tuesday had the highest incidence of spinal cord injuries with 48 (19.5%) and 44 (17.9%) respectively.

The average length of an inpatient hospital stay in 1999 was 12 days. In 1999, hospital charges for treatment for SCIs totaled more than $10 million. The average cost for acute inpatient hospital stay is $41,557.

In 1999, 54.5% (134) of initial inpatient stays were paid by fee for service insurance. Seventy-two (29.3%) initial inpatient stays were paid for by an Alternative Health Care Insurance Plan (HMO, PPO, PPA, etc.). This represents a 47.5% decrease over 1998, during which fee for service insurance paid 76% of SCI inpatient stays and Alternative Health Care Insurance Plans paid 31% of inpatient SCI stays, a decrease of 1.7%.

Spinal cord injuries have profound effects on the public health system because of the young age of those injured, the high cost of acute and rehabilitative care, and the long-term disability.

spinal cord injury events: 1999

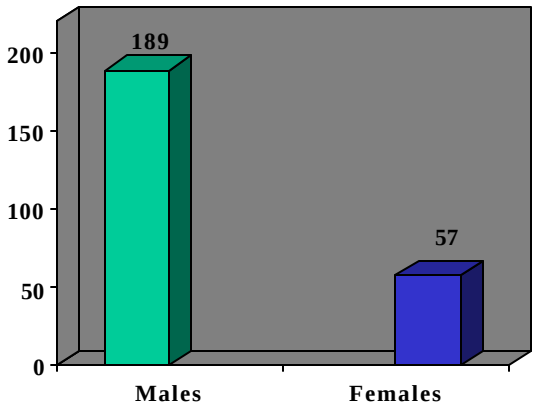
The Incidence of Spinal Cord Injury

From January 1, 1999 to December 31, 1999, a total of 246 Wisconsin residents were hospitalized for an SCI.

Demographics

Sex
Males sustained 189 injuries (77%) and females sustained 57 injuries (23%) (Graph 1.1).

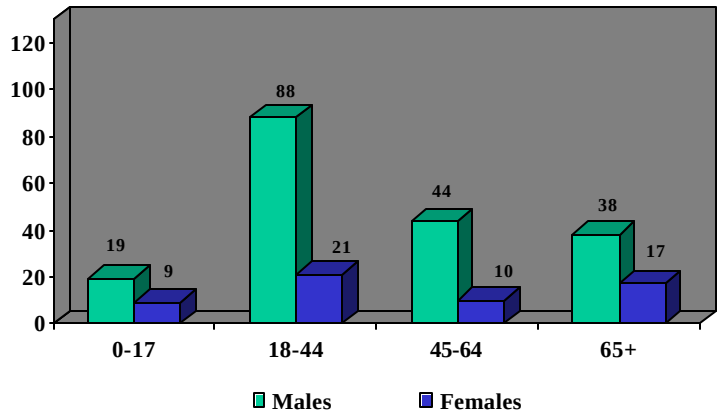
Graph 1.1
Injuries by Gender and Year
1999



Age
The average age at time of injury was 44.2. The mean age at injury was higher for females (37) than for males (20.6). Ages range from 10 to 96.

- Males aged 18-44 represent the overall largest group of injury with 88 (47%) injuries, followed by men in the 45-64 age group with 44 (23%) injuries.
- Females aged 18-44 represent the largest group of women with 21 (37%) injuries, followed by women 65+ with 17 injuries (30%) (Graph 1.2).

Graph 1.2
Injuries by Age and Gender
1999



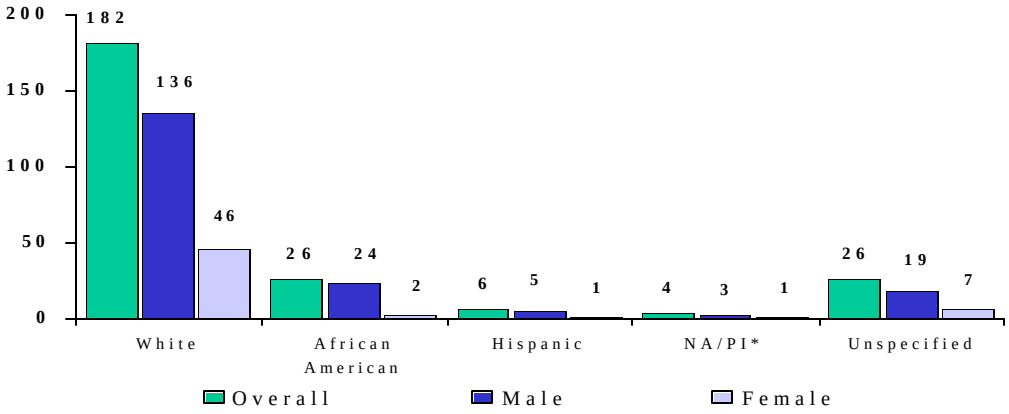
Overall, 44% of all injuries occurred to individuals between the ages of 18-44. The next highest age group was 65+, with 55 (22%) of all injuries. Fifty-four (22%) injuries occurred to individuals aged 45 to 64 and 28 (11%) injuries occurred between the ages of 0-17. The total number of spinal cord injuries for each age group and gender is listed in Table 1.5.

Among racial/ethnic groups, Native Americans had the highest mean age at injury (55 years), while Hispanics have the lowest mean age at injury (24 years). The mean age at injury for African Americans is 37 years, for Asian/Pacific Islanders, 32 years, and for whites, 47 years.

Ethnicity
The race of some patients in 1999 was unknown or documented as "other" or was otherwise unspecified (26 or 10.6%). The majority of individuals admitted for SCIs during 1999 were white (182 or 74%), followed by 26 (10.6%) for African Americans, 6 (2.4%) for Hispanics and 4 (1.6%) for Asian/Pacific Islanders and Native Americans (Graph 1.3).

Although whites sustained the majority of spinal cord injuries, members of minority groups sustained a disproportionate percentage relative to their numbers in Wisconsin. In fact, 5.7% of Wisconsin's population is African American (2000 Census), yet this group sustained 10.6% of all spinal cord injuries in Wisconsin.

Graph 1.3
Injuries by Race
1999



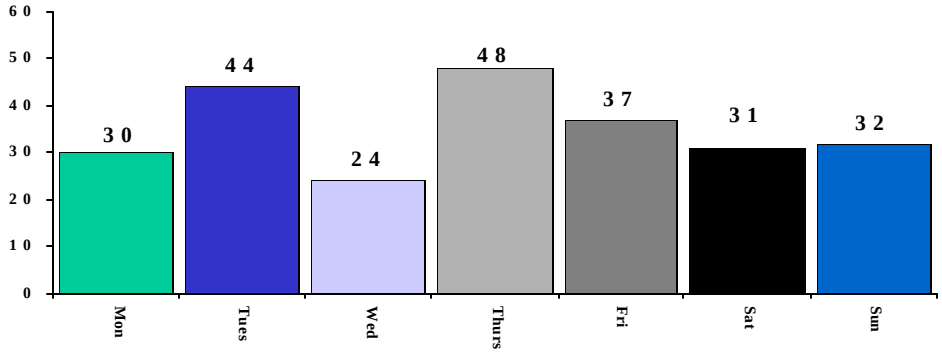
*NA/PI = Native American/Pacific Islander

Hospitalization and Cost Information

Admission Day, Month, Type and Source

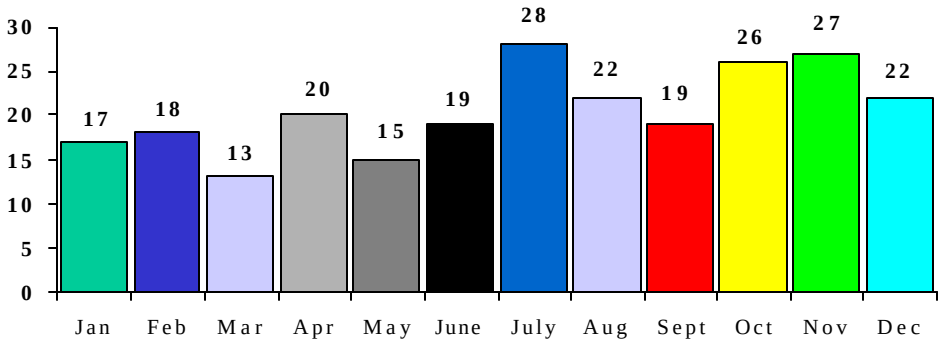
In 1999, the majority of SCI events occurred on Thursday with 48 injuries (19.5%), followed closely by Tuesdays with 44 injuries (17.9%). Wednesdays have the lowest number of injury events with 24 (9.6%) (Graph 1.4).

Graph 1.4
Admission by Day of the Week
1999



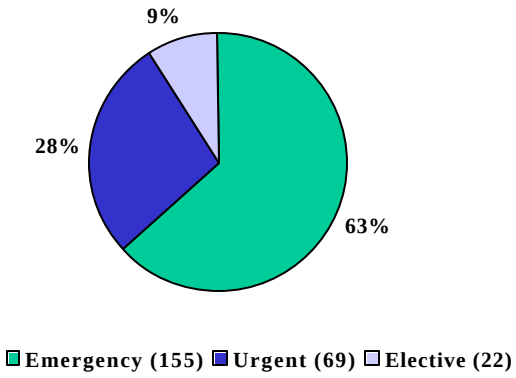
The highest number of injuries during one month, 28, occurred during July followed by 27 injuries in November. March and May had the lowest number of injuries with 13 and 15 respectively (Graph 1.5).

Graph 1.5
Admission by Month
1999



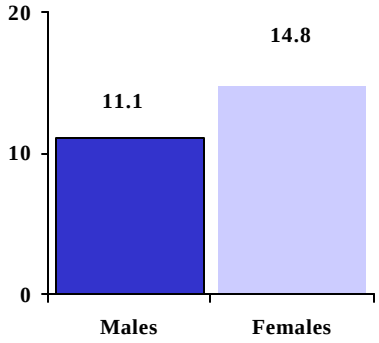
Both the largest type and source of admission to hospitals involving residents with SCIs occurred during emergency situations, 155 or 63%, when the patient required immediate medical intervention as a result of severe, life threatening or potentially disabling conditions (Graph 1.6).

Graph 1.6
Type of Admission
1999



Length of Inpatient Stay
The average length of an acute inpatient hospital stay in 1999 was 12 days. The average length of stay for men was 11.1 days, for women 14.8 days (Graph 1.7). The length of inpatient stay has decreased by 23.2 days since 1990 when the overall average length of stay was 35.2 days, 36.5 for men and 31.5 for women. The average length of stay for a tetraplegia injury was 10.5 days (9.5 for men and 13.4 for women) and for a paraplegia injury, 12.9 days (11.1 for men and 20.1 for women).

Graph 1.7
Average Length of Inpatient Stay by Gender
1999



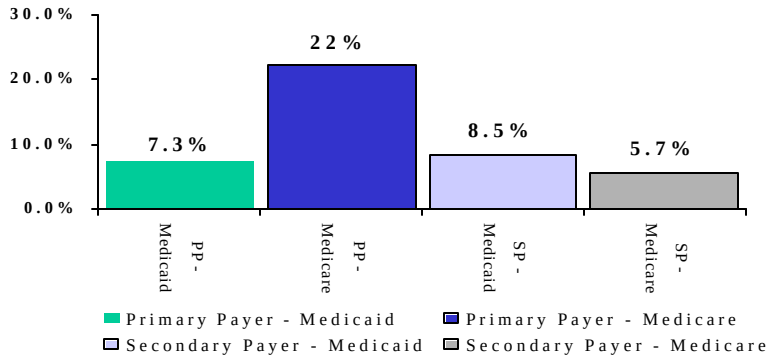
Cost of Inpatient Hospital Care
In 1999, acute care hospital charges for treatment of spinal cord injury totaled more than $10 million. In 1990 the overall cost totaled more than $11 million. Since 1990, which had an incidence of 204 SCIs in Wisconsin, compared with the 1999 incidence of 246, there has been a decrease of 23.2 days in the average length of inpatient stay. The average cost for an acute inpatient hospital stay has decreased from $55,542 in 1990 to $41,557.46 in 1999.

The cost of hospitalization was greater for females than males. In 1999, males averaged $39,160.69 per year, females averaged $49,504.65 per year, down from an average cost of $59,597 for men and $43,986 for women in 1990. Fifty-one percent of all injuries to females (29) resulted in tetraplegia, while 43.9% of injuries to males (83) resulted in a tetraplegia diagnosis. Seventeen (29.8% of all injuries to women) injuries resulted in paraplegia, while 64 injuries (33.7% of all injuries to men) resulted in paraplegia.

It is important to remember that these costs do not reflect the total cost for a spinal cord injury, because medical equipment, ongoing medical care, home and vehicle modifications and attendant care add to the overall costs of spinal cord injuries.

Payer Type
In 1999, the majority of initial inpatient stays (134 or 54.5%) were paid for by fee-for service insurance. Seventy-two (29.3%) initial inpatient stays were paid for by an Alternative Health Care Insurance Plan (HMO, PPO, PPA, etc.). Other payment types included worker's compensation (14 or 5.7%), general relief or other government agency or program (3 or 1.2%), and self-pay (12 or 4.9%). For 11 (4.5%) inpatient stays, the exact type of payment, either fee-for-service or HMO was unable to be determined.

Graph 1.8
Primary and Secondary Payers
1999



Primary and Secondary Payer
Medicare was the primary payer for 54 (22%) initial inpatient stays; Medicaid for 18 (7.3%) stays. Medicare was the secondary payer for 14 (5.7%) initial hospital stays; Medicaid for 21 (8.5%) (Graph 1.8).

Causes of Injury

Based on E-Codes, the leading cause of SCI during 1999 was motor vehicle accidents (103), followed by falls (81) and then other injury events (28) such as sports accident or being struck by an object or person. Motor vehicle crashes were the leading cause of injury to those aged 0 - 45. After age 45, the leading cause of injury was due to some type of fall (52 or 21.1%) (Graph 1.9).

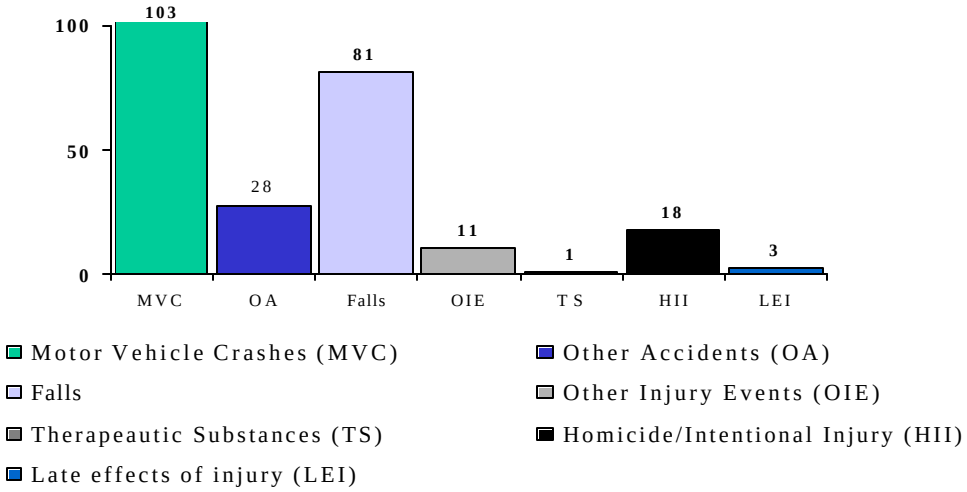
Motor vehicle accidents were the leading cause of injury to whites with 80 injuries, 32.5% overall or 44% of injuries to that population. Homicide and intentional injury (assault and self-inflicted injuries) were the leading cause of injuries to African Americans (10 or 4.1% overall) which represents 38.5% of injuries to that population. The second leading cause of injury to whites was Other Accidents (20 or 8.1% overall), followed by falls with 13 or 5.3% of injuries

overall. For African Americans, the second leading cause of injury was motor vehicle accidents (6 or 2.4% overall) which represent 23% of all SCIs to that group.

Graph 1.9

Causes of Injury

1999



The causes of SCIs for 1999 are listed in Table 1.4 in Appendix 1.1.

Table 1.1
Causes of SCI by Selected Age Groups and Gender: 1999

Age Groups and Causes	Total		Male		Female	
	Number of SCI Events	%	Number of SCI Events	%	Number of SCI Events	%
0-17						
Total All Causes	**28**	**100**	**19**	**67.9**	**9**	**32.1**
Motor Vehicle Crashes	13		6		7	
Other Accidents	6		6		0	
Falls	3		3		0	
Other Injury Events	2		1		1	
Homicide/Intentional Injury	4		3		1	
18-44						
Total All Causes	***108**	**100**	**87**	**80.6**	**21**	**19.4**
Motor Vehicle Crashes	54		39		15	
Falls	26		24		2	
Other Accidents	13		12		1	
Homicide/Intentional Injury	10		9		1	
Other Injury Events	4		2		2	
Late Effects of Injury	1		1		0	
45-64						
Total All Causes	**54**	**100**	**44**	**81.5**	**10**	**18.5**
Falls	20		16		4	
Motor Vehicle Crashes	18		13		5	
Other Accidents	7		7		0	
Homicide/Intentional Injury	4		4		0	
Other Injury Events	3		3		0	
Therapeutic Substances	1		0		1	
Late Effects of Injury	1		1		0	
65+						
Total All Causes	**55**	**100**	**38**	**69.1**	**17**	**30.9**
Falls	32		20		12	
Motor Vehicle Crashes	18		14		4	
Other Injury Events	2		1		1	
Other Accidents	2		2		0	
Late Effects of Injury	1		1		0	

*One male did not have an e-code; incidence in this age group is 109.

Motor Vehicle Accidents

In 1999, motor vehicle accidents (MVAs) were the leading cause of SCI in Wisconsin and the leading cause of injury to persons of both genders ages 0 to 44. Of the 103 injury events, 72 (29.3%) resulted in injuries to males and 31 (12.6%) to females.

In 27.6% (68) of MVAs, the driver sustained an SCI. The remainder of injuries sustained in an MVA occurred to passengers or pedestrians. Four (3.8%) of all MVAs occurred to individuals on a motorcycle (Table 1.9).

Falls
Falls were the second leading cause of SCI among Wisconsin residents, comprising 32.9% of all injuries (81). Males sustained approximately 3.5 times as many injuries as females. Falls were the leading cause of spinal cord injury for both genders ages 45 and older. Fourteen (5.7%) of falls occurred when an individual fell from one level to another while 12 (4.9%) of falls were the result of a slip, trip or stumble (a fall on the same level). Of all falls, 13% occurred to persons older than 65.

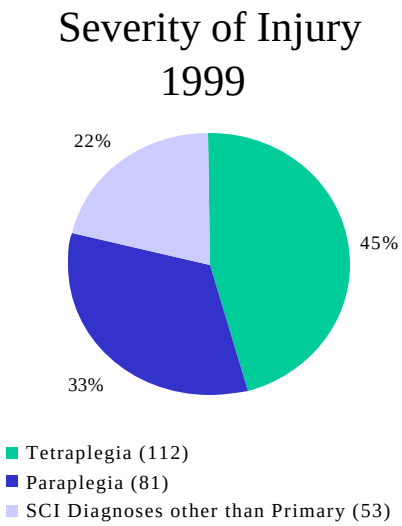
Other Accidents
This was the third leading cause of injury, not related to transport vehicles, but including injuries incurred from sports, agriculture, other machinery and over exertion. Twenty-eight injuries (11.4%) were sustained due to these events.

Homicide/Intentional Injuries
Homicide and intentional injuries were the fourth leading cause of SCI in 1999 with 7.3% (18) of all injuries. The majority of injuries in this category were due to assault by firearms (13 or 5.3%), 14 injuries to males and 1 to a female. This category also includes suicide attempts, firearm injuries-intention unknown and fights.

Level and Severity of Injury

There are two categories of spinal cord injuries: paraplegia and tetraplegia. A person is said to have paraplegia when there is a loss of feeling in the lower portion of the body. Tetraplegia is described as loss of movement in both the upper and lower portions of the body (Maddox, 1993). Based on Primary Diagnosis data, 112 (45.5%) of all SCIs resulted in tetraplegia and 81 (33%) in paraplegia (Graph 1.10). Men sustained 83 injuries (74.1% of all tetraplegia injuries) and women 29, 25.9% of injuries resulting in tetraplegia. Men received 64 injuries (79% of all paraplegia injuries) and women 17, 21% of injuries resulting in paraplegia.

Graph 1.10



The severity of a spinal cord injury is determined by the level of the injury and by the amount of neurological impairment. A spinal cord injury at any level may impair strength, sensation, bowel, bladder and sexual functioning.

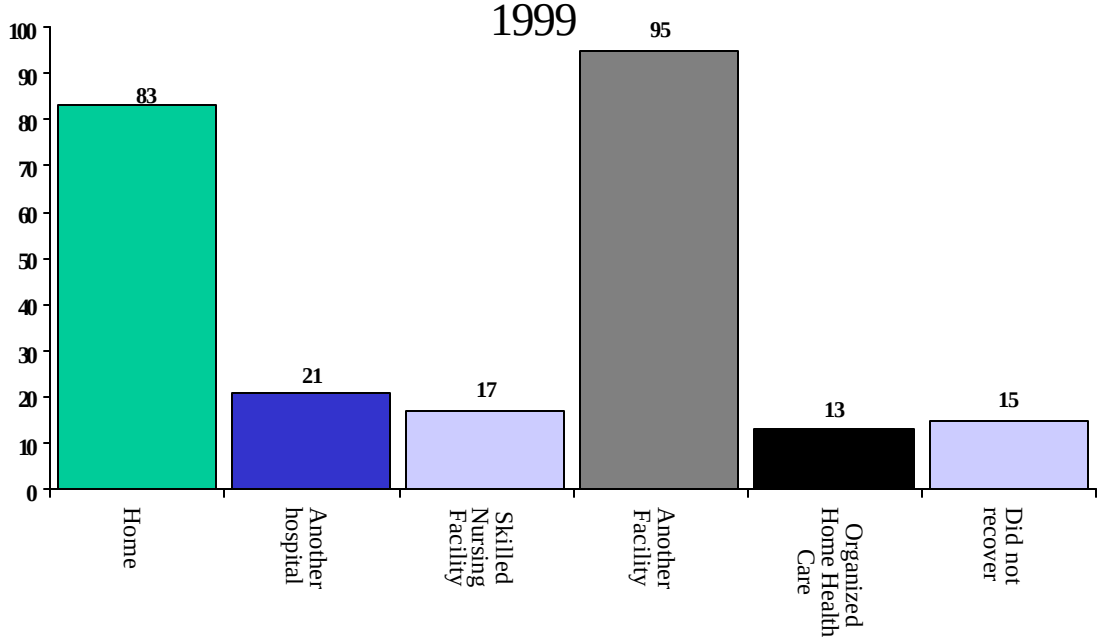
An SCI can also be described as complete or incomplete. With a complete injury an individual has no function, sensation or voluntary movement below the level of injury. In most cases, both sides are equally affected. With an incomplete injury there is some functioning below the primary level of injury and the individual may be able to move one limb more than another, feel parts of the body that cannot be moved, or may have more functioning on one side of the body than the other. Due to advances in medicine, the incomplete injury is more common.

Discharge Location

The majority of SCI patients were discharged to another facility (95 or 39%). Discharges to home were the second most common with 83 (34%) discharges (Graph 1.11).

Graph 1.11

Patient Discharge Location
1999



conclusions

The statewide SCI database documents factors and demographics associated with individuals who sustain SCIs. These data indicate major etiologies of injury, the disproportionate injuries sustained by certain age and gender groups and the cost of these injuries.

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All population estimates

Wisconsin Department of Health and Family Services. http://www.dhfs.state.wi.us/population

appendix 1.1

Hospitals Reporting SCI
Principal Diagnoses
E Codes

hospitals reporting SCI
table 1.2

hospital	city	county
Langlade Memorial Hospital	Antigo	Langlade
Appleton Medical Center	Appleton	Outagamie
St. Elizabeth Hospital	Appleton	Outagamie
St. Clare Hospital and Health Services	Baraboo	Sauk
Beloit Memorial Hospital, Inc.	Beloit	Rock
Berlin Memorial Hospital	Berlin	Green Lake
Elmbrook Memorial Hospital	Brookfield	Waukesha
Memorial Hospital Corp. of Burlington	Burlington	Racine
St. Joseph's Hospital	Chippewa Falls	Chippewa
Luther Hospital	Eau Claire	Eau Claire
Sacred Heart Hospital	Eau Claire	Eau Claire
Lakeland Medical Center, Inc.	Elkhorn	Walworth
St. Agnes Hospital	Fond du Lac	Fond du Lac
Bellin Memorial Hospital	Green Bay	Brown
St. Mary's Hospital Medical Center	Green Bay	Brown
St. Vincent Hospital	Green Bay	Brown
Mercy Health System Corporation	Janesville	Rock
Kenosha Hospital and Medical Center	Kenosha	Kenosha
Lutheran Hospital – La Crosse	La Crosse	La Crosse
Franciscan Skemp Medical Center, Inc.	La Crosse	La Crosse
Meriter Hospital,Inc.	Madison	Dane
St. Mary's Hospital Medical Center	Madison	Dane
University of Wisconsin Hospital and Clinics	Madison	Dane
Bay Area Medical Center	Marinette	Marinette
Saint Joseph's Hospital	Marshfield	Wood
Community Memorial Hospital	Menomonee Falls	Waukesha
St. Mary's Hospital – Ozaukee	Mequon	Ozaukee
Children's Hospital of Wisconsin	Milwaukee	Milwaukee
Columbia Hospital, Inc.	Milwaukee	Milwaukee
Froedtert Memorial Lutheran Hospital	Milwaukee	Milwaukee
Sinai Samaritan Medical Center	Milwaukee	Milwaukee
St. Francis Hospital	Milwaukee	Milwaukee
St. Joseph's Hospital – Milwaukee	Milwaukee	Milwaukee
St. Luke's Medical Center	Milwaukee	Milwaukee
Theda Clark Medical Center	Neenah	Winnebago

hospital	city	county
Memorial Hospital and Oconomowoc	Oconomowoc	Waukesha
Mercy Medical Center	Oshkosh	Winnebago
Saint Mary's Medical Center	Racine	Racine
St. Nicholas Hospital	Sheboygan	Sheboygan
Stoughton Hospital Association	Stoughton	Dane
Lakeview NeuroRehab Center - Midwest	Waterford	Racine
Waukesha Memorial Hospital, Inc.	Waukesha	Waukesha
Wausau Hospital	Wausau	Marathon
St. Joseph's Community Hospital	West Bend	Washington
Howard Young Medical Center, Inc.	Woodruff	Oneida

principal diagnosis
table 1.3

diagnosis code	principal diagnosis	all	male	female
806	**fracture of vertebral column with SCI**			
806.0	**cervical, closed**			
806.00	C1-C4 level with unspecified spinal cord injury	3	1	2
806.01	C1-C4 level with complete lesion of cord	6	5	1
806.03	C1-C4 level with central cord syndrome	4	3	1
806.04	C1-C4 level with other specified spinal cord injury	3	3	0
806.05	C5-C7 level with unspecified spinal cord injury	13	10	3
806.06	C5-C7 level with complete lesion of cord	12	9	3
806.07	C5-C7 level with anterior cord syndrome	3	2	1
806.08	C5-C7 level with central cord syndrome	7	4	3
806.09	C5-C7 level with other specified spinal cord injury	12	9	3
806.1	**cervical, open**			
806.11	C1-C4 level with complete lesion of cord	1	0	1
806.13	C1-C4 level with central cord syndrome	1	0	1
806.16	C5-C7 level with complete lesion of cord	1	1	0
806.19	C5-C7 level with other specified spinal cord injury	1	1	0
806.2	**dorsal (thoracic), closed**			
806.20	T1-T6 level with unspecified spinal cord injury	4	2	2
806.21	T1-T6 level with complete lesion of cord	6	4	2
806.23	T1-T6 level with central cord syndrome	1	1	0
806.24	T1-T6 level with other specified spinal cord injury	4	3	1
806.25	T7-T12 level with unspecified spinal cord injury	6	2	4
806.26	T7-T12 level with complete lesion of cord	9	7	2
806.29	T7-T12 level with other specified spinal cord injury	3	2	1
806.3	**dorsal (thoracic), open**			
806.30	T1-T6 level with unspecified spinal cord injury	1	1	0
806.31	T1-T6 level with complete lesion of cord	1	1	0
806.35	T7-T12 level with unspecified spinal cord injury	1	1	0
806.4	**lumbar, closed**	**26**	**21**	**5**
806.5	**lumbar, open**	**2**	**2**	**0**
806.6	**sacrum and coccyx, closed**			
806.69	With other spinal cord injury	1	1	0
952	**SCI without evidence of spinal bone injury**			
952.0	**cervical**			
952.00	C1-C4 level with unspecified spinal cord injury	12	9	3
952.03	C1-C4 level with central cord syndrome	11	9	2
952.04	C1-C4 level with other specified spinal cord injury	4	3	1
952.05	C1-C4 level with unspecified spinal cord injury	5	4	1
952.06	C5-C7 level with complete lesion of spinal cord	1	1	0
952.07	C5-C7 level with anterior cord syndrome	1	1	0
952.08	C5-C7 level with central cord syndrome	7	4	3
952.09	C5-C7 level with other specified spinal cord injury	4	4	0

diagnosis code	principal diagnosis	all	male	female
952.1	**dorsal (thoracic)**			
952.11	T1-T6 level with complete lesion of spinal cord	2	2	0
952.15	T7-T12 level with unspecified spinal cord injury	4	4	0
952.16	T7-T12 level with complete lesion of spinal cord	1	1	0
952.2	**lumbar**	**3**	**3**	**0**
952.9	**unspecified site of spinal cord**	**6**	**6**	**0**
Totals*		**193**	**147**	**46**

*Numbers do not coincide with 1999 incidence because only principal diagnoses are counted here.

e codes
Table 1.4

e code	description	all	male	female
E810.0- E819.9	**motor vehicle accidents - traffic**			
812.0	Traffic accident with motor vehicle, driver	13	8	5
812.1	Traffic accident with motor vehicle, passenger	10	7	3
813.0	Traffic accident, collision with other vehicle, driver	2	2	0
813.6	Traffic accident, collision with other vehicle, cyclist	1	1	0
814.7	Traffic accident, collision with pedestrian, pedestrian	4	3	1
815.0	Traffic accident, collision on the highway, driver	2	1	1
815.1	Traffic accident, collision on the highway, passenger	1	0	1
816.0	Traffic accident, loss of control, driver	38	26	12
816.1	Traffic accident, loss of control, passenger	7	4	3
816.2	Traffic accident, loss of control, motorcyclist	3	3	0
816.3	Traffic accident, loss of control, motorcycle passenger	1	0	1
816.9	Traffic accident, loss of control, unspecified person	1	1	0
817.9	Traffic accident, while boarding, unspecified person	1	0	1
818.0	Traffic accident, non-collision, driver	1	0	1
818.1	Traffic accident, other, non-collision, passenger	1	1	0
819.0	Unspecified motor vehicle accident, driver	7	6	1
819.7	Unspecified motor vehicle accident, pedestrian	1	0	1
819.9	Unspecified motor vehicle accident, unspecified person	3	3	0
E820.0-E825.9	**motor vehicle accidents – non traffic**			
820.0	Non-traffic accident (snow vehicle), driver	2	2	0
821.0	Off-road motor vehicle, driver	2	2	0
821.2	Off-road motor vehicle, passenger	1	1	0
823.0	Collision with moving object, driver	1	1	0
E826.0-E829.9	**other road vehicle accidents**			
826.1	Pedal cycle accident, cyclist	4	2	2
E840.0-E845.9	**air and space transport accidents**			
844.7	Other specified air transport accidents, parachutist	1	1	0
844.9	Other specified air transport accidents, other person	1	1	0
E849.0-E849.9	**place of occurrence**			
849.4	Place for recreation and sport	1	1	0
849.7	Residential institution	1	0	1
849.9	Unspecified place	1	1	0
E870.0-E876.9	**during surgical and medical care**			0
870.0	Accidental cut, puncture, perforation or hemorrhage	1	0	1
E878.0-E879.9	**surgical and medical procedure**			
879.6	Later complication or abnormal reaction from procedure	1	1	0
E880.0-E888.9	**accidental falls**			
880.9	Fall from stairs or steps, other stairs or steps	14	8	6
881.0	Fall from ladder	7	6	1
882	Fall from or out of building	6	6	0

e code	description	all	male	female
883.0	Accident from diving or jumping into water	8	8	0
884.2	Fall from chair	1	1	0
884.4	Fall from bed	1	1	0
884.6	Fall from commode	1	0	1
884.9	Fall from one level to another	14	14	0
885	Fall from same level, slip, trip, or stumble	12	10	2
886.0	Sports tackle	1	1	0
888	Other & unspecified fall	16	8	8
E916.0-E928.9	**other accidents**			
916	Struck by falling object	5	5	0
917.0	Struck by objects or persons – in sports	7	7	0
917.9	Struck by objects or persons – other	1	1	0
919.0	Accident caused by agricultural machinery	2	1	1
919.1	Accident caused by mining and earth-drilling machinery	1	1	0
919.8	Accident caused by machinery	1	1	0
922.9	Accident caused by firearm, unspecified firearm	3	3	0
927	Overexertion and strenuous movements	5	5	0
928.9	Unspecified environmental and accidental causes	3	3	0
E929.0-E929.9	**late effects of injury**			
929.0	Of motor vehicle accident	1	1	0
929.9	Of unspecified accident	1	1	0
E930.0-E949.9	**therapeautic use**			
935.8	Analgesics, antipyretics and antirheumatics - Pentazocine	1	0	1
E950.0-E959.9	**suicide and self inflicted**			
955.4	Firearms, air guns and explosives, unspecified	1	1	0
957.0	Jumping from a high place, residential premises	1	1	0
958.8	Unspecified means	1	1	0
E960.0-E969.9	**homicide and intentional injury**			
965.0	Assault by firearms, handgun	3	3	0
965.1	Assault by firearms, shotgun	1	1	0
965.4	Assault by firearms, other and unspecified firearms	9	8	1
E985.0-	**undetermined intent of injury**			
985.4	Injury by firearms, intent unknown, unspecified firearms	2	1	1
E999.0-E999.9	**operations of war**			
999.9	Late effect of injury, unspecified unconventional warfare	1	1	0

*Numbers will not match incidence. One male did not have an E code.

appendix 1.2

SCI Data 1999

1999 data
Table 1.5

category of data	total	male	female
incidence			
Incidence (by gender)	246	189 (76.8%)	57 (23.2%)
age			
0-17	28	19	9
18-44	109	88	21
45-64	54	44	10
65+	55	38	17
race			
American Indian, Native Alaskan	3	2	1
Asian, Pacific Islander	1	1	0
African American	26	24	2
White	182	136	46
Hispanic	6	5	1
Other	2	2	0
Unspecified	26	19	7
admission month			
January	17	11	6
February	18	14	4
March	13	10	3
April	20	12	8
May	15	11	4
June	19	18	1
July	28	21	7
August	22	16	6
September	19	16	3
October	26	21	5
November	27	21	6
December	22	18	4
admission day			
Monday	30	24	6
Tuesday	44	34	10
Wednesday	24	22	2
Thursday	48	35	13
Friday	37	24	13
Saturday	31	25	6
Sunday	32	25	7
admission type			
Emergency	155	122	33
Urgent	69	49	20
Elective	22	18	4

category of data	total	male	female
admission source			
Physician referral	31	25	6
Clinic referral	1	0	1
HMO referral	3	3	0
Transfer from hospital	37	21	16
Transfer from another health care facility	4	3	1
Emergency room	169	136	33
Information not available	1	1	0
length of inpatient stay			
Total number of days	2,949	2,106	843
Average number of days	12.0	11.1	14.8
cost of inpatient hospital data			
Total	$10,223,134.67	$7,401,369.71	$2,821,764.96
Average	$41,557.46	$39,160.69	$49,504.65
causes of injury			
Falls	81	63	18
Motor vehicle accidents – traffic and non traffic	103	72	31
Other accidents/Other injury events	31	29	2
Other transportation injuries	6	4	2
Homicide, intentional injury, intention unknown	18	16	2
During medical care	2	1	1
Late effects of injury	3	3	0
Therapeutic Substances	1	0	1
level of severity			
Tetraplegia	112	83	29
Paraplegia	81	64	17
patient discharge location			
Discharged to home or self-care	83	71	12
Discharged or transferred to another short-term general hospital	21	16	5
Discharged or transferred to a skilled nursing facility	17	12	5
Discharged or transferred to an intermediate care facility	2	0	2
Discharged or transferred to another type of institution	95	73	22
Discharged or transferred to home under care of organized home health service	13	6	7
Left against medical advice	0	0	0
Expired or did not recover	15	11	4

*Numbers do not coincide with 1999 incidence because only principal diagnoses are counted here.

appendix 1.3

Glossary of Terms
Wisconsin's Population and Incidence of Injury by County
Wisconsin's Population Projections by Age Group

glossary of terms

Central Nervous System (CNS): the brain, spinal cord and retina.

Cervical Spine: highest level in the spine, the neck region, consisting of seven vertebrae and eight nerve roots.

Clinic Referral: the patient was admitted to a facility upon recommendation of a clinic physician.

Coccyx: the tailbone, with one vertebrae and nerve root.

Complete Injury: injury that leaves no motor function or sensation below the spinal cord injury zone.

Elective Admission: an admission that can be delayed without substantial risk to the health of the individual. This means the patient's condition permits adequate time to schedule the availability of a suitable accommodation.

Emergency Admission: the patient requires immediate medical intervention as a result of severe, life threatening or potentially disabling conditions. Usually the patient is admitted through the emergency room.

Emergency Referral: the patient was admitted to a facility upon recommendation of an emergency room physician.

HMO Referral: the patient was referred to a facility upon the recommendation of a health maintenance organization physician.

Incomplete Injury: spinal cord damage leaving some sensation and/or motor control below the injury zone because some nerve pathways remain intact.

Level of Injury: level of injury is determined by which vertebrae of the spinal cord has been injured. The closer the injury is to the brain, the greater the loss of function and feeling will be. C3-T1 will produce tetraplegia. T1 and below will produce paraplegia; C5 and above will produce tetraplegia with reduced respiratory function.

Lumbar Spine: the strongest part of the spine, the lower back, consisting of five vertebrae and nerve roots.

Paraplegia: loss of function below the cervical spinal cord segments, upper body usually retains most function and sensation.

Physician Referral: the patient was admitted to a facility upon the recommendation of his or her physician.

Tetraplegia (formerly quadraplegia): loss of function of any injured or diseased cervical spinal cord segment, affecting all four limbs.

Transfer from Another Health Care Facility: the patient was admitted to a facility as a transfer from a health care facility other than an acute care facility or a skilled nursing facility.

Transfer from a Hospital: the patient was admitted to a facility as a transfer from an acute care facility where he or she was an inpatient.

Transfer from a Skilled Nursing Facility: the patient was admitted to a facility as a transfer from a skilled nursing facility where he or she was and inpatient.

Sacrum Spine: below the lumbar spine, with five vertebrae and nerve roots.

Spinal Cord Injury: any injury of the neural elements within the spinal canal. Can occur from either trauma or disease.

Thoracic Spine: at the level of the chest, has twelve vertebrae and nerve roots.

Urgent Admission: the patient requires immediate attention for the care and treatment of a physical or mental disorder. Generally the patient is admitted to the first available and suitable accommodation.

Ventilator: a mechanical apparatus or machine, which is used for artificially ventilating the lungs.

wisconsin's population and incidence of injury by county

table 1.6

county name	1990 census	1999 estimates	number of injuries
Adams	15,682	18,330	-
Ashland	16,307	16,860	-
Barron	40,750	43,620	2
Bayfield	14,008	14,730	-
Brown	195,594	222,130	10
Buffalo	13,584	13,940	1
Burnett	13,084	14,230	-
Calumet	34,291	39,580	-
Chippewa	52,360	55,470	-
Clark	31,647	32,890	2
Columbia	45,088	50,130	3
Crawford	15,940	16,720	-
Dane	367,085	415,810	16
Dodge	76,559	84,730	4
Door	25,690	26,620	1
Douglas	41,758	42,370	-
Dunn	35,909	38,710	4
Eau Claire	85,183	92,360	8
Florence	4,590	5,080	-
Fond du Lac	90,083	96,960	2
Forest	8,776	9,330	1
Grant	49,266	49,910	4
Green	30,339	32,240	1
Green Lake	18,651	19,620	2
Iowa	20,150	22,270	3
Iron	6,153	6,350	-
Jackson	16,588	18,500	1
Jefferson	67,783	74,360	3
Juneau	21,650	23,590	3
Kenosha	128,181	142,810	4
Kewaunee	18,878	20,100	2
LaCrosse	97,904	106,640	2
Lafayette	16,074	16,270	-
Langlade	19,505	20,640	3
Lincoln	26,993	29,030	2
Manitowoc	80,421	84,890	5
Marathon	115,400	126,850	2

county name	1990 census	1999 estimates	number of injuries
Marinette	40,548	43,130	5
Marquette	12,321	13,900	4
Menominee	3,890	4,840	1
Milwaukee	959,275	956,710	54
Monroe	36,633	39,330	2
Oconto	30,226	33,850	3
Oneida	31,679	35,050	-
Outagamie	140,510	159,000	7
Ozaukee	72,831	81,100	3
Pepin	7,107	7,260	-
Pierce	32,765	35,240	-
Polk	34,773	37,700	-
Portage	61,405	67,620	-
Price	15,600	16,420	-
Racine	175,034	189,550	9
Richland	17,521	17,890	-
Rock	139,510	151,290	8
Rusk	15,079	15,320	2
St. Croix	50,251	59,520	-
Sauk	46,975	53,140	5
Sawyer	14,181	15,710	1
Shawano	37,157	39,200	2
Sheboygan	103,877	112,450	6
Taylor	18,901	19,610	3
Trempealeau	25,263	26,600	1
Vernon	25,617	26,840	-
Vilas	17,707	19,680	2
Walworth	75,000	86,020	6
Washburn	13,772	14,930	-
Washington	95,328	114,610	2
Waukesha	304,715	352,650	12
Waupaca	46,104	50,320	2
Waushara	19,385	21,040	3
Winnebago	140,320	155,050	7
Wood	73,605	77,940	5
	4,891,769	**5,295,180***	**246**

1999 estimates are effective July 1, 1999.

*Numbers may not add exactly due to rounding by State demographers.

wisconsin population projections by age group

Table 1.7

age group	male	female	1999 population projections
0 - 17	693,440	660,140	1,353,580
18 – 44	1,049,380	1,038,880	2,088,270
45 – 64	569,500	586,450	1,156,040
65+	289,730	407,560	697,290
totals	2,602,140	2,693,040	**5,295,180**