

# Traumatic Brain Injury in Utah

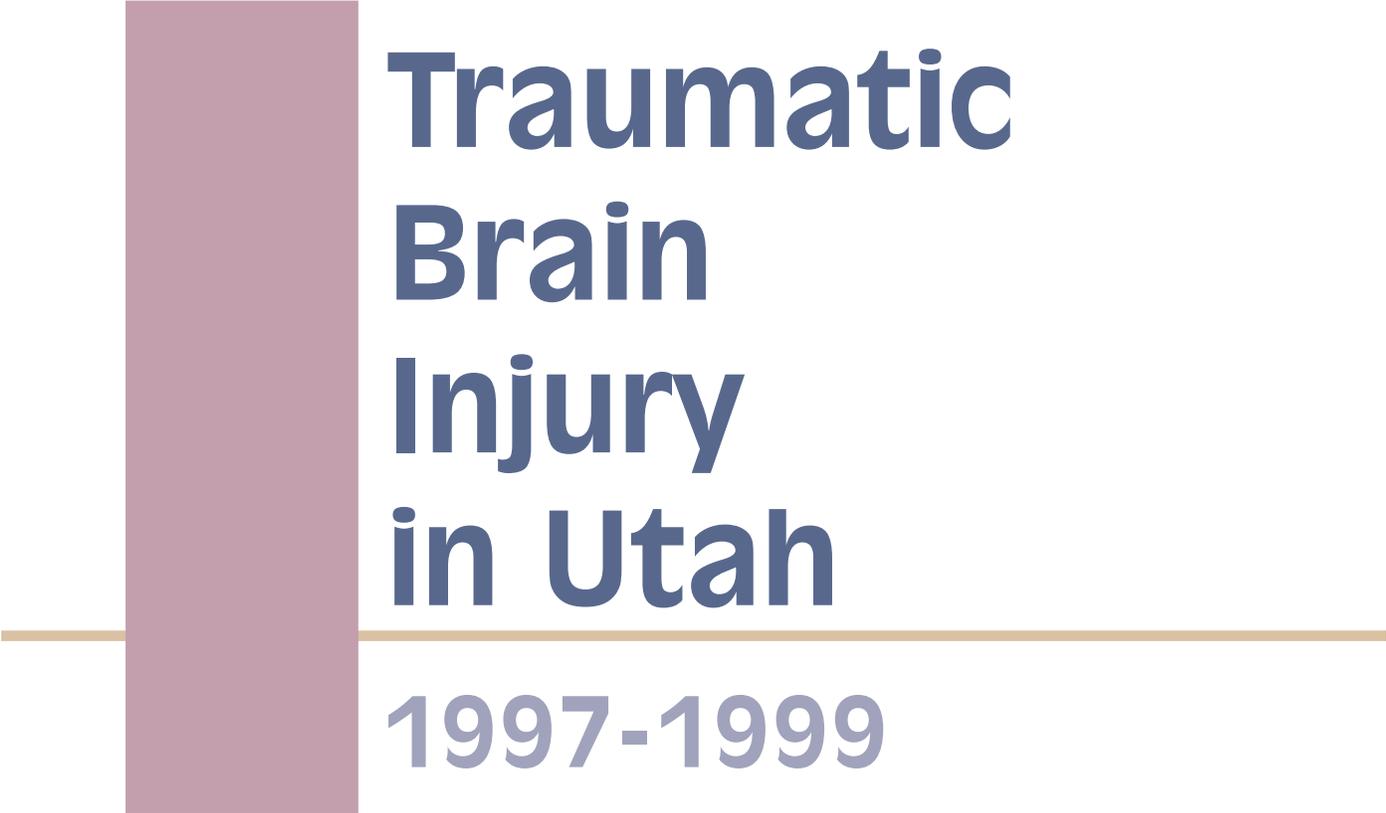
**1997-1999**

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# Traumatic Brain Injury in Utah

1997-1999



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# Executive Summary

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*“Traumatic Brain Injury (TBI) is a leading cause of death and disability among children and young adults in the United States. Each year an estimated 1.5 million Americans sustain a TBI.”<sup>1</sup>*

The Utah Department of Health (UDOH), through a collaborative agreement with the Centers for Disease Control and Prevention, collects TBI information for the State of Utah through review of Hospital Discharge Data and Vital Statistics Data. A large random sample of cases is selected, and a full medical record review is conducted to collect additional information on those cases. This report provides a brief overview of TBI in the State of Utah—including incidence, etiology, intention of injury, type of care administered, discharge disposition and payment source information.<sup>2</sup>

During the three-year period 1997-1999, there were a total of 5,533 incidents of TBI severe enough to result in acute care hospitalization and/or death sustained by Utah residents. Of those, 1,284 died as a result of the TBI. That is an average of one TBI-related death and four severe but non-fatal cases of TBI per day. Nearly twice as many males as females experienced a traumatic brain injury.

Incidence rates were highest among those 15-24 years of age (387.4 per 100,000 persons), 75-84 years of age (606.8 per 100,000 persons), and for those over age 85 (1041.4 per 100,000 persons). “Falls and fall-related injury” was the leading cause of TBI in those over age 60 (59.9%), while “Motor vehicle and other transport” injury was responsible for the majority of TBIs in those younger than 60 (58.2%). This trend is even more noticeable in females.

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# Executive Summary

Unintentional injuries are the most common type of TBI-related injury for males (56%) and for females (75%). However, for males, the percentage of intentional injuries was more than double that of females (35% and 15%, respectively). Also, the percentage of TBI as a result of “Self-inflicted, suggestive of suicide” was more than three times for males (21%) than for females (6%).

Over the three-year period 1997-1999, 2,905 males and 1,630 females were hospitalized as a result of a TBI. Another 756 males and 246 females died as a result of a TBI prior to being admitted to a hospital. Those individuals admitted to the emergency department are not considered “hospital inpatient” and, if they are categorized as “emergency department” cases, they died as a result of their injuries. Patients treated and released from the emergency department did not meet the case definition and were not included in surveillance.

The majority of TBI cases who were hospitalized were discharged from the hospital to home for self-care or other assistance (70.1% of males and 67.1% of females). However, for all TBI cases, nearly one-quarter died as a result of the TBI (23.1%).

The most common sources of payment for a TBI were private or employer insurance or an HMO (63.2%). Government programs provided payment for 25.4 percent, and 9.5 percent were “self-pay” cases.

# Introduction

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It has been estimated that 1.5 million Americans sustain a traumatic brain injury (TBI) each year, and that 5.3 million people live with long-term TBI-related disability.<sup>1</sup> While many who sustain a TBI die as a result of their injury, many more survive to live the remainder of their lives with disability.

“The long-term impairments and disabilities associated with TBI are grave and the full human cost is incalculable. Yet because these disabilities are not readily apparent to the public – unlike a broken leg, for example – TBI is often referred to as an ‘invisible epidemic.’ These disabilities, arising from cognitive, emotional, sensory, and motor impairments, often permanently alter a person’s vocational aspirations and have profound effects on social and family relationships.”<sup>1</sup>

Preventing TBI begins with understanding its causes and contributing factors, which is the purpose of the surveillance. TBI surveillance in Utah began in 1990 under the Utah Department of Health, Bureau of Epidemiology. From 1993 to 1997, the project was conducted by the Disabilities Prevention Program; since 1997, it has been maintained by the Violence and Injury Prevention Program.

In 1995, the Centers for Disease Control and Prevention, National Center for Injury Prevention and Control, published “Guidelines for Surveillance of Central Nervous System Injury,” a manual to establish standards for collecting TBI and spinal cord injury (SCI) data.

In 1996, Congress enacted Public Law 104-166, the Traumatic Brain Injury Act of 1996, which authorizes state surveillance systems to obtain information on the number of people affected by traumatic brain injury (TBI), the causes of these injuries, and their severity.

Injury surveillance is the first step in understanding and combating TBI, but analyzing and sharing the findings of that surveillance is equally important. This report is intended to educate and inform readers about the major causes and contributing factors of TBI in Utah. In addition, the TBI Surveillance Project provides data and information in support of specific prevention programs. The authors hope that increased awareness and information will lead to effective policies and actions to reduce the terrible cost of TBI to individuals, families and communities in Utah.

A decorative graphic consisting of a vertical reddish-brown bar on the left and a horizontal gold line extending from its base to the right.

# Results and Graphs

# Results and Graphs

- From 1997 to 1999 there were 5,533 cases of traumatic brain injury (TBI) among Utah residents that resulted in either acute care hospitalization or death.
- Males sustained nearly twice as many TBIs (3,663) as females (1,870) during the three-year period.
- The average annual number of cases was 1,844. This equates to an average of five cases per day that were serious enough to result in hospitalization or death.
- From 1997 to 1999, the age-adjusted incidence of TBI was consistently nearly twice as high for males as for females.
- There was no substantial change in the age-adjusted incidence rate of TBI over the three-year period in any category.
- The overall age-adjusted incidence rate for TBI in Utah for the three-year period was 88.5 per 100,000 persons, with a rate of 119.3 per 100,000 for males, and 59.7 per 100,000 for females.

Figure 1.

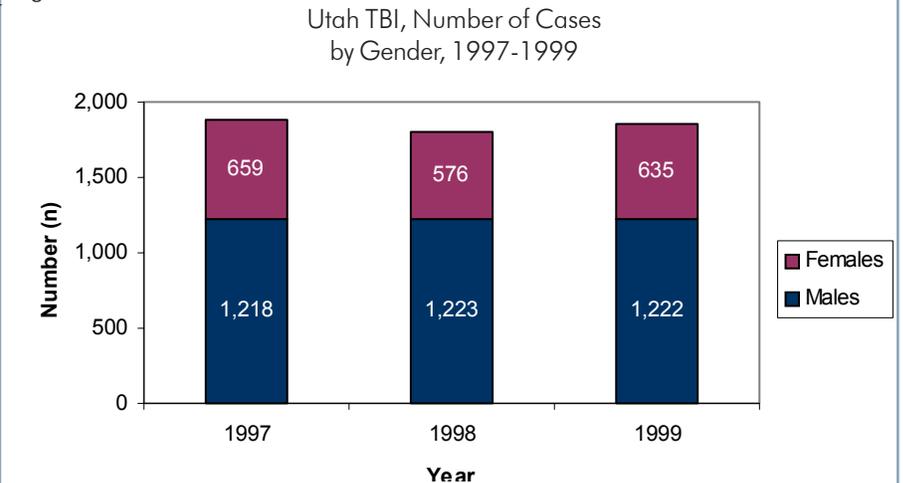
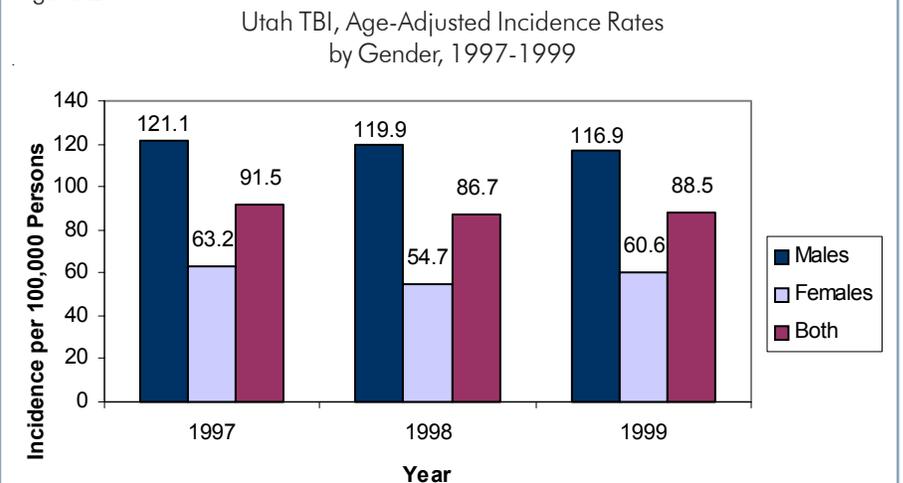


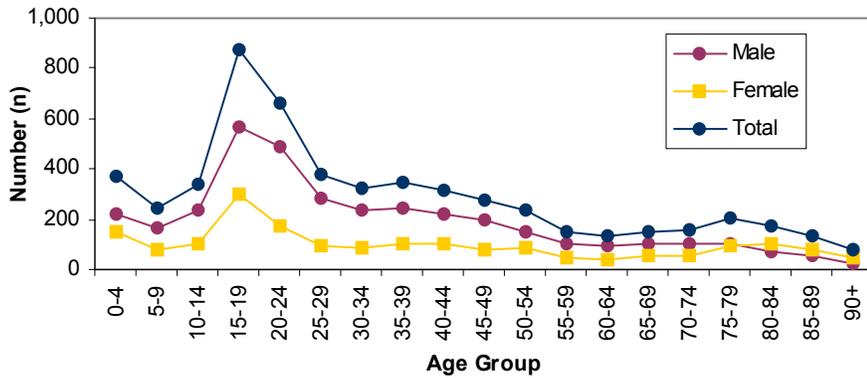
Figure 2.



# Results and Graphs

Figure 3a.

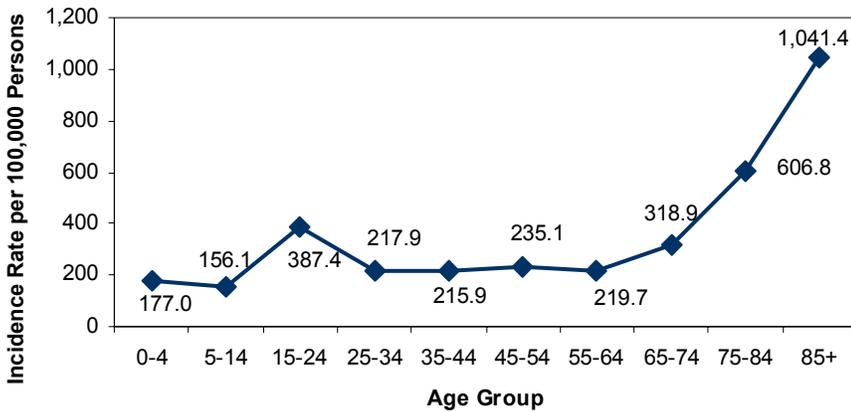
Utah TBI, Number of Cases of TBI by Age Group and Gender, 1997-1999



- Young people 15 to 24 years of age sustain the greatest number of TBIs, with males sustaining more than twice as many (1,052) as females (476).
- When incidence rates are calculated, adolescents and young adults still show a high incidence of TBI. However, older adults (age 75 to 84 and 85+ years) have an incidence rate 1.5 to nearly 3 times that of those 15-24 years of age.

Figure 3b.

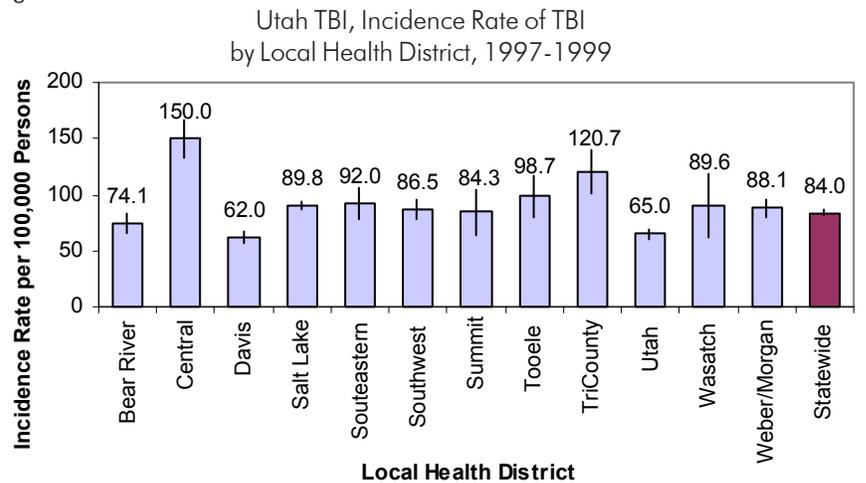
Utah TBI, Incidence Rate of TBI by Age Group, 1997-1999



# Results and Graphs

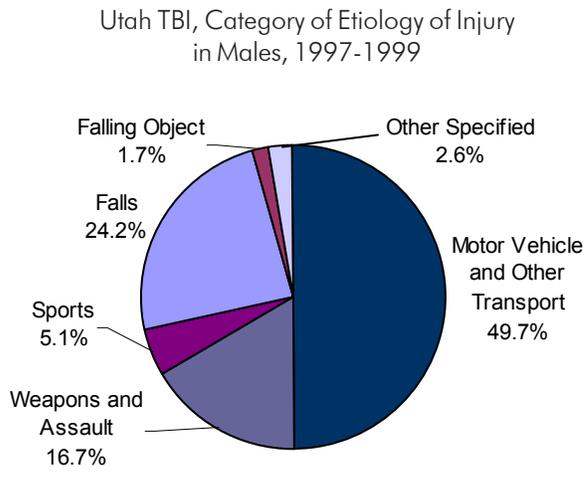
- The Central Utah and TriCounty Health Districts had the highest TBI incidence rates in the state. The rate for Central Utah Health District was 150.0 per 100,000 persons, and the rate for TriCounty Health District was 120.7 per 100,000 persons.
- The Utah County and Davis County Health Districts had the lowest incidence rates in the state. The rate for Utah County Health District was 65 per 100,000 persons (95% confidence interval: 69.9, 60.1), and the rate for Davis County Health District was 62 per 100,000 persons (95% confidence interval: 67.9, 56.2).
- Salt Lake Valley Health District had the highest number of TBIs with 2,345 incidents, or nearly 45% of all TBIs in the state. Wasatch County Health District had the fewest number with 38, less than 1% of all TBIs in the state.

Figure 4.



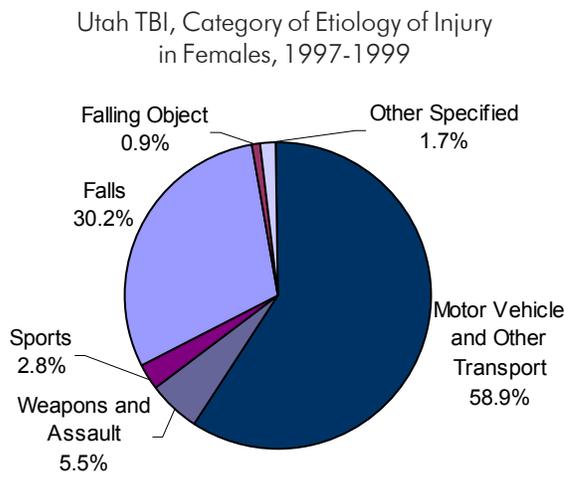
# Results and Graphs

Figure 5a.



- In both males and females, the leading causes of TBI were “Motor vehicle and other transport” (males: 49.7%, females: 58.9%) and “Falls” (males: 24.2%, females: 30.2%).
- The percentage of males with TBI caused by “Weapons and assault” was more than three times the percentage of females (17% and 6%, respectively).

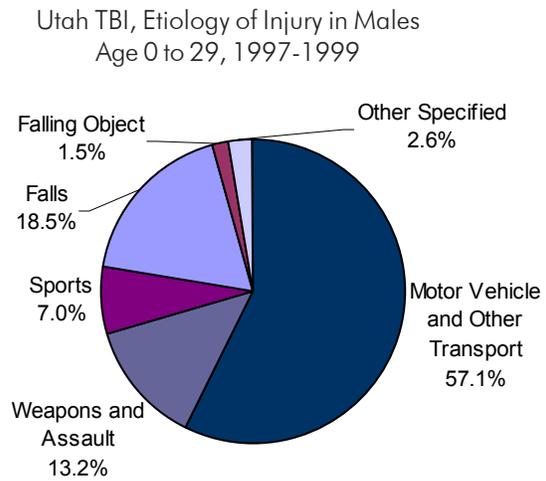
Figure 5b.



# Results and Graphs

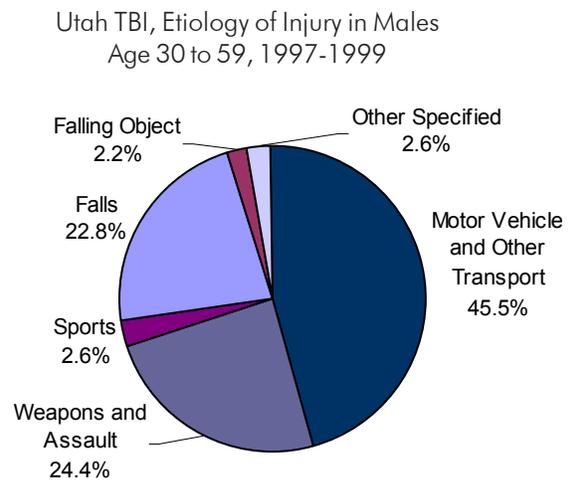
- Among males in the “Under 29” and “30 to 59” age groups, “Motor vehicle and other transport” was the leading cause of TBI (57.1% and 45.5%, respectively). In the “Age 60 and over” age group, half of the TBIs (50.2%) were sustained in fall-related events.

Figure 6a.



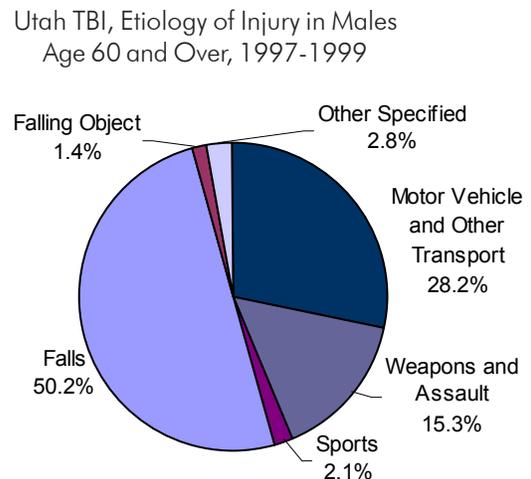
n = 1,164

Figure 6b.



n = 587

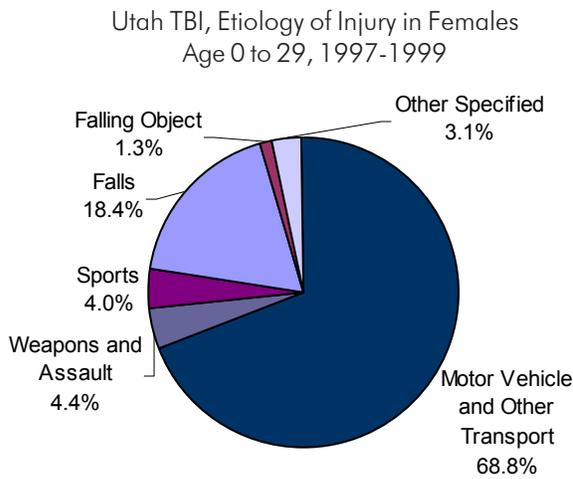
Figure 6c.



n = 287

# Results and Graphs

Figure 7a.



- Among females in the “Age 0 to 29” age group and the “Age 30 to 59” age group, “Motor Vehicle and Other Transport” was the leading cause of TBI (68.8% and 69.7%, respectively). In the “Age 60 and over” group, nearly three-fourths of the TBIs (71.3%) were sustained in fall-related events.

Figure 7b.

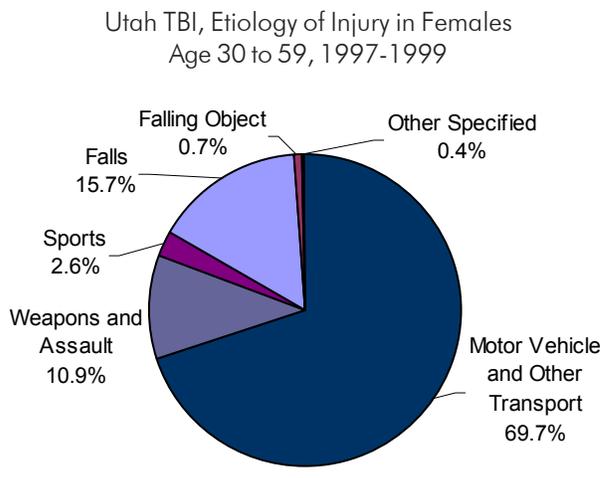
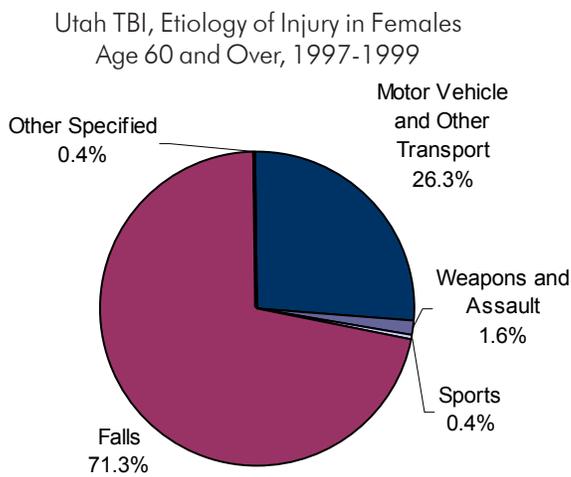


Figure 7c.



# Results and Graphs

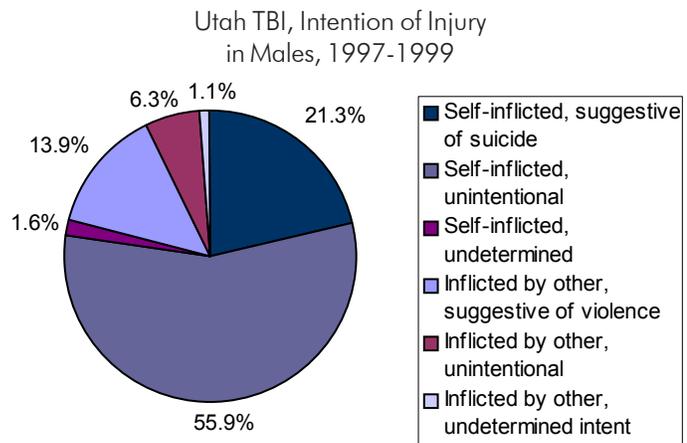
- Among TBIs that were “Self-inflicted” or “Inflicted by other,” the majority were classified as “Unintentional.” For males, 55.9% were “Self-inflicted, unintentional” and 6.3% were “Inflicted by other, unintentional,” for a total of 62.2%. For females, 74.4% were “Self-inflicted, unintentional” and 9.3% were “Inflicted by other, unintentional,” for a total of 83.7%.

- The percentage of intentional TBIs among males (35.2%) was more than twice that of females (15.2%).

- Of the 2,905 males hospitalized as a result of a TBI, 181 died prior to being discharged from care. Of the 1,630 females hospitalized as a result of a TBI, 99 died prior to being discharged from care.

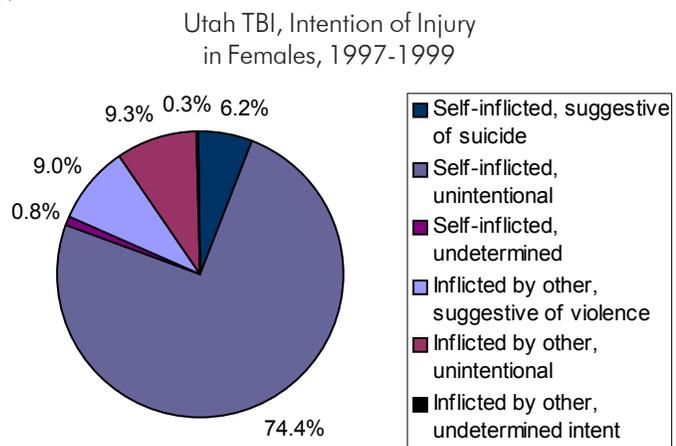
NOTE: Only emergency department TBI-related deaths are included in the emergency department category because only these cases meet the case definition for the TBI surveillance system.

Figure 8a.



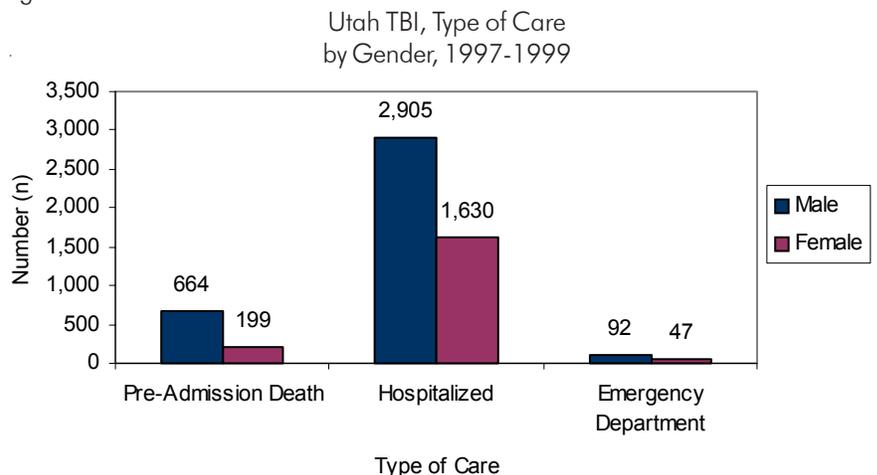
n = 943

Figure 8b.



n = 387

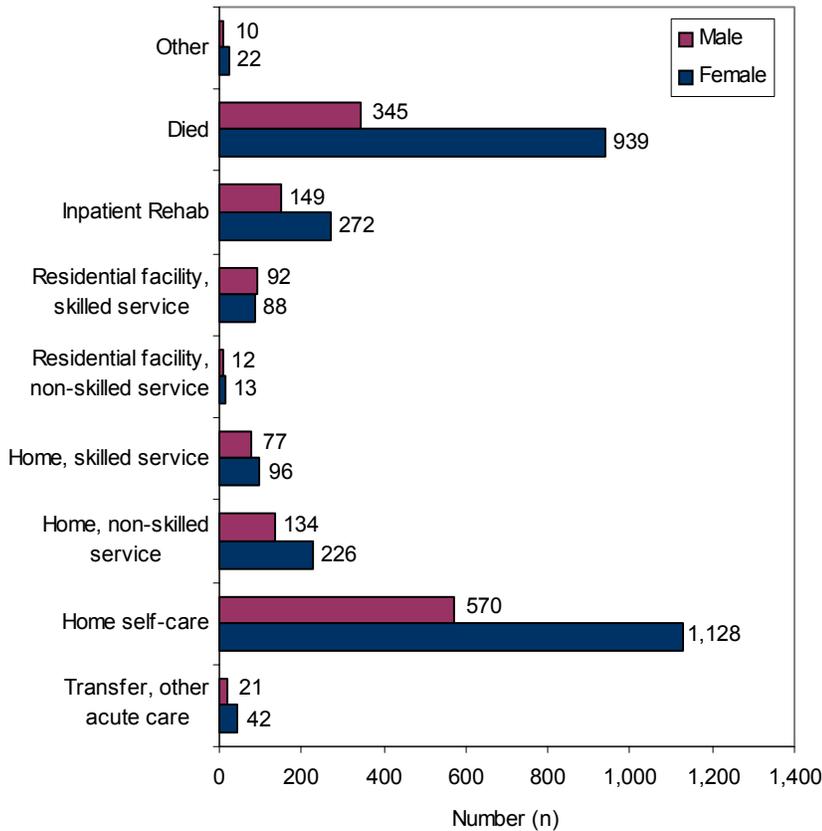
Figure 9.



# Results and Graphs

Figure 10.

Utah TBI, Discharge Disposition  
by Gender, 1997-1999



n = 4,236

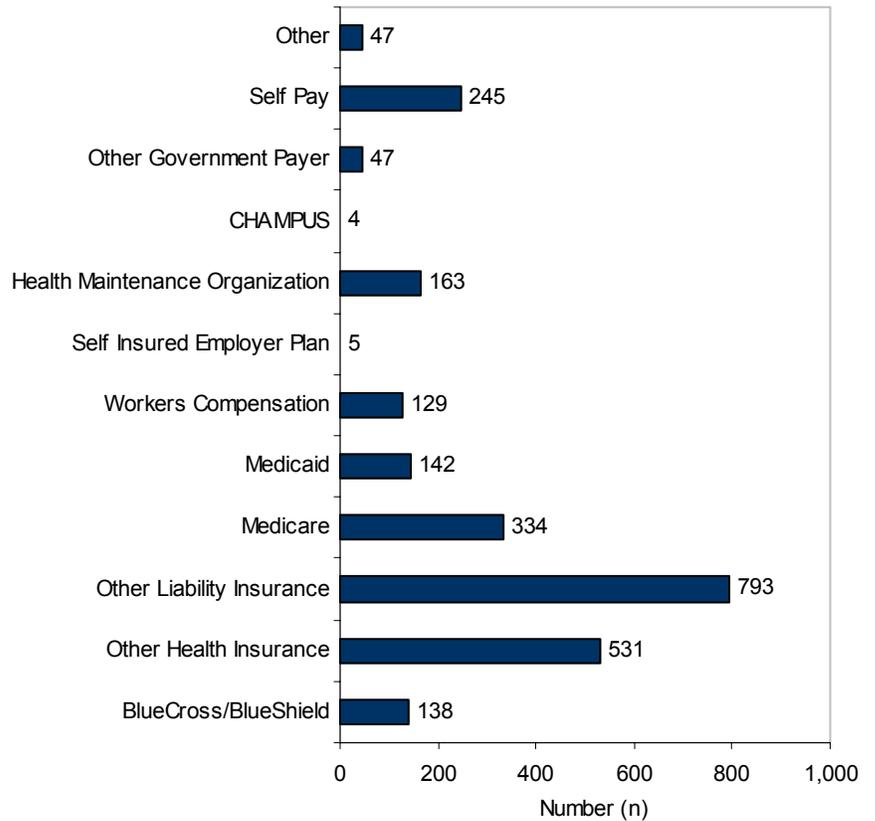
- When Discharge Disposition was known, 23.1% of those who sustained a TBI died as a result of the TBI, either before being admitted to a hospital or after admission. When categorized by gender, 25.6% of males and 18.1% of females died as a result of TBI.
- Among males hospitalized as a result of a TBI and for whom the hospital discharge disposition was known, 70.1% were discharged to home with or without skilled services, 18% were transferred to a residential facility with or without skilled services or to an inpatient rehabilitation facility, and 8.7% died.
- Among females hospitalized as a result of a TBI and for whom the hospital discharge disposition was known, 67.1% were discharged to home with or without skilled services, 21.7% were transferred to a residential facility with or without skilled services or to an inpatient rehabilitation facility, and 8.5% died.

# Results and Graphs

- When payment source was available, 63.2% of TBI costs were paid by an insurance company (private or employer) or a health maintenance organization, 25.4% were paid through government programs, and 9.5% were self-pay.

Figure 11.

Utah TBI, Source of Payment for Services, 1997-1999



n = 2,578





# Appendix

# Data Sources and Clinical Case Definition

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## Data Sources

To ensure a complete morbidity data set, persons with cases of traumatic brain injury (TBI) discharged from hospitals in Utah were ascertained through two data sources within the UDOH: the Bureau of Epidemiology, Injury Registry, and the Office of Health Care Statistics (HCS), Hospital Discharge Database. Mortality cases were identified using death data from the UDOH, Office of Vital Records and Statistics. Once cases were identified, the three data sets were compiled into one database and unduplicated using personal identifiers.

## Clinical Case Definition

A case of TBI<sup>3</sup> (craniocerebral trauma) is defined as either:

- An occurrence of injury to the head that is documented in a medical record, with one or more of the following conditions attributed to head injury:
  - Observed or self-reported decreased level of consciousness
  - Amnesia
  - Skull fracture
  - Objective neurological or neuropsychological abnormality
  - Diagnosed intracranial lesion
- An occurrence of death resulting from trauma, with head injury listed on the death certificate, autopsy report, or medical examiner's report in the sequence of conditions that resulted in death.

The clinical definition of TBI excludes the following:

- Lacerations or contusions of the face, eye, ear, or scalp, without other criteria listed above
- Fractures of facial bones, without other criteria listed above
- Birth trauma
- Primary anoxic, inflammatory, infectious, toxic, or metabolic encephalopathies that are not complications of head trauma
- Cancer
- Brain infarction (ischemic stroke) and intracranial hemorrhage (hemorrhagic stroke) without associated trauma

# International Classification of Diseases Codes

## ICD-9 Codes for Surveillance Years 1997 and 1998:

### Morbidity:

800.0 – 801.9	Fracture of the vault or base of the skull
803.0 – 804.9	Other and unqualified and multiple fractures of the skull
850.0 – 854.1	Intracranial injury including concussion, contusion, laceration, and hemorrhage
959.01	Head injury, unspecified

### Mortality:

800.0 – 801.9	Fracture of the vault or base of the skull
803.0 – 804.9	Other and unqualified and multiple fractures of the skull
850.0 – 854.1	Intracranial injury including concussion, contusion, laceration and hemorrhage

## ICD Codes for Surveillance Year 1999:

### Morbidity: (ICD-9)

800.0 – 801.9	Fracture of the vault or base of the skull
803.0 – 804.9	Other and unqualified and multiple fractures of the skull
850.0 – 854.1	Intracranial injury including concussion, contusion, laceration and hemorrhage
959.01	Head injury, unspecified

### Mortality: *(The ICD-10 was implemented in 1999)*

S01.0 – S01.9	Open wound of the head
S02.0, S02.1, S02.3, S02.7-S02.9	Fracture of the skull and facial bones
S06.0, S06.2 – S06.9	Intracranial injury
S07.0, S07.1, S07.8, S07.9	Crushing injury of head
S09.7-S09.9	Other unspecified injury of the head
T01.0	Open wounds involving head with neck
T02.0	Fractures involving head with neck
T04.0	Crushing injuries of head with neck
T06.0	Injuries of brain and cranial nerve with injuries of nerves and spinal cord at neck level
T90.1, T90.2, T90.4, T90.5, T90.8, T90.9	Sequelae of injuries of head

# Population Denominators

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## Population Denominators and Rates

Population Data: Figures were taken from the Utah Department of Health Indicator Based Information System (IBIS) General Utah Population Estimated.

IBIS NOTE: *“This module produces mid-year (July 1) estimates from the Governor’s Office of Planning and Budget (GOPB), generated by the Utah Process Economic and Demographic (UPED) model. These population estimates and projections are typically released each January with the Economic Report to the Governor. The data currently available in IBIS incorporates information from the 2000 U.S. Census.*

*For more information, go to the Census Bureau Web site: [www.census.gov](http://www.census.gov), or the site for the Governor’s Office of Planning and Budget: [www.governor.utah.gov/dea](http://www.governor.utah.gov/dea).”*

## Rate Calculations

Incidence Rate per 100,000 persons:

$$\frac{\text{Number of Events of TBI} \times (100,000)}{\text{Population at Risk}}$$

Age-adjusted Incidence Rate:

$$\text{SUM} [(\text{Age-group incidence rate}) \times (\text{Population Standard Weight}^4)]$$

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# Data Limitations

- Federal hospital data (Veterans Administration Hospital, Hill Air Force Base Hospital, etc.), Indian Health Services (IHS) data, and emergency department data are not included in the data surveillance.
- Discharges to skilled nursing, either to home, a residential care facility, or rehabilitation center, may be a result of other injuries sustained at the time of injury and may not necessarily be due to the TBI.
- Individual etiology categories were condensed to illustrate large category groups for the purpose of creating easy-to-read graphs and may not show the true etiology of every injury.
- Data Graphs for Intent, Etiology, Discharge, Type of Care, and Payment Source are compiled only for cases where these variables were known. Unknown cases were not included. However, the data are based on a sufficiently large sample of cases to be representative of all TBIs.
- Population figures are estimated based on 1990 and 2000 census data and may not represent the true population at the time the data were collected.
- ICD codes used in the clinical case definitions for mortality changed between 1998 (ICD-9) and 1999 (ICD-10). Incidence rates could have been affected by this change.

# Data Tables

**Table 1.**  
**Number of Cases of TBI by Age Group and Local Health District**  
**Utah 1997-1999**

Age Group	Bear River	Central	Davis	Salt Lake	Southeastern	Southwest	Summit	Tooele	TriCounty	Utah	Wasatch	Weber/ Morgan	Statewide
0-4	22	18	40	149	6	28	2	6	11	59	0	21	362
5-14	32	39	43	211	17	56	10	13	21	86	1	47	576
15-24	94	94	114	633	44	91	23	33	37	206	13	115	1,497
25-34	39	33	42	315	22	31	7	9	21	80	5	69	673
35-44	23	32	40	309	13	38	8	20	13	65	2	69	632
45-54	21	19	44	235	15	22	10	9	11	49	8	61	504
55-64	14	18	23	115	6	19	6	3	8	33	3	29	277
65-74	22	12	26	119	11	27	3	4	8	27	2	42	303
75-84	15	17	42	159	12	21	1	4	8	41	3	43	366
85+	11	9	13	100	5	11	0	4	4	26	1	23	207
<b>Total</b>	<b>293</b>	<b>291</b>	<b>427</b>	<b>2,345</b>	<b>151</b>	<b>344</b>	<b>70</b>	<b>105</b>	<b>142</b>	<b>672</b>	<b>38</b>	<b>519</b>	<b>5,397</b>

**Table 2.**  
**Average Population by Age Group and Local Health District**  
**Utah 1997-1999**

Age Group	Bear River	Central	Davis	Salt Lake	Southeastern	Southwest	Summit	Tooele	TriCounty	Utah	Wasatch	Weber/ Morgan	Statewide
0-4	13,618	5,329	20,784	81,692	4,413	12,376	2,048	3,138	3,077	41,507	1202	18,749	207,933
5-14	24,726	11,217	42,551	151,294	9,776	21,901	4,321	5,666	7,484	62,741	2,409	32,638	376,724
15-24	27,488	12,300	41,386	144,840	10,083	22,900	3,998	6,142	7,247	84,131	2,533	34,447	397,495
25-34	19,252	8,595	34,509	131,718	7,118	22,001	4,786	5,553	4,892	53,207	1,923	29,535	323,089
35-44	17,113	8,742	34,550	135,528	7,507	18,585	5,364	5,187	5,919	39,650	2,316	26,580	307,041
45-54	11,482	6,722	24,069	97,552	6,061	12,626	3,679	3,941	4,254	25,869	1,602	20,304	218,161
55-64	7,432	4,122	15,084	55,193	3,782	7,457	1,701	2,605	2,838	15,655	926	13,362	130,157
65-74	5,540	3,751	10,225	39,780	3,253	7,198	1,013	1,870	2,049	12,063	657	11,063	98,462
75-84	3,647	2,865	5,118	24,814	2,007	5,725	561	1,049	1,101	7,572	442	7,395	62,296
85+	1,426	1,033	1,168	8,324	730	1,788	199	320	361	2,423	121	2,368	20,261
<b>Total</b>	<b>131,724</b>	<b>64,676</b>	<b>229,444</b>	<b>870,735</b>	<b>54,730</b>	<b>132,557</b>	<b>27,670</b>	<b>35,471</b>	<b>39,222</b>	<b>344,818</b>	<b>14,131</b>	<b>196,441</b>	<b>2,141,619</b>

**Table 3.**  
**Percent of Cases of TBI and Percent of Population by Local Health District**  
**Utah 1997-1999**

	Bear River	Central	Davis	Salt Lake	Southeastern	Southwest	Summit	Tooele	TriCounty	Utah	Wasatch	Weber/ Morgan	Statewide
Percent of Population	5.4%	5.4%	7.9%	43.5%	2.8%	6.4%	1.3%	1.9%	2.6%	12.5%	0.7%	9.6%	100.0%
Percent of TBI Cases	6.2%	3.0%	10.7%	40.7%	2.6%	6.2%	1.3%	1.7%	1.8%	16.1%	0.7%	9.2%	100.0%

**Table 4.**  
**Number of Sampled Cases of TBI by Known Etiology of Injury and Sex**  
**Utah 1997-1999**

Etiology of Injury	Male	Percent of Males	Female	Percent of Females	All	Percent of All
Automobile	484	23.7	431	41.4	915	29.7
Truck, light	81	4.0	33	3.2	114	3.7
Truck, heavy	15	0.7	-	0.0	15	0.5
Truck, unspecified	11	0.5	4	0.4	15	0.5
Motorcycle	104	5.1	19	1.8	123	4.0
ATV/snowmobile	56	2.7	20	1.9	76	2.5
Bicycle/motor vehicle collision	52	2.6	9	0.9	61	2.0
Bicycle, other	66	3.2	19	1.8	85	2.8
Vehicle, unknown	2	0.1	1	0.1	3	0.1
Other Transport	19	0.9	7	0.7	26	0.8
Pedestrian/MV	116	5.7	66	6.3	182	5.9
Pedestrian/Bicycle	3	0.1	2	0.2	5	0.2
Pedestrian, other	5	0.2	3	0.3	8	0.3
Firearm, handgun	133	6.5	25	2.4	158	5.1
Firearm, other	71	3.5	10	1.0	81	2.6
Firearm, unspecified	27	1.3	-	0.0	27	0.9
Cutting instrument	4	0.2	-	0.0	4	0.1
Blunt object	36	1.8	2	0.2	38	1.2
Other weapon	10	0.5	1	0.1	11	0.4
Weapon unknown	4	0.2	2	0.2	6	0.2
Assault w/o weapon	56	2.7	16	1.5	72	2.3
Assault by pushing from high place	-	0.0	1	0.1	1	0.0
Football	13	0.6	-	0.0	13	0.4
Diving	1	0.0	-	0.0	1	0.0
Snow skiing	30	1.5	7	0.7	37	1.2
Other snow sport/recreation	11	0.5	2	0.2	13	0.4
Sport specified	46	2.3	20	1.9	66	2.1
Sport unspecified	2	0.1	-	0.0	2	0.1
Fall from one level to another	302	14.8	124	11.9	426	13.8
Fall on same level	137	6.7	143	13.7	280	9.1
Jump from high place	6	0.3	1	0.1	7	0.2
Fall, other	4	0.2	2	0.2	6	0.2
Fall, not specified	12	0.6	16	1.5	28	0.9
Struck by falling object	35	1.7	9	0.9	44	1.4
Equestrian	32	1.6	29	2.8	61	2.0
Other Cause	53	2.6	18	1.7	71	2.3
<b>Total Known</b>	<b>2,039</b>	<b>100.0</b>	<b>1,042</b>	<b>100.0</b>	<b>3,081</b>	<b>100.0</b>

# Data Tables

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Table 5.

Local Health District by County	
Local Health District	Counties
Bear River	Box Elder Cache Rich
Central	Beaver Juab Millard Piute Sanpete Sevier Wayne
Davis	Davis
Salt Lake	Salt Lake
Southeastern	Carbon Emery Grand San Juan
Southwest	Garfield Iron Kane Washington
Summit	Summit
Tooele	Tooele
TriCounty	Daggett Duchesne Uintah
Utah	Utah
Wasatch	Wasatch
Weber-Morgan	Weber Morgan

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