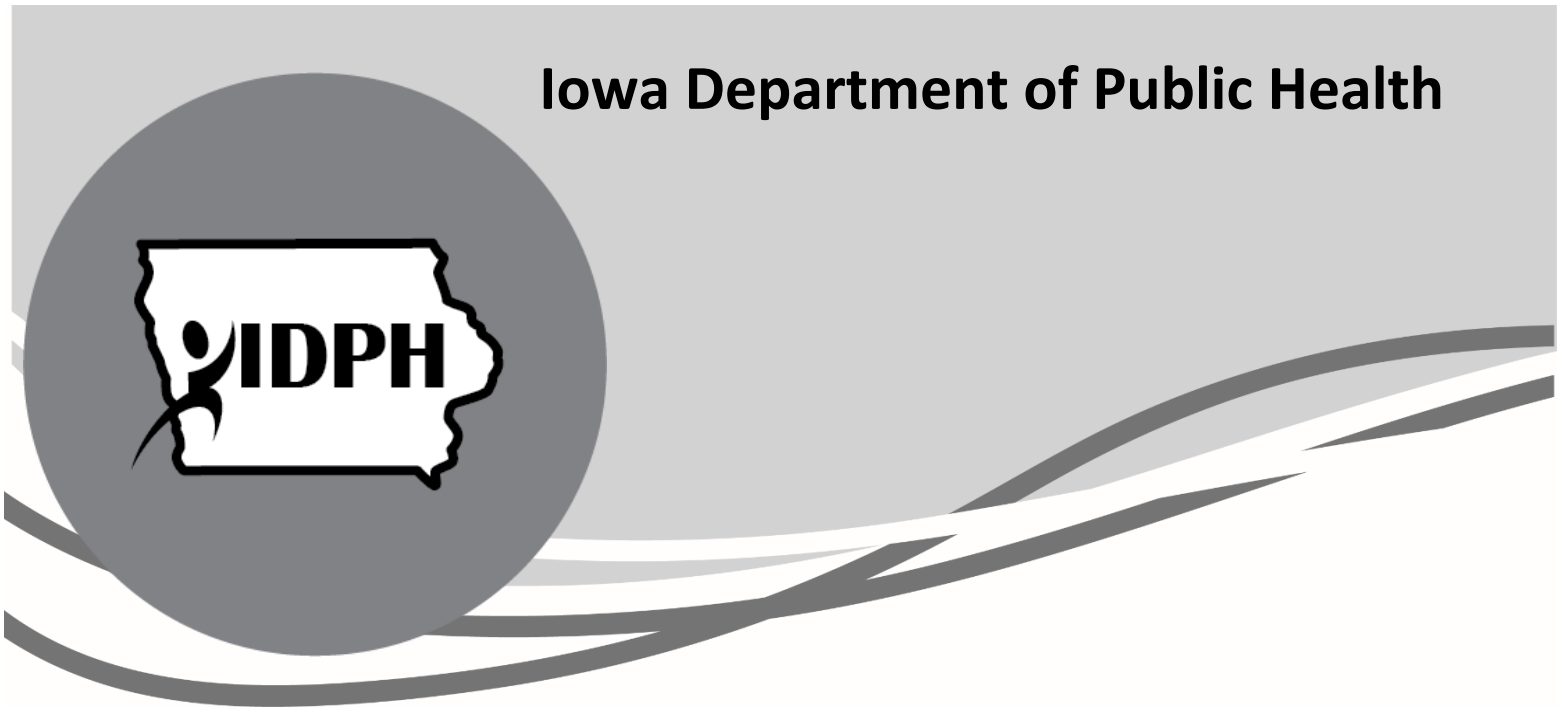
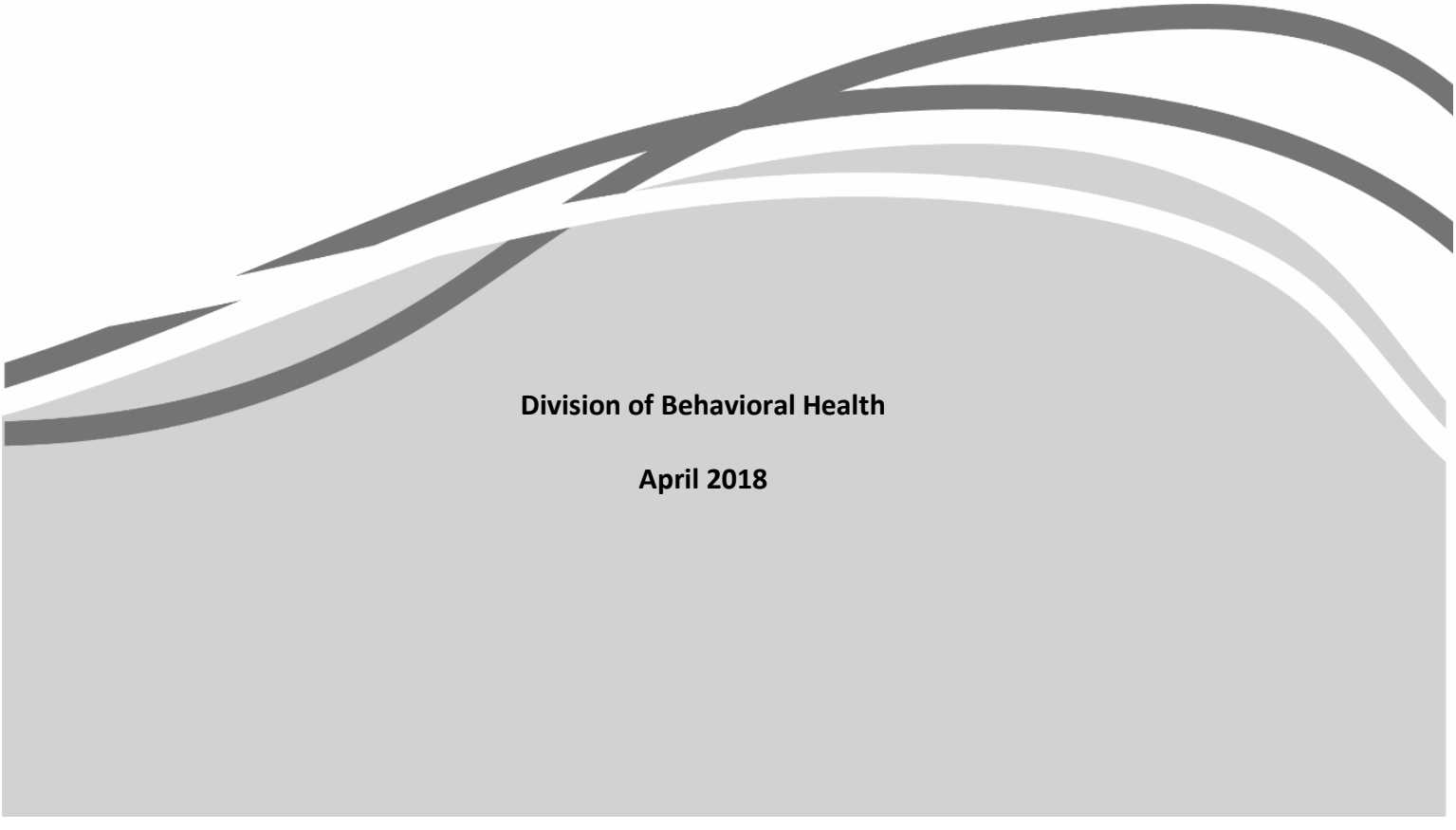
Iowa Department of Public Health



Traumatic Brain Injury in Iowa, 2011-2015

Office of Disability, Injury and Violence Prevention



Division of Behavioral Health

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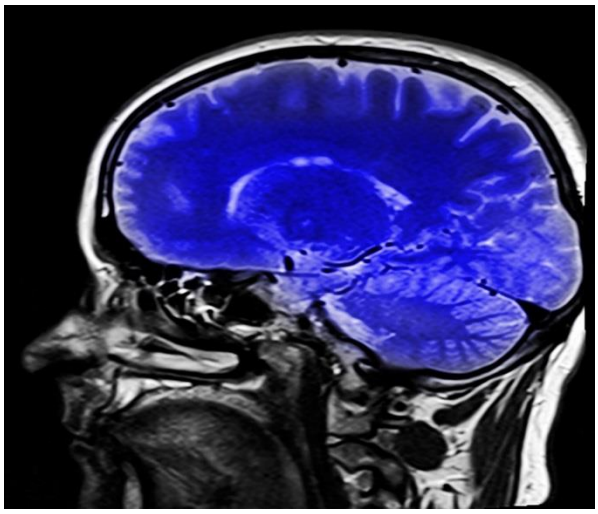
Executive Summary



Traumatic brain injury (TBI) is an important public health concern in Iowa. An external force frequently causes TBI, such as hitting your head during a fall or car crash, a collision with an object or another person during activities such as participating in sports or when assaulted. TBI is often referred to as the "silent epidemic" because the complications from TBI, which include changes to individuals' thinking, language, or even general emotions, are often missed. These complications include changes that affect an individual's thinking, sensation, language or emotions.

The Iowa Department of Public Health's Brain Injury Program conducts surveillance activities to determine the incidence and prevalence of traumatic brain injury in all age groups in the general population of Iowa. Population-based data on TBI are critical to understanding the impact of TBI on Iowans. This report presents data on TBI-related emergency department visits, hospitalizations, and deaths for the years 2011 through 2015. This report presents the average number of TBIs occurring each year, groups most affected, and the leading causes of TBIs in Iowa. This report intends to present a picture of the silent epidemic of TBI by using vital records and hospital discharge data to raise awareness among policymakers, researchers and the general public about the magnitude and cost of TBI in Iowa.

Key Findings

Traumatic Brain Injury in Iowa

- An estimated 27,500 Iowans sustain a TBI annually.
- Of these 27,500:
  - 570 died,
  - 3,100 were hospitalized, and
  - 23,900, nearly 87 percent, were treated and released from an emergency department.

Traumatic Brain Injury by Age

- Children aged 1 to 4 years, older adolescents aged 15 to 24 years, and adults aged 75 to 84 years are most likely to sustain a TBI.
- Approximately one-quarter of emergency department visits for TBI-related injuries annually are by children 14 years old and younger.
- Iowans aged 75 to 84 have the highest rates of TBI-related hospitalization and death.

Traumatic Brain Injury by Sex

- In every age group, TBI morbidity and mortality rates are higher for males than for females. For example, more than 70 percent of TBI-related deaths are for males.

- Males aged 15-24 years, 75 to 84, and 35 to 44 have the highest rates for emergency department visits, hospitalizations, and deaths.

TBI by Mechanism of Injury

- Falls are the leading cause of TBI-related emergency department visits (23,900) and hospitalizations (3,100). Rates are highest for children aged 1 to 4 years and for adults aged 75 to 84 years.
- Motor vehicle–traffic injury is the leading cause of TBI-related death. Rates are highest for people aged 15 to 24 years.

Additional Traumatic Brain Injury Findings

- TBI-related emergency department visits were highest among Blacks and lowest for Asian/Pacific Islanders across racial groups.
- American Indian/Alaska Natives had the highest rates of TBI-related hospitalizations compared to other racial groups.
- Compared with other racial groups, Whites had the highest rates of TBI-related deaths, followed by American Indian/Alaska Natives.
- TBI prevalence varies across all 99 Iowa counties. The average annual TBIs for counties with the highest rates ranged from 835.5 to 1,405.1 per 100,000 population for emergency department visits; 132.9 to 158.8 per 100,000 population for hospitalizations, and 26.3 to 57.5 per 100,000 population for deaths.

Conclusions

This report highlights relevant data on TBI-related emergency department visits, hospitalizations, and deaths. Information presented in the report help inform TBI prevention strategies, identify potential research areas and expand services to Iowans living with a TBI. From 2011 to 2015, an estimated 27,500 TBI-related emergency department visits, hospitalizations, and deaths occurred annually in Iowa. There are differences across ages, race, and geography that suggest prevention and treatment efforts be tailored to best meet the needs of these different populations. Although this report presents data on the various TBIs occurring in Iowa, it has not been possible to account for all cases of TBI in Iowa. Currently, there are no estimates for the number of Iowans who did not receive hospital-based medical care; therefore, the reported data do not represent all cases of TBIs.

Methodology

This report presents data about TBI-related emergency department visits, hospitalizations, and deaths in Iowa for the years 2011 through 2015. The findings in this report are organized into three main sections. These sections include emergency department visits, hospitalizations, and deaths. Each section presents detailed data tables and figures, including the summaries for the findings. When necessary, average annual numbers of TBIs per year and annual rates are both reported. While the annual numbers show the magnitude of the problem, the rates show how a certain group is affected by TBI by relating the number of TBIs to the size of the population. For instance, a relatively small number of TBIs occurring in a small population would result in a higher TBI rate than if the same number of TBIs occurred in a larger population.

Data in the report include:

- TBI as a Proportion of All Injuries
- TBI by Age
- TBI by Sex
- TBI by Race
- TBI by Mechanism of Injury

County level data on TBI are presented in this report using three different maps for emergency department visits, hospitalizations and deaths. It is important to point out that TBI-related deaths from 2011 to 2015 estimates based on one year of data could produce different results.

Limitations

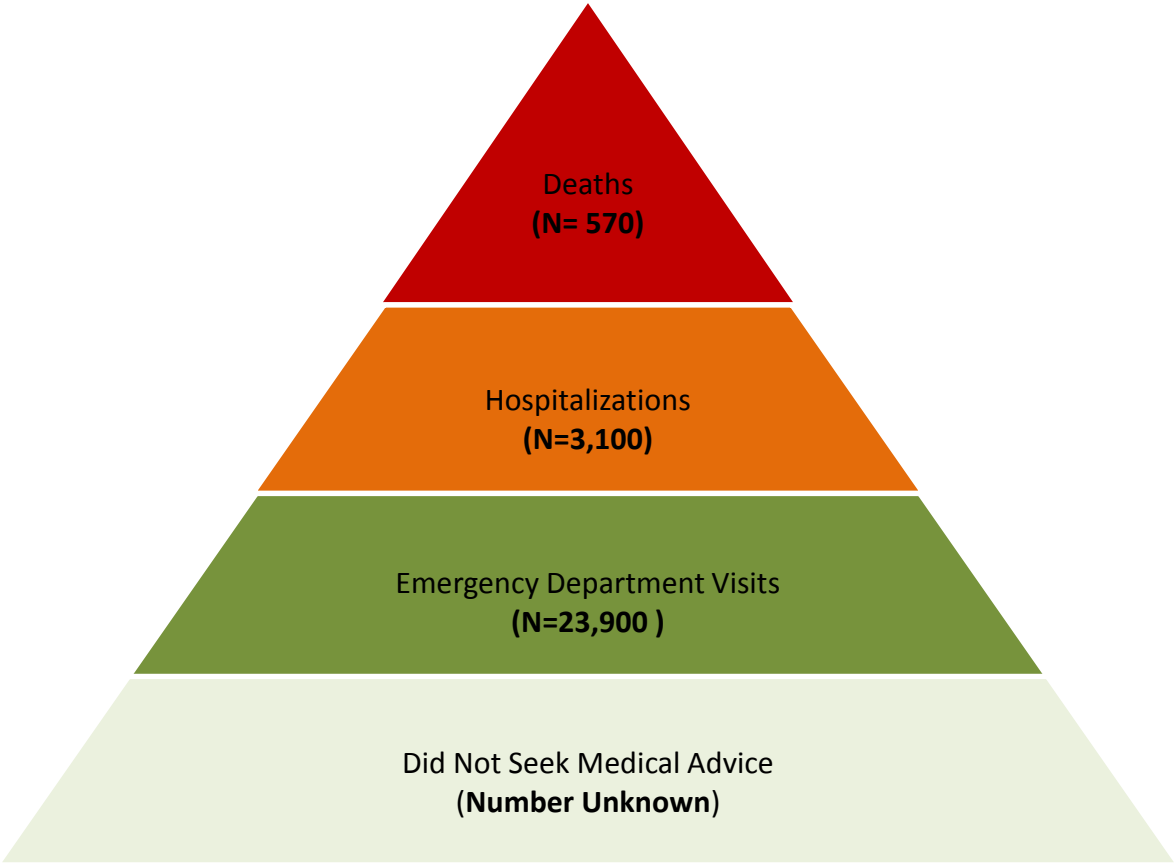
In this report, three different data sources were used to present information about TBIs in Iowa. This report has some limitations. Limitations in this report pertain to the nature of the emergency department visits and hospitalizations data. Emergency department and hospital discharge data are primarily used for patient or insurance billing and are secondarily used for surveillance purposes. In many cases, key information could be missing from the emergency department and hospital discharge data (e.g., information about race, sex or external cause of the injury). These could be attributed to poor coding of relevant information or lack of data entry. In such cases, missing International Classification of Disease codes and race information could impact the quality of the data and mechanism of injury, leading to underestimation or misleading TBI data. On October 1, 2015, Iowa hospitals transitioned from ICD-9-CM to ICD-10-CM codes. With this transition, hospitals are required to use ICD-10-CM to code emergency department visits and hospitalizations. This change has been shown to impact the 2015 data. Caution should be used when interpreting trends related to 2015 data and prior years.

Traumatic Brain Injury in Iowa

Injury Pyramid

Figure 1 is a pyramid illustrating the estimated average annual number of TBI-related emergency department visits, hospitalizations, and deaths in Iowa for the years 2011 to 2015. The data for the base of the pyramid is unknown. From 2011 to 2015, an estimated 27,550 TBIs occurred in Iowa annually. Of the 27,550 TBIs occurring each year in Iowa, approximately 87 percent were emergency department visits, 11 percent were hospitalizations and 2 percent were deaths.

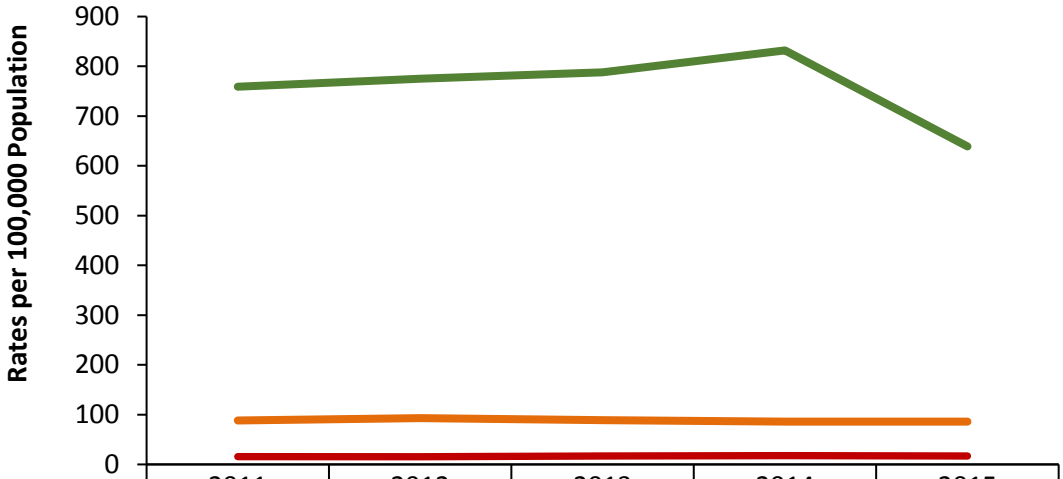
Figure 1: Average Annual Number of Traumatic Brain Injury-Related Emergency Department Visits, Hospitalizations, and Deaths, Iowa, 2011-2015



Traumatic Brain Injury-Related Trends

Figure 2 shows the age-adjusted rates of traumatic brain injury-related emergency department visits, hospitalizations and deaths by year. From 2011 to 2015, the average age-adjusted rate for TBI-related emergency department visits increased steadily from 759 per 100,000 population in 2011 to 832 per 100,000 population in 2014, but decreased to 639 per 100,000 population in 2015. This decrease could be attributed to the transition from ICD-9-CM to ICD-10-CM that occurred on October 1, 2015. With this transition, hospitals are required to use ICD-10-CM to code both emergency department visits and hospitalizations. The rates fluctuate for TBI-related hospitalizations and TBI-related deaths during the same time period.

Figure 2: Age-Adjusted Rates of Traumatic Brain Injury-Related for Emergency Department Visits, Hospitalizations, and Deaths by Year, 2011-2015



	2011	2012	2013	2014	2015
ED Visits	759	775	788	832	639
Hospitalizations	88	93	89	86	86
Deaths	16	15	17	18	17

Traumatic Brain Injury-Related Emergency Department, Hospitalizations, Deaths and All Injuries

Table 1 illustrates estimated annual average number of emergency department visits, hospitalizations and deaths for all injuries. TBIs comprise 10 percent of all injuries seen in emergency department visits and 21 percent of all hospitalizations. Of all the injury-related deaths in Iowa, TBI was a contributing factor 29 percent of the time.

Table 1: Average Annual Numbers and Percentages of Traumatic Brain Injury-Related Emergency Department Visits, Hospitalizations, Deaths and All Injuries 2011-2015

	All Injuries			Traumatic Brain Injuries		
	All Visits	Number of Visits	Percent of All Visits	Number of Visits	Percent of All Injuries	Percent of All Visits
Emergency Department Visits	1,027,053	248,798	24	23,902	10	2
Hospitalizations	314,829	14,735	5	3,108	21	1
Deaths	143,198	1,975	1	571	29	<1
Total	1,485,080	265,482	18	27,568	10	2

In Iowa, from 2012 to 2015, an estimated average annual number of 14,318 TBIs occurred among males compared with 13,250 among females (Table 2). Overall, about 1.08 times as many TBIs occurred among males as among females.

Table 2: Average Annual Numbers of Traumatic Brain Injury-Related Emergency Department Visits, Hospitalizations, and Deaths by Sex, 2011-2015

Sex	Emergency Department Visits	Hospitalizations	Deaths	Total
Female	11,696	1,393	161	13,250
Male	12,206	1,715	397	14,318

Table 3 illustrates estimated annual average numbers and crude rates for emergency department visits, hospitalizations and deaths for all injuries by age. The average annual number of TBI-related emergency department visits was 4,285 (582.3 per 100,000 population) for Iowans ages 15-24 years and 3,085 (455.1 per 100,000) for children aged 5 to 14 years. However, the average annual number of TBI-related hospitalization was higher (611 or 472.3 per 100,000) among people aged 85 years compared to all other age groups. The annual average number of deaths was higher among adults aged 85 years or older than the other age groups (129 or 99.7 per 100,000).

Table 3: Average Annual Numbers and Crude Rates for Traumatic Brain Injury-Related Emergency Department Visits, Hospitalizations and Deaths by Age, 2011-2015

	Emergency Department		Hospitalizations		Deaths		All TBI-Related Injuries	
Age (in years)	# of Visits	Rate per 100,000	# of Visits	Rate per 100,000	# of Visits	Rate per 100,000	# of Visits	Rate per 100,000
<1	693	1,067.5	31	47.8	—	—	724	1,115.2
1-4	2,719	1,028.3	35	13.2	13	4.9	2,767	1,046.5
5-14	3,085	455.1	86	12.7	7	1.0	3,178	468.8
15-24	4,285	582.3	288	39.1	57	7.7	4,630	629.1
25-34	2,315	355.5	222	34.1	45	6.9	2,582	396.6
35-44	1,735	287.6	208	34.5	40	6.6	1,983	328.7
45-54	1,821	263.9	307	44.5	84	12.2	2,212	320.6
55-64	1,736	260.2	370	55.5	71	10.6	2,177	326.3
65-74	1,500	360.2	374	89.8	64	15.4	1,938	465.4
75-84	1,976	778.1	575	226.4	93	36.6	2,644	1,041.2
85+	2,038	1,575.4	611	472.3	129	99.7	2,778	2,147.4

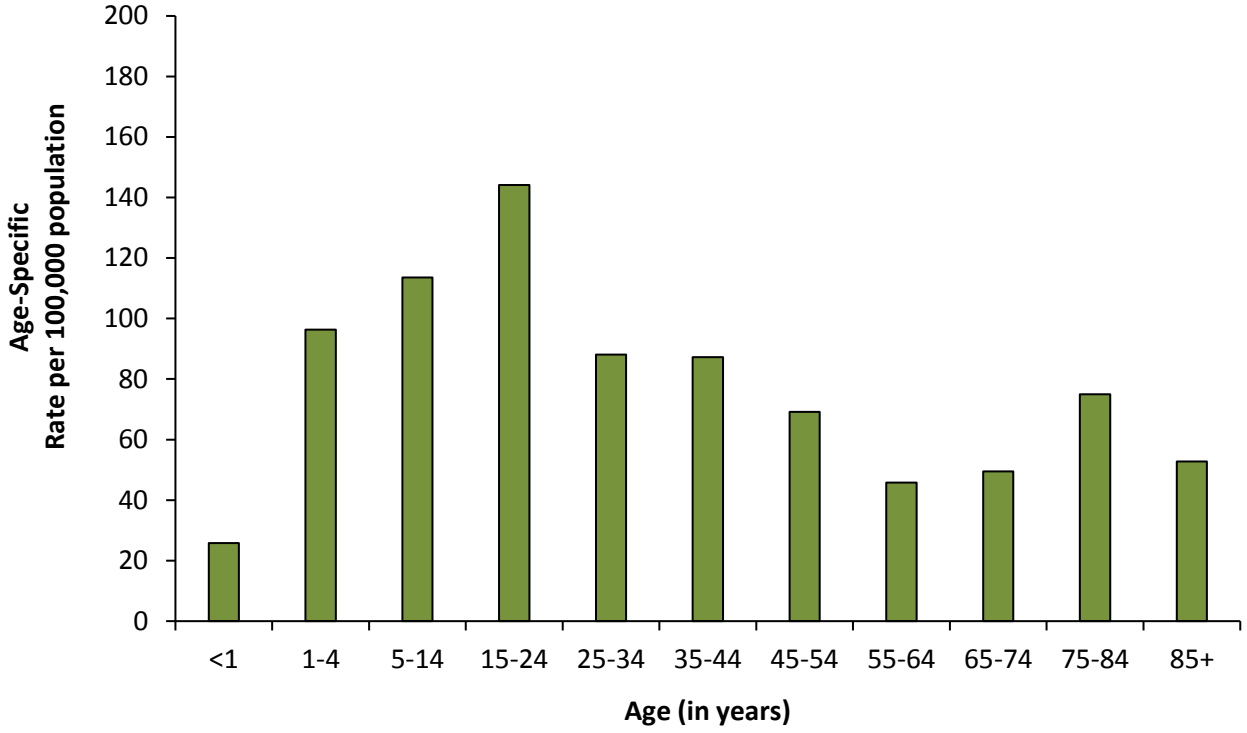
(—) indicates a zero

Traumatic Brain Injury-Related Emergency Department Visits

Traumatic Brain Injury-Related Emergency Department Visits by Age

Figure 3 illustrates the average annual rates of TBI-related emergency department visits by age in Iowa. During 2002 to 2006, children less than one year had the lowest rates of TBI-related emergency department visits (26 per 100,000 population) compared to the other age groups. People aged 15-24 had the highest rates of TBI-related emergency department visits (144 per 100,000 population), followed by children ages 1-4 years (96 per 100,000 population).

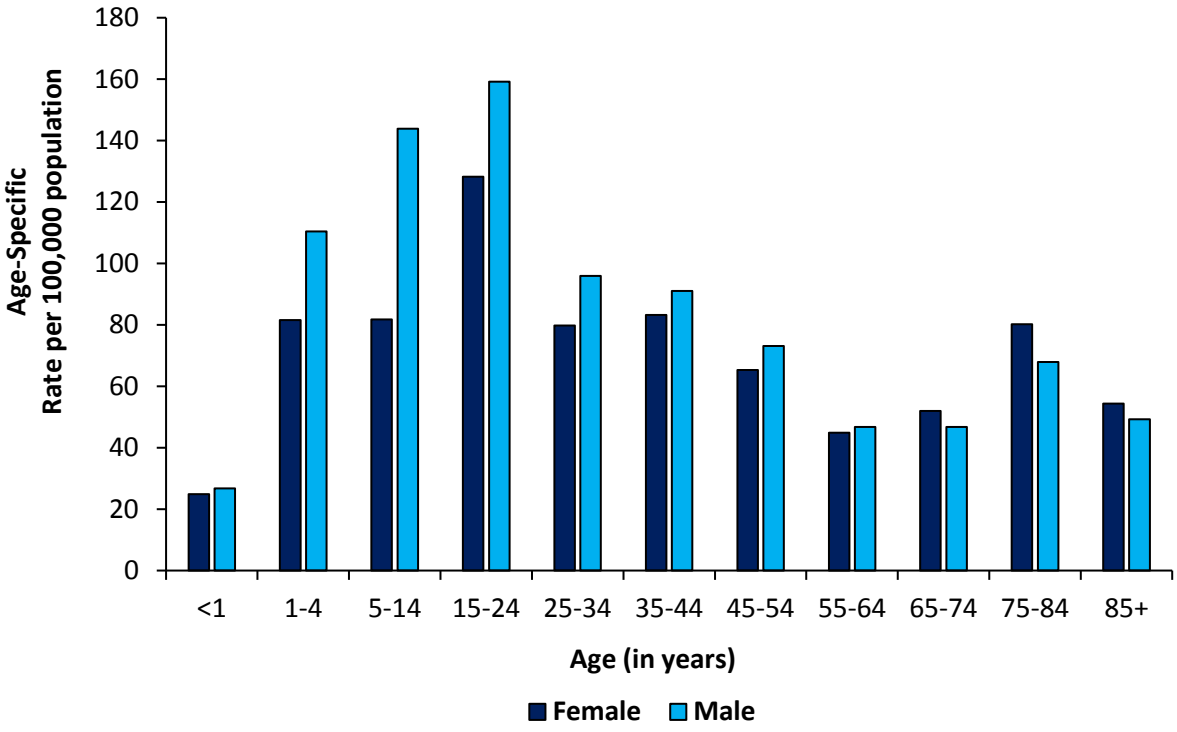
Figure 3: Average Annual Rates of Traumatic Brain Injury-Related Emergency Department Visits by Age, 2011-2015



Traumatic Brain Injury-Related Emergency Department Visits by Sex

Figure 4 illustrates the average annual rates of TBI-related emergency department visits by age and sex. Males aged 15-14 years (159 per 100,000 population) had the highest average annual age-adjusted rates for emergency department compared to females aged 75-84 years (80 per 100,000 population).

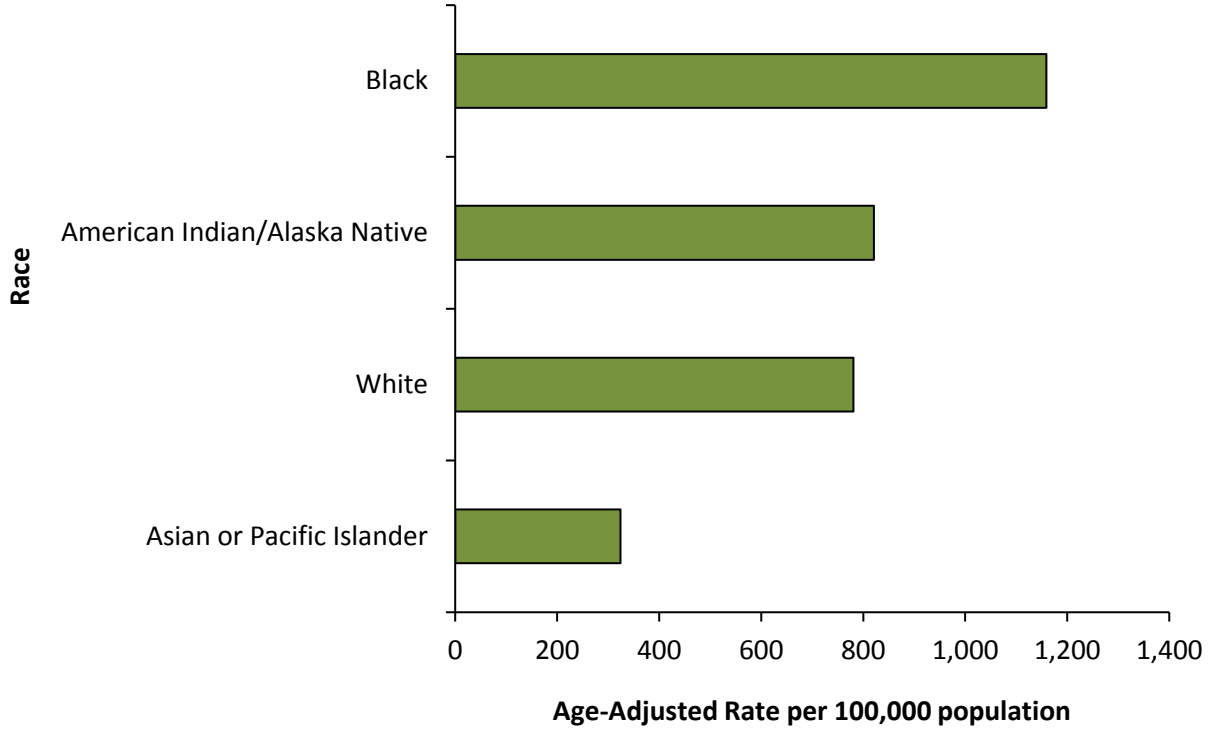
Figure 4: Average Annual Rates of Traumatic Brain Injury-Related Emergency Department Visits by Age, Sex, 2011-2015



Traumatic Brain Injury-Related Emergency Department Visits by Race

Figure 5 illustrates the average annual rates of TBI-related emergency department visits by race in Iowa. Age-adjusted rates from TBI-related emergency department visits are higher for Blacks (1,159 per 100,000 population) and American Indian/Alaska Natives (821 per 100,000 population) than for people of other racial groups. However, the average annual rates of TBI-related emergency department visits are lower among Asian or Pacific Islanders (324 per 100,000 population).

Figure 5: Average Annual Rates of Traumatic Brain Injury-Related Emergency Department Visits by Race, 2011-2015



Traumatic Brain Injury-Related Emergency Department Visits by Mechanism of Injuries

Figure 6 illustrates the average annual rates of TBI-related emergency department visits by age and mechanism of injury. Falls are the leading cause of TBI-related emergency department visits for children aged 1 to 4 years (74 per 100,000 population) and 75 to 84 years (54 per 100,000 population). Struck by/against events were highest among children aged 5 to 14 years (48 per 100,000 population) and 15 to 24 years (40 per 100,000 population). People aged 15 to 24 had the highest average annual rates of TBIs related to motor vehicle traffic (33 per 100,000 population) and assault (26 per 100,000 population). Overall, adults aged 55 and older had the lowest average annual rates of TBIs related to struck by/against events, motor vehicle traffic, and assault.

Figure 6: Average Annual Rates of Traumatic Brain Injury-Related Emergency Department Visits by Age, Mechanism of Injury, 2011-2015

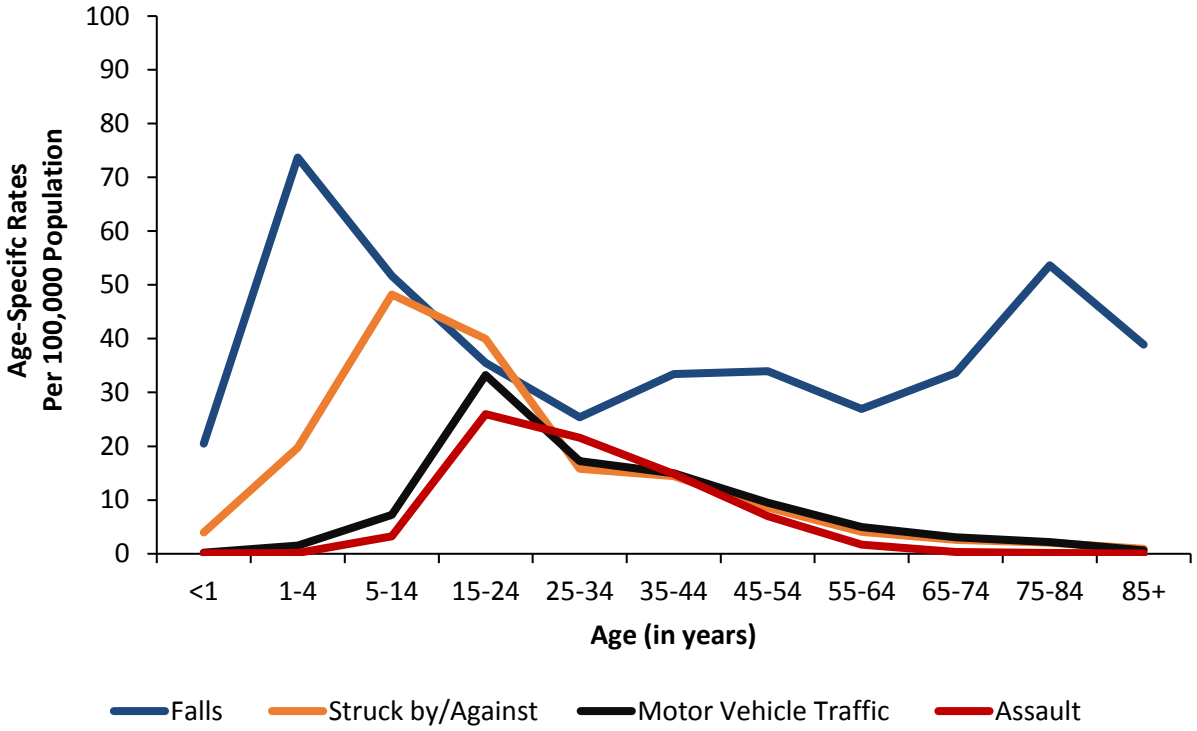
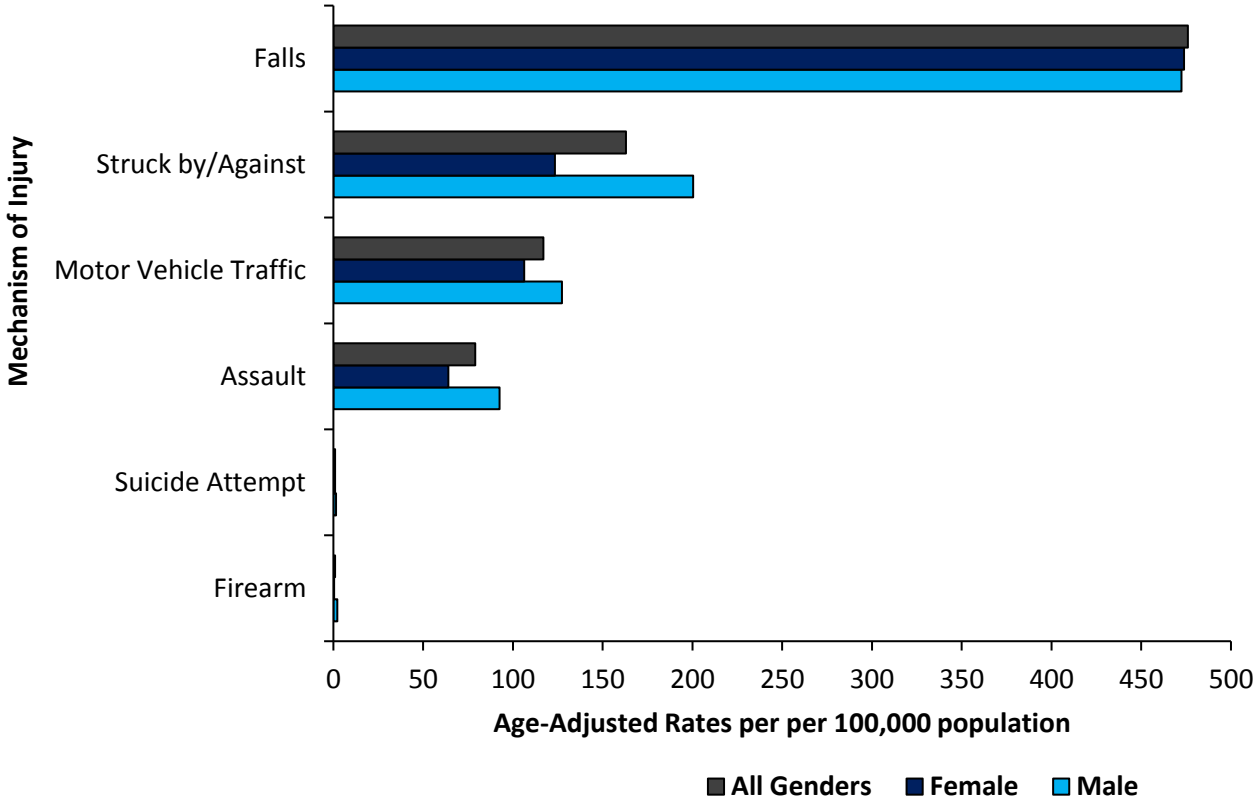


Figure 7 illustrates the average annual rates of TBI-related emergency department visits by mechanism of injury and sex in Iowa. Falls are the leading cause of TBI-related emergency department visits for both sexes, followed by struck by/against events. Iowa females experience slightly more fall-related traumatic brain injuries than male counterparts. Overall, the average annual rates of TBI-related emergency department visits are higher amongst males for all other mechanism of injuries than female counterparts.

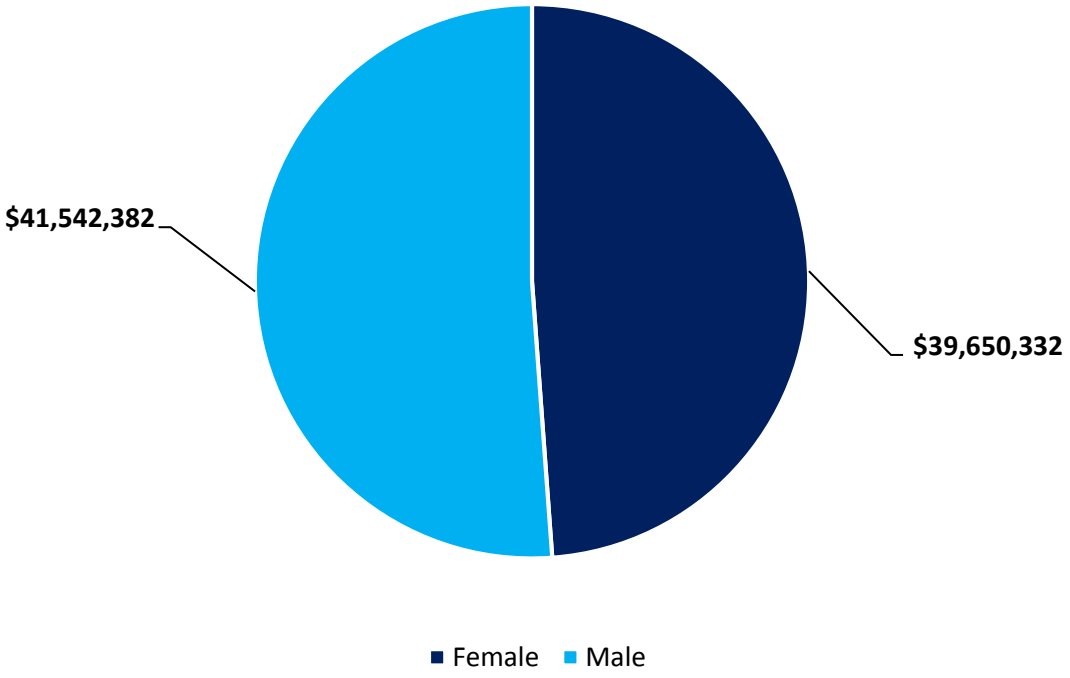
Figure 7: Average Annual Rates of Traumatic Brain Injury-Related Emergency Department Visits by Mechanism of Injury, Sex, 2011-2015



Traumatic Brain Injury-Related Emergency Department Visit Charges by Sex

Figure 8 illustrates the average annual charges for TBI-related emergency department visits by sex. From 2011 to 2015, the average annual charges for TBI-related emergency department visits was $81 million. Of the $81 million, about 51 percent were for males and 49 percent for females.

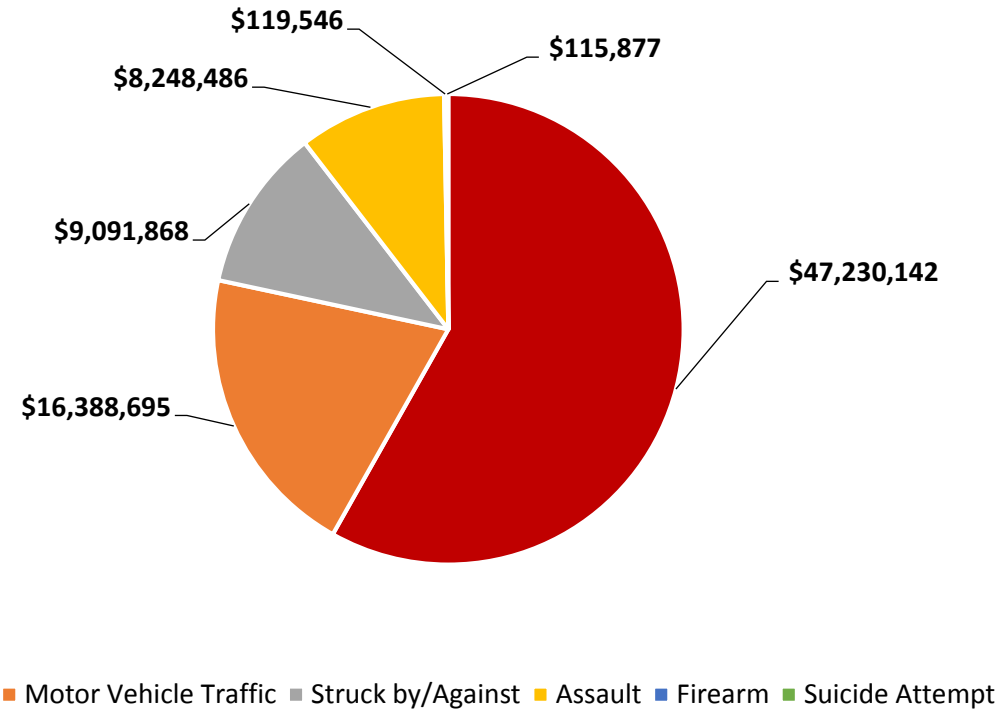
Figure 8: Average Annual Charges for Traumatic Brain Injury-Related Emergency Department Visits, Sex, 2011-2015



Traumatic Brain Injury-Related Emergency Department Charges by Mechanism of Injury

Figure 9 illustrates the average annual charges for TBI-related emergency department visits by mechanism of injury. TBI-related to falls had the highest average annual charges of $47 million (58 percent), followed by $16 million for motor vehicle traffic-related emergency department visits (20 percent). Suicide attempt had the lowest average annual charges of $115,877 (0.14 percent) among all the other mechanism of injuries.

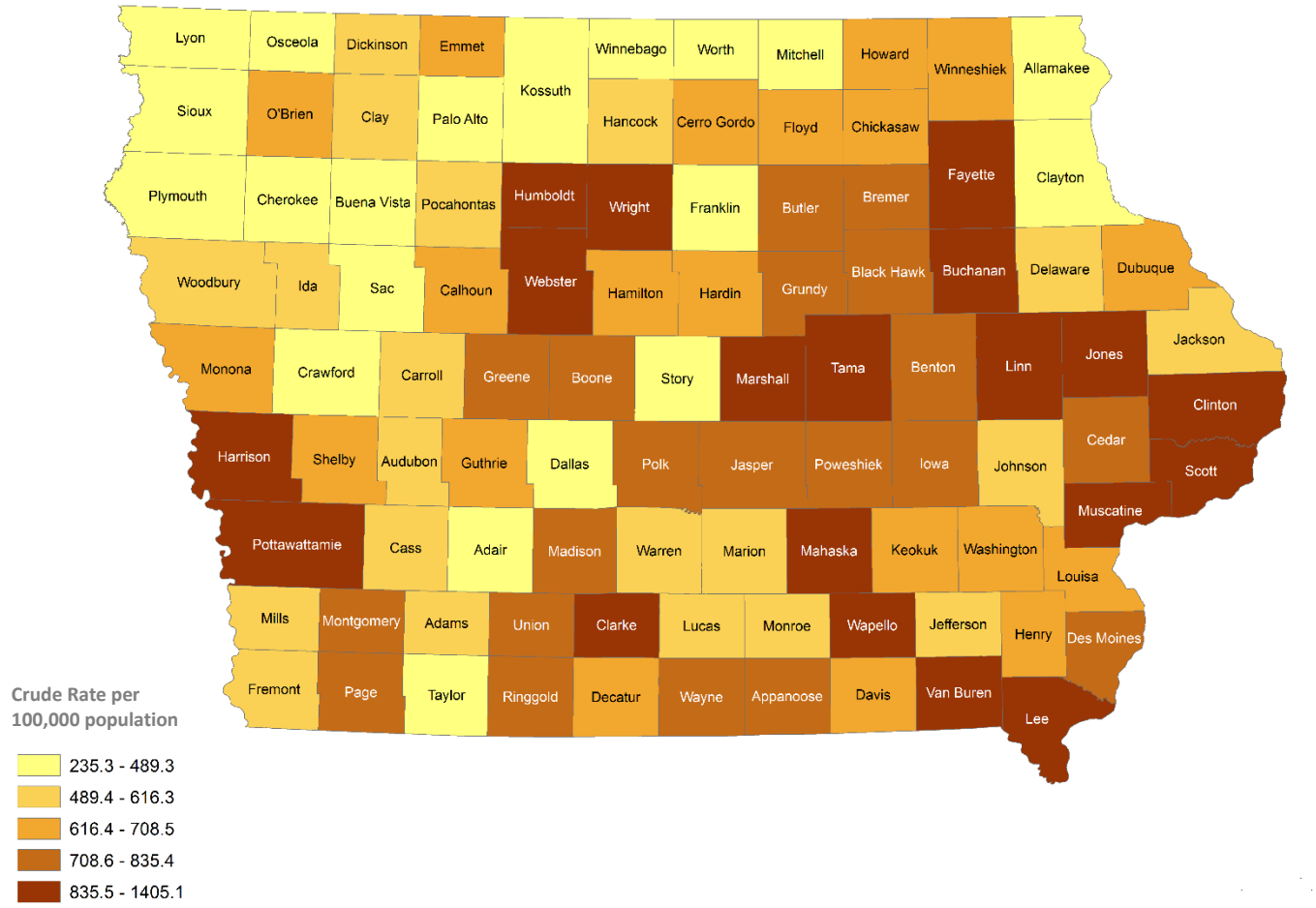
Figure 9: Average Annual Charges for Traumatic Brain Injury-Related Hospitalizations by Mechanism of Injury, 2011-2015



Traumatic Brain Injury-Related Emergency Department by County

Figure 10 maps the average annual rates for TBI-related emergency department visits by county. The color legend below the map illustrates the range of rates for the frequency distribution of the average annual rates for TBI-related emergency department visits for all 99 Iowa counties. Counties with the lowest average annual rates for TBI-related emergency department visits ranged from 235.3 to 489.3 per 100,000 population. Counties with the highest TBI-related emergency department visits ranged from 835.5 to 1,405.1 per 100,000 population.

Figure 10: Average Annual Rates for Traumatic Brain Injury-Related Emergency Department Visits by County, 2011-2015

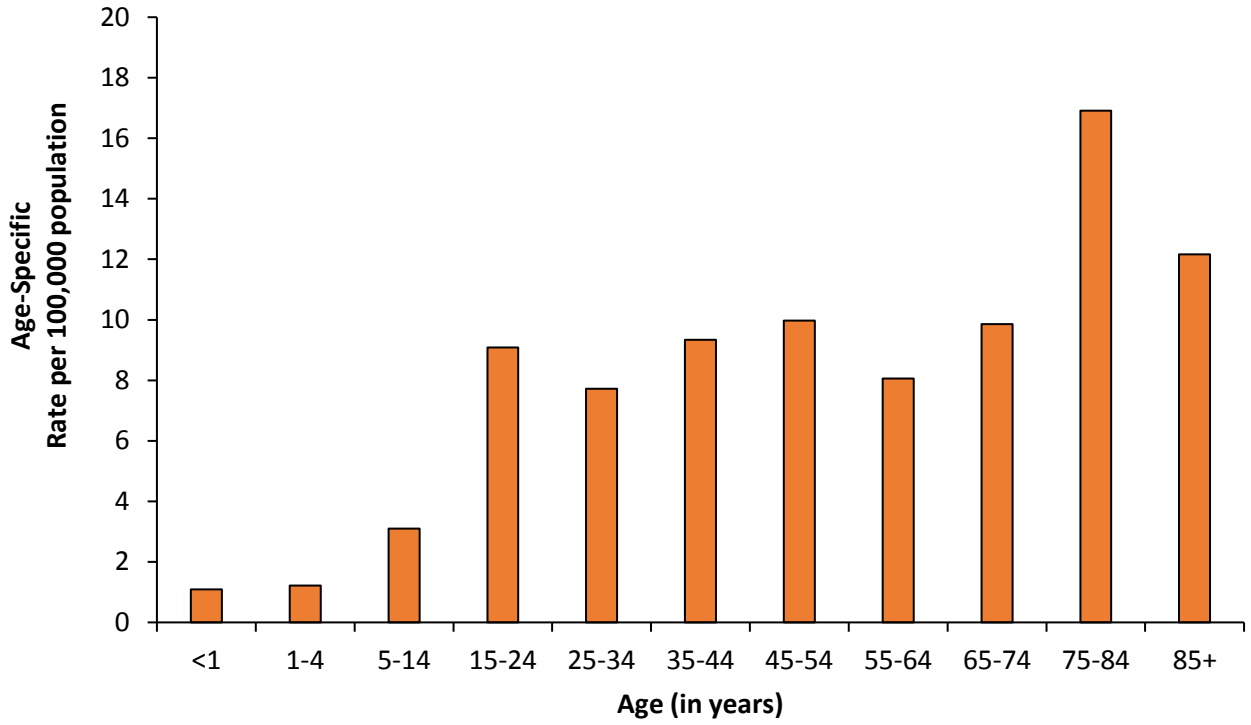


Traumatic Brain Injury-Related Hospitalizations

Traumatic Brain Injury-Related Hospitalizations by Age

Figure 11 illustrates the average annual rates of TBI-related hospitalizations by age in Iowa. During 2002 to 2006, children less than 1 year (1 per 100,000 population), 1 to 4 years (1 per 100,000 population), and 5 to 14 years (3 per 100,000 population) had the lowest rates of traumatic brain injury-related hospitalizations, followed by adults ages 25 to 34 (8 per 100,000 population). Older adults ages 75 to 84 years (17 per 100,000 population) had the highest rate of TBI-related hospitalizations compared to all age groups.

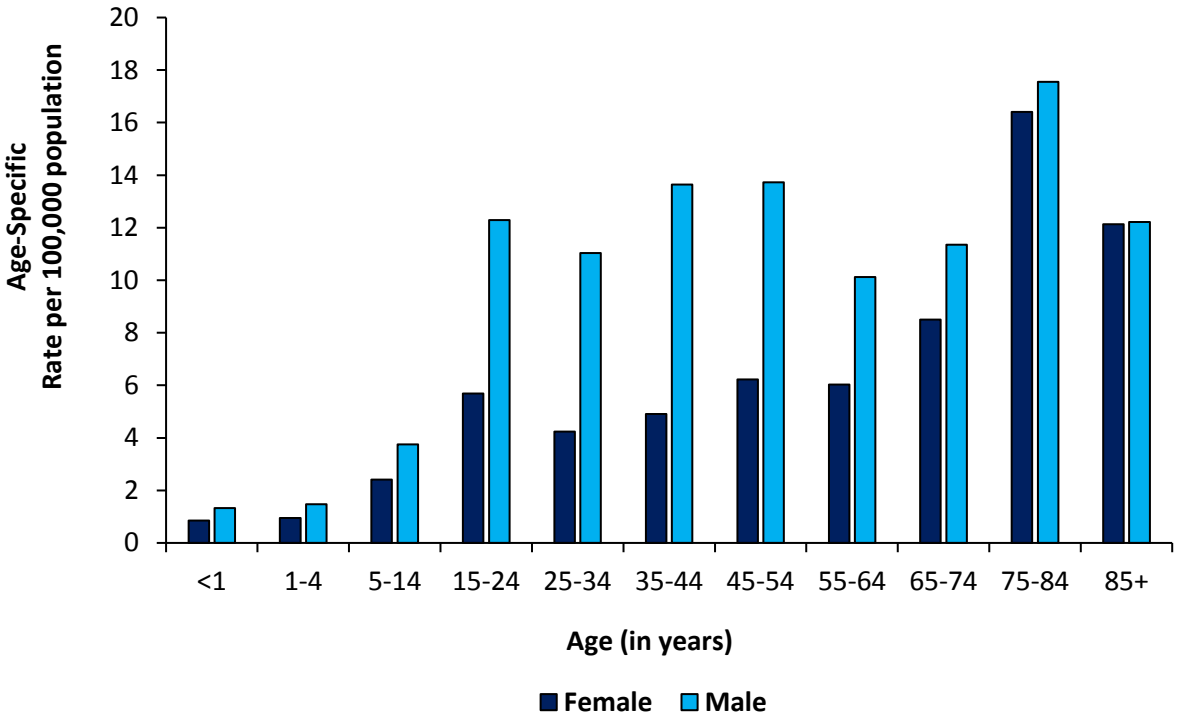
Figure 11: Average Annual Rates of Traumatic Brain Injury-Related Hospitalizations by Age, 2011-2015



Traumatic Brain Injury-Related Hospitalizations by Sex

Figure 12 illustrates the average annual rates of TBI-related hospitalizations by age and sex. The average annual number of hospitalizations for children 0 -14 years was 152 and 1,561 for older adults ages 65 or older. Males of all age groups, except for people 85 years or older, had the highest rates of TBI-related hospitalizations compared to females. Both males and females ages 85 or older had similar rates of TBI-related hospitalizations.

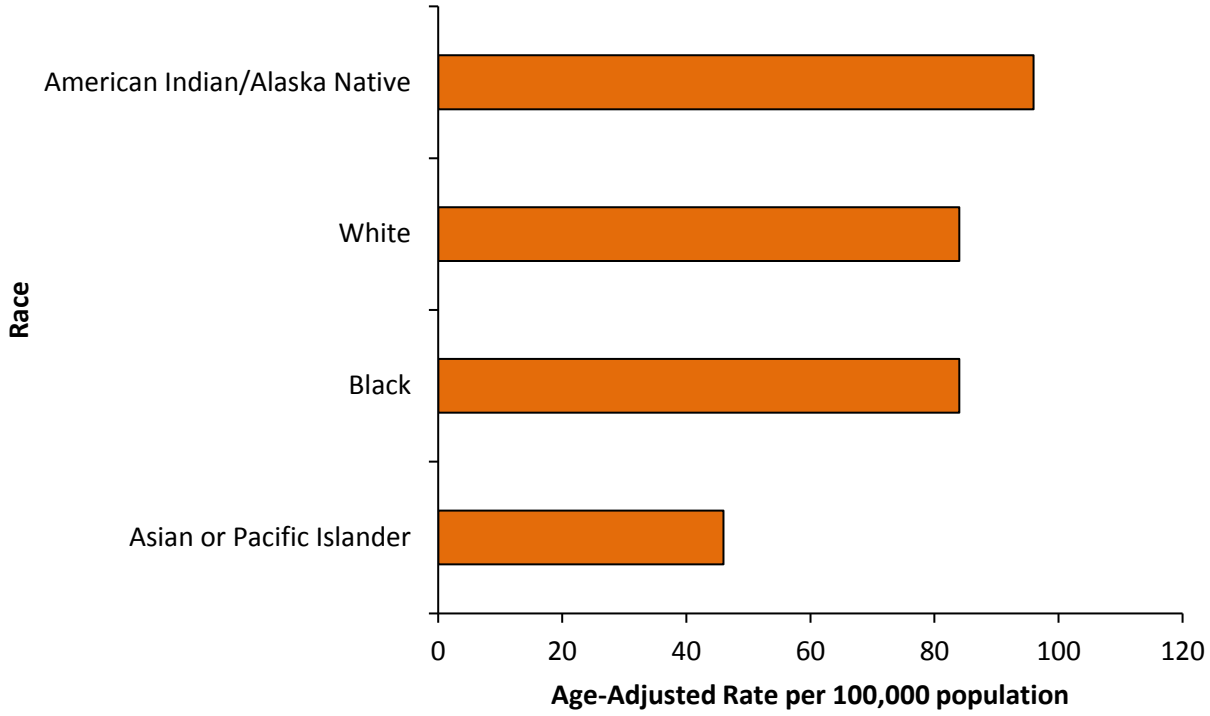
Figure 12: Average Annual Rates of Traumatic Brain Injury-Related Hospitalizations by Age and Sex, 2011-2015



Traumatic Brain Injury-Related Hospitalizations by Race

Figure 13 illustrates the average annual rates of TBI-related hospitalizations by race in Iowa. Age-adjusted rates from TBI-related hospitalizations are higher for American Indians and Alaska Natives (96 per 100,000 population) than for people of other racial groups. The average annual rates of TBI-related hospitalizations are similar among Whites and Blacks, but lower among Asian or Pacific Islanders (46 per 100,000 population).

Figure 13: Average Annual Rates of Traumatic Brain Injury-Related Hospitalizations by Race, 2011-2015



Traumatic Brain Injury-Related Hospitalizations by Mechanism of Injuries

Figure 14 illustrates the average annual rates of TBI-related hospitalizations by age and mechanism of injury. Falls are the leading cause of TBI-related hospitalizations for adults aged 55 to 64, 65 to 74, and 75 to 84 years. Falls were highest among adults aged 75 to 84 years (14 per 100,000 population). People aged 85 or older (11 per 100,000 population) had the second highest rates of falls. Motor vehicle traffic was higher among people aged 15 to 24 years (5 per 100,000 population). Assault and struck by/against events were relatively low for all age groups.

Figure 14: Average Annual Rates of Traumatic Brain Injury-Related Hospitalizations by Age, Mechanism of Injury, 2011-2015

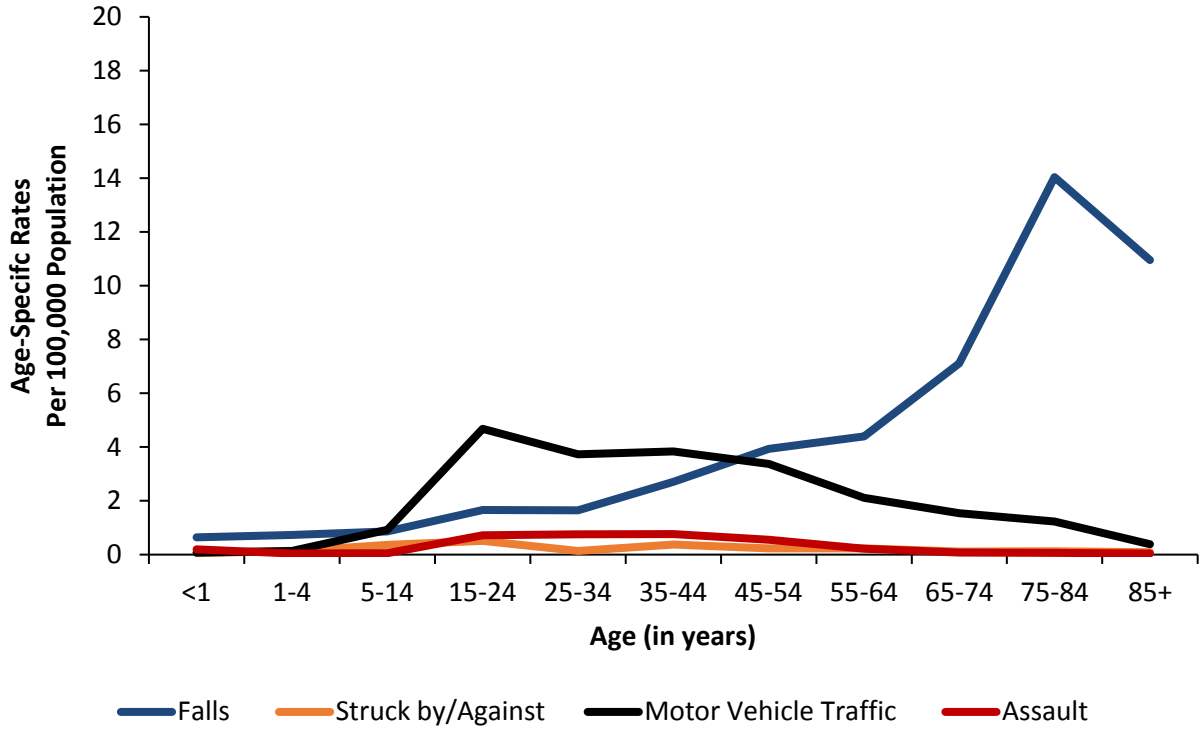
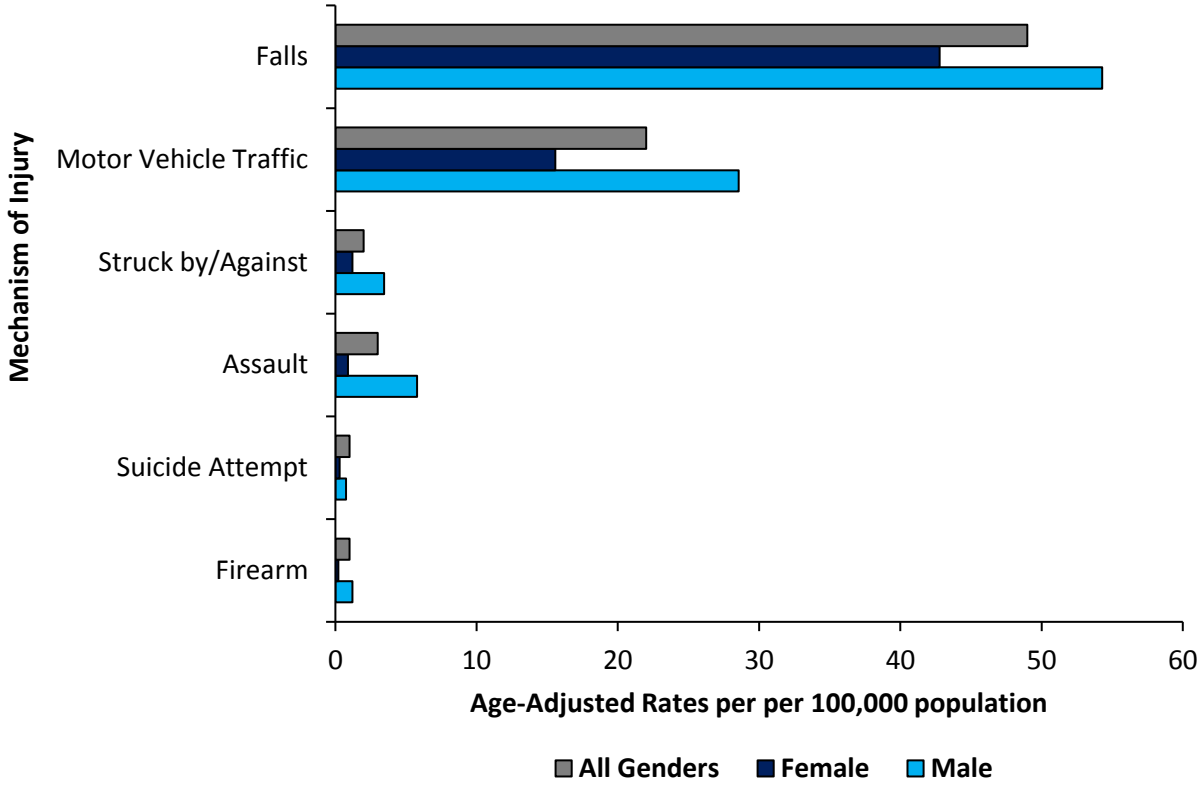


Figure 15 illustrates the average annual rates of TBI-related hospitalizations by mechanism of injury and sex in Iowa. Falls are the leading cause of TBI-related hospitalizations among Iowans. Iowa males experience more fall-related traumatic brain injuries than female counterparts. From 2011 to 2015, the average rates for both falls (54 per 100,000 population) and motor vehicle traffic-related (28 per 100,000 population) TBIs were highest among males. Among females, the average annual rates for both falls and motor vehicle traffic-related TBIs were 42 per 100,000 population and 15 per 100,000 population, respectively.

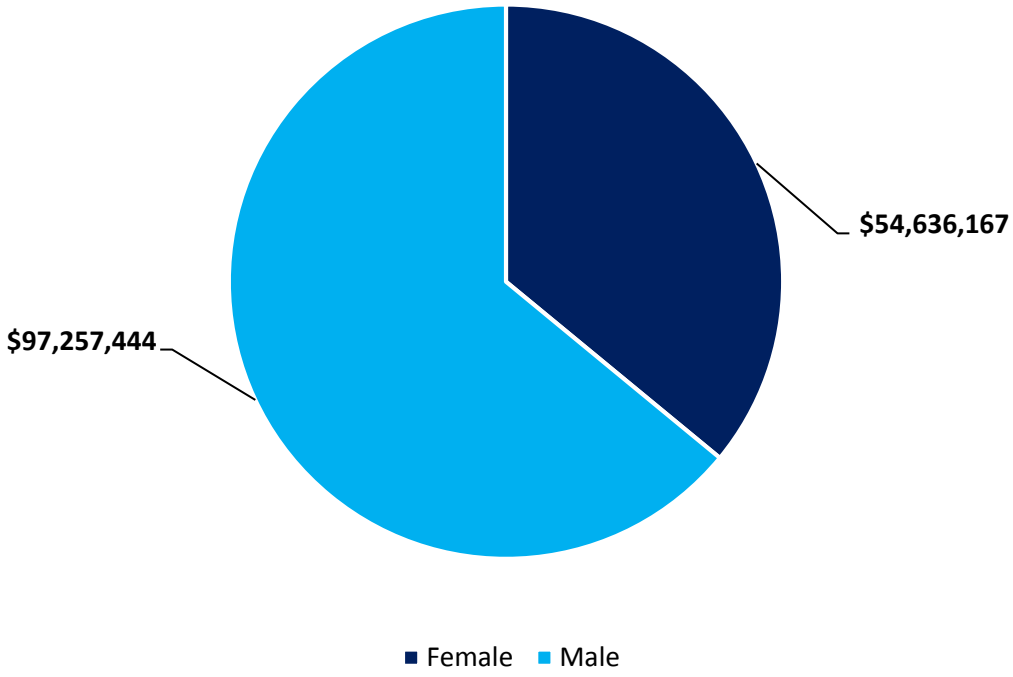
Figure 15: Average Annual Rates of Traumatic Brain Injury-Related Hospitalizations by Mechanism of Injury, Sex, 2011-2015



Traumatic Brain Injury-Related Hospitalization Charges by Sex

Figure 16 illustrates the average annual charges for TBI-related hospitalizations by sex. From 2011 to 2015, the average annual charges for TBI-related hospitalizations was $151 million. Of the $151 million, about 64 percent were for males and 36 percent for females.

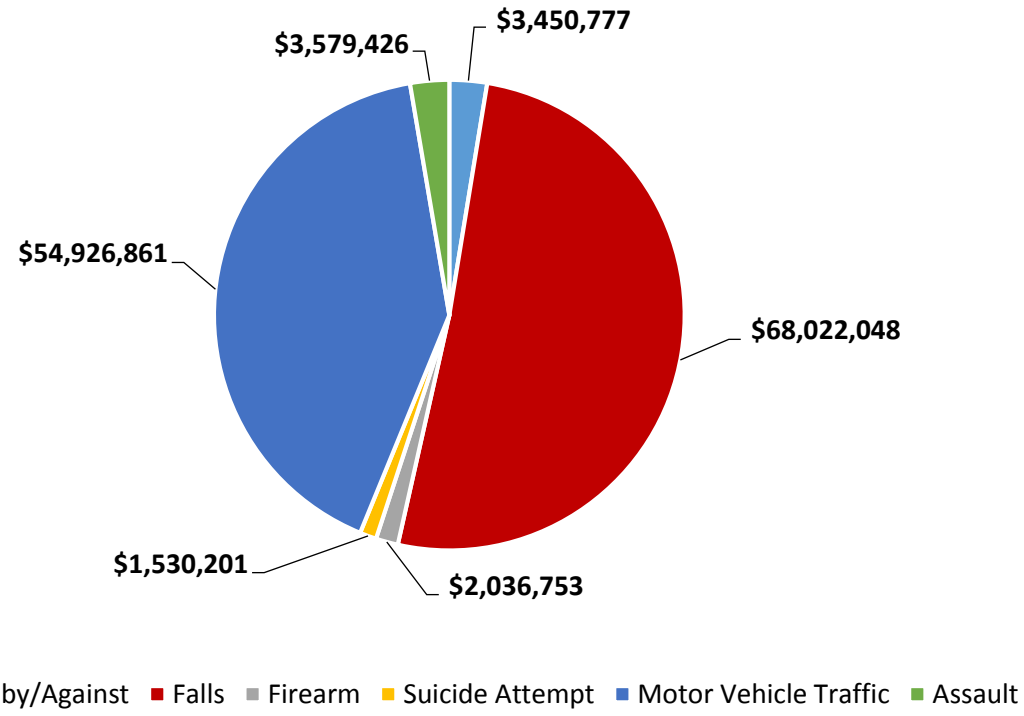
Figure 16: Average Annual Charges for Traumatic Brain Injury-Related Hospitalizations, Sex, 2011-2015



Traumatic Brain Injury-Related Hospitalization Charges by Mechanism of Injury

Figure 17 illustrates the average annual charges for TBI-related hospitalizations by mechanism of injury. TBI-related to falls had the highest average annual charges ($68 million), followed by motor vehicle traffic ($54 million). Suicide attempt had the lowest average annual charges ($1.5 million) among all the other mechanism of injuries.

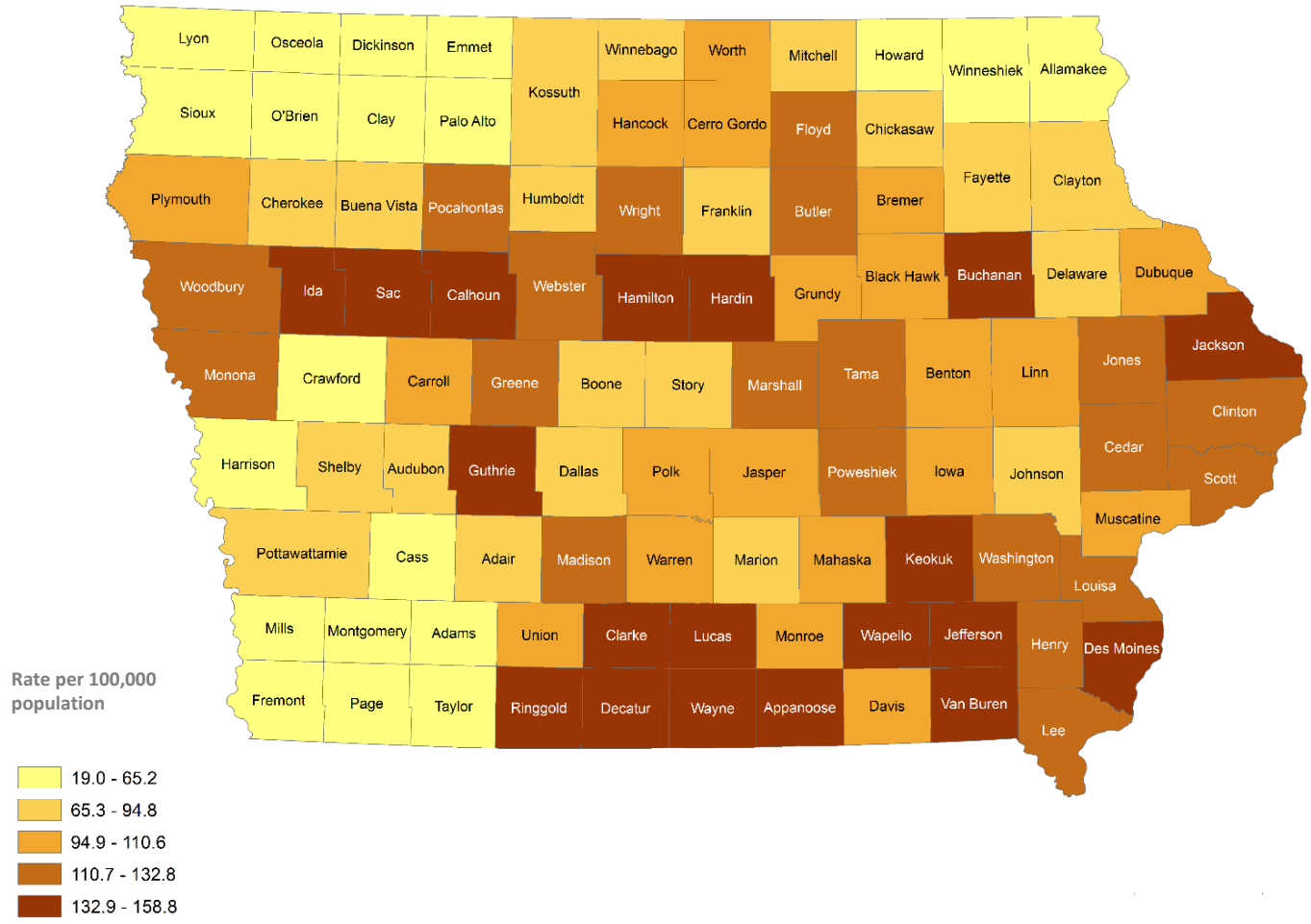
Figure 17: Average Annual Charges for Traumatic Brain Injury-Related Hospitalizations by Mechanism of Injury, 2011-2015



Traumatic Brain Injury-Related Hospitalizations by County

Figure 18 maps the average annual rates for TBI-related hospitalizations by county. The color legend below the map illustrates the range of rates for the frequency distribution of the average annual rates for TBI-related hospitalizations for all 99 Iowa counties. Counties with the lowest average annual rates for TBI-related hospitalizations ranged from 19.0 to 65.2 per 100,000 population. Counties with the highest TBI-related hospitalizations ranged from 132.9 to 185.8 per 100,000 population.

Figure 18: Average Annual Rates for Traumatic Brain Injury-Related Hospitalizations by County, 2011-2015

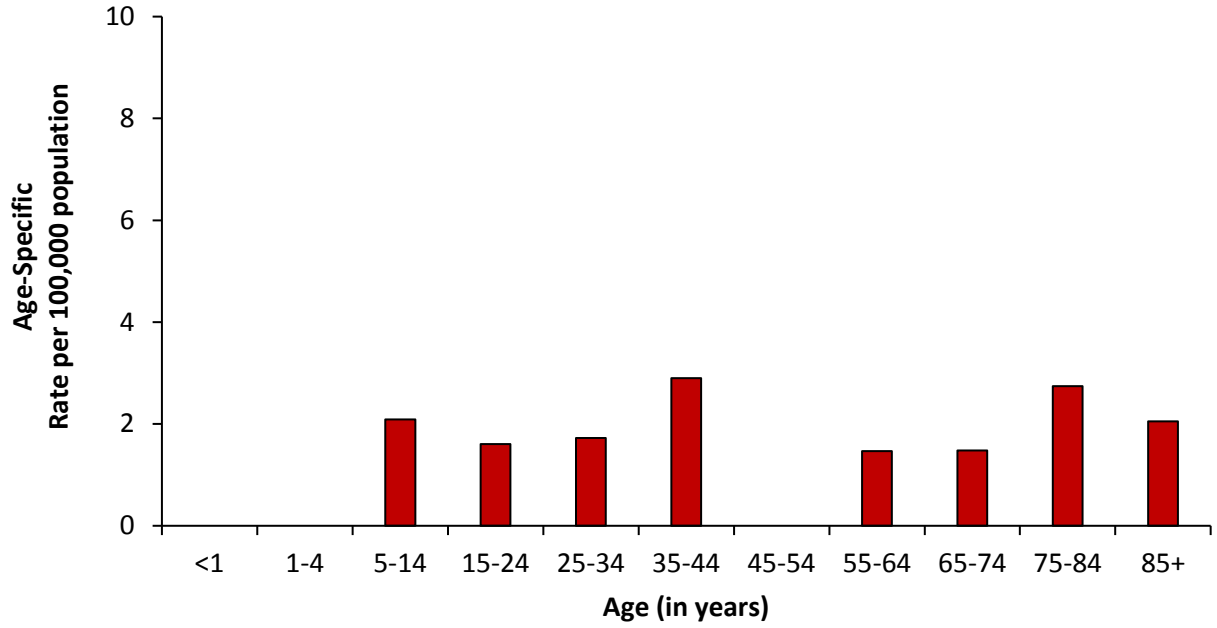


Traumatic Brain Injury-Related Deaths

Traumatic Brain Injury-Related Deaths by Age

Figure 19 illustrates the average annual rates of TBI-related deaths by age in Iowa. From 2011 to 2015, people aged 35-44 (3 per 100,000 population) and 75-84 (3 per 100,000 population) had the highest rates of TBI-related deaths compared to other age groups. Rates were similar for people aged 15-24, 25-34, 55-64, and 65-74.

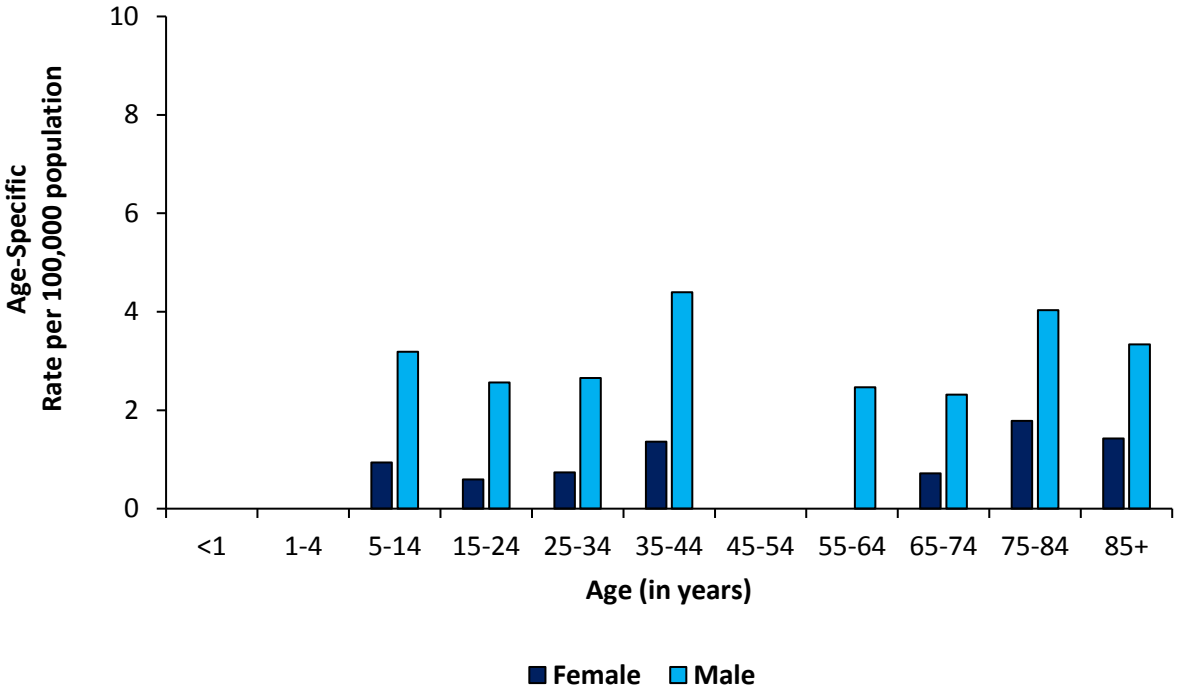
Figure 19: Average Annual Rates of Traumatic Brain Injury-Related Deaths by Age, 2011-2015



Traumatic Brain Injury-Related Deaths by Sex

Figure 20 illustrates the average annual rates of TBI-related deaths by age and sex. Although the average annual rates of deaths for males aged 35-44 (4 per 100,000 population) and 75-84 (4 per 100,000 population) were higher compared with all age groups, males had the highest rates of TBI-related deaths compared to female counterparts. Among females, people aged 75-84 had the highest rates of TBI-related deaths.

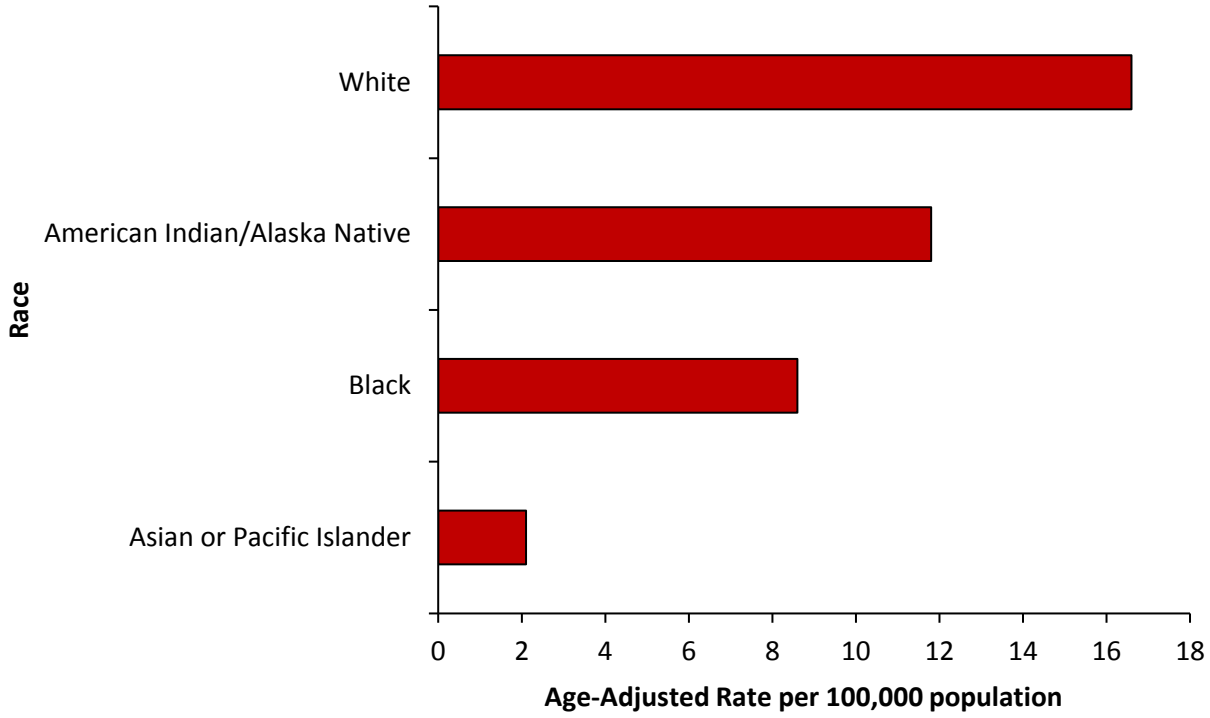
Figure 20: Average Annual Rates of Traumatic Brain Injury-Related Hospitalizations by Age and Sex, 2011-2015



Traumatic Brain Injury-Related Deaths by Race

Figure 21 illustrates the average annual rates of TBI-related deaths by race in Iowa. Age-adjusted rates from TBI-related deaths are higher for Whites (16 per 100,000 population), followed by American Indian/Alaska Natives (11 per 100,000 population). Blacks (9 per 100,000 population) and Asian or Pacific Islanders (2 per 100,000 population) had the lowest average annual rates of TBI-related deaths in Iowa.

Figure 21: Average Annual Rates of Traumatic Brain Injury-Related Deaths by Race, 2011-2015



Traumatic Brain Injury-Related Deaths by Mechanism of Injuries

Figure 22 illustrates the average annual rates of TBI-related deaths by age and mechanism of injury. Falls are the leading cause of TBI-related deaths for adults aged 75 to 84 years (2 per 100,000 population). The average annual rates of TBI-related falls were similar among people aged 5 to 14 years, 35 to 44 years, and 65 to 74 years (1 per 100,000 population). Homicide-related TBI deaths were more prevalent among people aged 35 to 44 years.

Figure 22: Average Annual Rates of Traumatic Brain Injury-Related Deaths by Age, Mechanism of Injury, 2011-2015

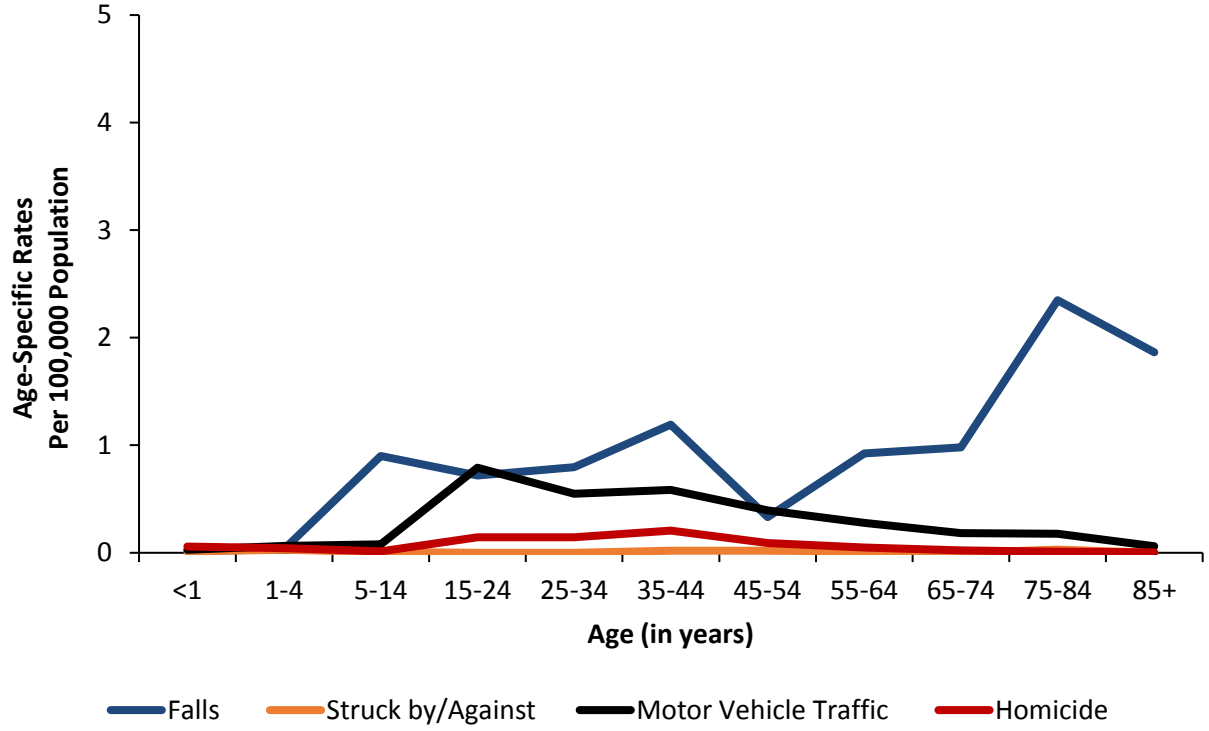
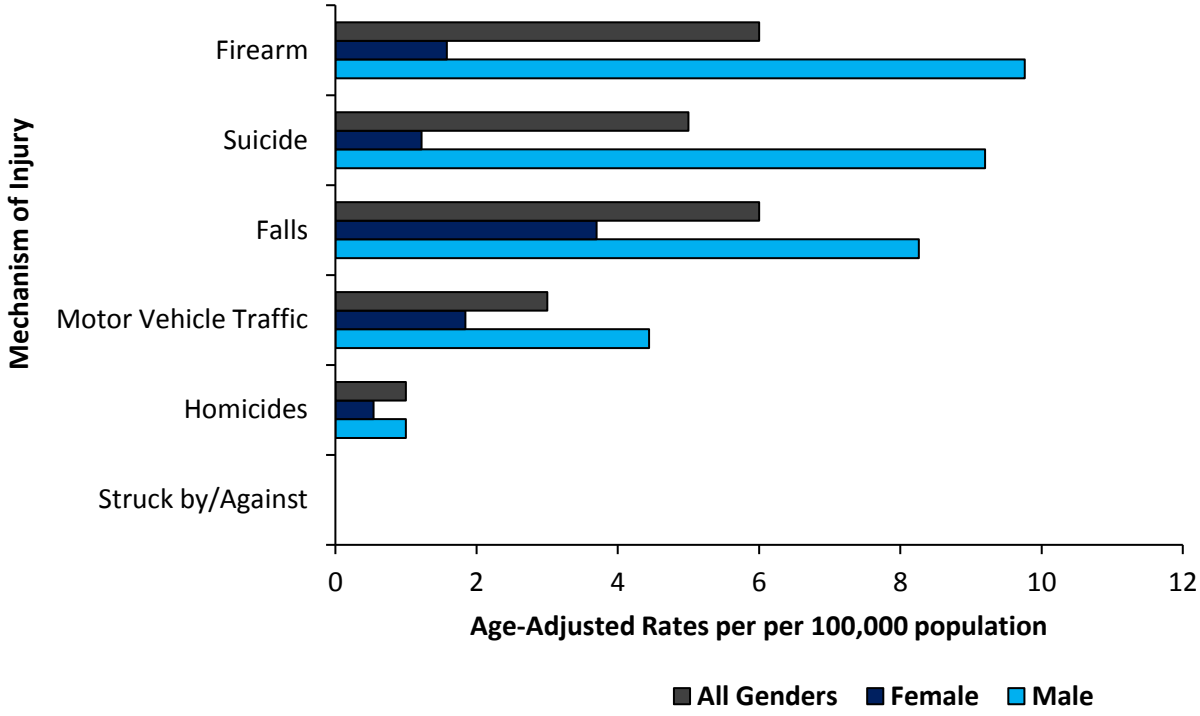


Figure 23 illustrates the average annual rates of TBI-related deaths by mechanism of injury and sex in Iowa. Firearms are the leading cause of TBI-related deaths among Iowans, followed by suicide and falls. Iowa males experience more firearm-related traumatic brain injury deaths (10 per 100,000 population) than female counterparts (2 per 100,000 population). From 2011 to 2015, the average number of firearm-related TBI deaths was 176 annually. The average annual suicide-related TBI deaths was 163. The average annual rates of TBI-related deaths were 9 per 100,000 population for males and 5 per 100,000 population for females. The average annual rates of TBI-related deaths are higher amongst males for all mechanism of injuries than for female counterparts.

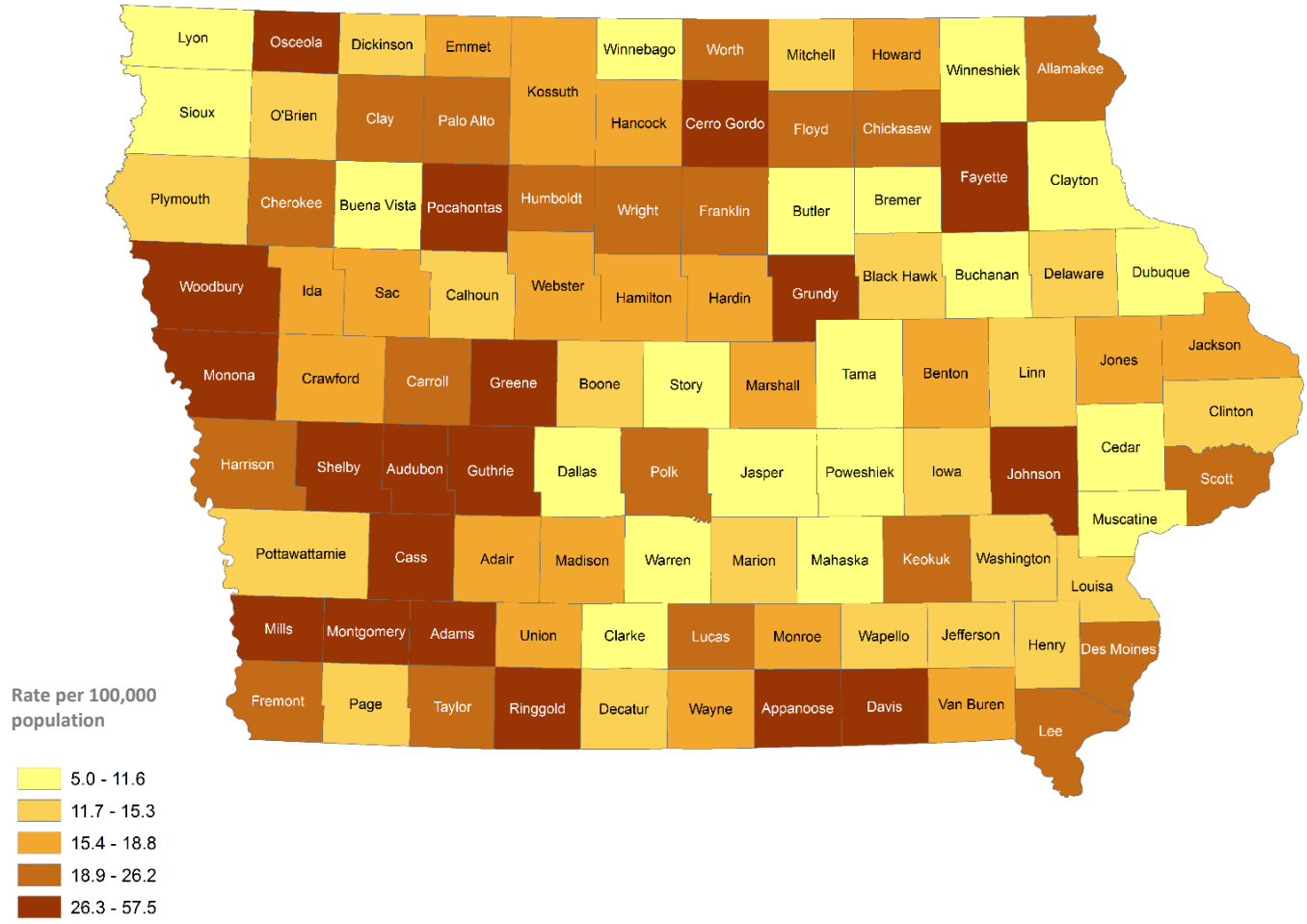
Figure 23: Average Annual Rates of Traumatic Brain Injury-Related Deaths by Mechanism of Injury, Sex, 2011-2015



Traumatic Brain Injury-Related Deaths by County

Figure 24 maps the average annual rates for TBI-related deaths by county. The color legend below the map illustrates the range of rates for the frequency distribution of the average annual rates for TBI-related deaths for all 99 Iowa counties. Counties with the lowest average annual rates for TBI-related deaths ranged from 5.0 to 11.6 per 100,000 population. Counties with the highest TBI-related deaths ranged from 26.3 to 57.5 per 100,000 population.

Figure 24: Average Annual Rates for Traumatic Brain Injury-Related Deaths by County, 2011-2015



Traumatic Brain Injury-Related County Rankings

Traumatic brain injury affects Iowans in every county. Counties were ranked from 1 to 99, where 1 represents the lowest rate and 99 represents the highest rate. Table 4 illustrates the top five counties with the lowest and highest rankings for TBI-related emergency department visits, hospitalizations and deaths.

Table 4: Top Five Counties with the Lowest and Highest Rankings for Traumatic Brain Injury-Related Emergency Department Visits, Hospitalizations and Deaths, 2011-2015

	Lowest Rankings		Highest Rankings	
	County	**Rank**	**County**	**Rank**
Emergency Department Visits	Osceola	1	Scott	99
	Crawford	2	Clinton	98
	Plymouth	3	Marshall	97
	Palo Alto	4	Webster	96
	Sioux	5	Clarke	95
Hospitalizations	Howard	1	Van Buren	99
	Emmet	2	Des Moines	98
	Lyon	3	Appanoose	97
	Crawford	4	Sac	96
	Page	5	Lucas	95
Deaths	Bremer	1	Johnson	99
	Dallas	2	Monona	98
	Story	3	Adams	97
	Winneshiek	4	Montgomery	96
	Buchanan	5	Cerro Gordo	95

Among these Iowa counties, the average rate of TBI-related emergency department visits was 686.2 per 100,000 population and 98.9 per 100,000 population for hospitalizations. The average rate of TBI-related deaths was 19.0 per 100,000 population (see Appendix A for more illustration on rates and rankings for TBI-related emergency department visits, hospitalizations and deaths by county).

Appendix A: County Rankings

Table 5: Traumatic Brain Injury-Related Rankings for Emergency Department Visits, Hospitalizations and Deaths by County, 2011-2015

County	Emergency Department (rate per 100,000 Population)	Emergency Department Rank	Hospitalizations (rate per 100,000 Population)	Hospitalizations Rank	Deaths (rate per 100,000 population)	Deaths Rank
Adair	417.5	9	78.1	24	18.9	60
Adams	504.8	23	51.5	15	38.6	97
Allamakee	452.2	14	28.4	6	24.2	77
Appanoose	783.8	71	157.7	97	28.9	85
Audubon	515.2	25	81.9	28	34.1	94
Benton	821.6	78	105.4	54	18.6	58
Black Hawk	796.9	74	97.6	43	15.4	40
Boone	775.8	68	92.5	37	13.7	27
Bremer	779.6	69	105.8	55	5.1	1
Buchanan	869.9	83	145.6	92	8.3	5
Buena Vista	486.6	18	84.2	31	8.8	7
Butler	795.1	73	129.6	78	10.7	16
Calhoun	665.2	50	139.1	87	15.1	35
Carroll	616.3	40	99.8	45	19.4	63
Cass	575.3	32	36.9	9	29.5	87
Cedar	775.8	67	116.4	64	9.5	10
Cerro Gordo	689.0	56	102.6	46	36.3	95
Cherokee	381.3	7	79.3	26	20.2	65
Chickasaw	640.3	46	78.4	25	20.4	67
Clarke	1145.1	95	140.2	89	10.8	18
Clay	575.8	33	59.3	18	24.2	78
Clayton	455.8	15	88.7	34	9.8	12
Clinton	1314.7	98	113.4	62	15.3	38
Crawford	323.1	2	20.9	4	16.0	44
Dallas	449.1	12	71.6	21	6.4	2
Davis	619.6	41	96.0	41	26.7	81
Decatur	660.6	49	138.4	86	15.2	36
Delaware	504.9	24	94.8	40	14.8	33
Des Moines	819.2	77	157.8	98	18.9	61
Dickinson	587.9	35	45.9	11	15.3	39
Dubuque	689.1	57	105.1	52	10.0	13
Emmet	702.7	59	20.2	2	17.7	53
Fayette	924.4	88	79.7	27	31.6	92
Floyd	680.4	53	132.1	79	21.8	72
Franklin	430.6	10	89.5	35	21.0	69
Fremont	495.6	21	36.6	8	21.1	70
Greene	835.4	80	124.7	72	30.1	88

(Table Continued)

County	Emergency Department (rate per 100,000 Population)	Emergency Department Rank	Hospitalizations (rate per 100,000 Population)	Hospitalizations Rank	Deaths (rate per 100,000 population)	Deaths Rank
Grundy	801.3	75	104.8	50	26.9	82
Guthrie	690.9	58	150.8	94	27.9	83
Hamilton	679.6	52	133.3	81	17.0	48
Hancock	578.7	34	106.4	56	18.0	55
Hardin	708.5	60	138.3	85	15.8	43
Harrison	902.9	87	58.1	17	22.1	73
Henry	627.6	43	117.7	66	12.0	23
Howard	667.3	51	19.0	1	17.6	51
Humboldt	846.1	81	93.1	38	20.7	68
Ida	546.8	28	136.0	83	17.7	54
Iowa	791.0	72	107.7	57	14.7	32
Jackson	606.8	39	150.2	93	18.4	57
Jasper	730.8	62	110.6	60	10.4	15
Jefferson	594.8	36	136.4	84	14.9	34
Johnson	600.3	38	75.2	22	57.5	99
Jones	986.3	90	127.6	76	15.6	41
Keokuk	686.5	55	134.2	82	19.4	64
Kossuth	462.0	16	82.5	29	18.3	56
Lee	945.0	89	124.4	71	21.5	71
Linn	1,058.4	92	99.3	44	14.6	30
Louisa	635.6	45	118.6	67	12.4	26
Lucas	501.2	22	151.1	95	22.9	74
Lyon	360.0	6	20.5	3	8.5	6
Madison	729.0	61	125.3	74	16.6	45
Mahaska	1,124.6	93	104.5	49	10.7	17
Marion	549.6	29	93.9	39	12.0	24
Marshall	1,222.9	97	114.0	63	17.6	52
Mills	528.0	26	49.8	14	31.0	89
Mitchell	489.4	20	83.7	30	14.0	28
Monona	660.3	48	125.5	75	39.6	98
Monroe	540.1	27	105.0	51	18.8	59
Montgomery	827.4	79	47.8	12	38.2	96
Muscatine	886.0	85	110.5	59	11.7	20
O'Brien	657.1	47	65.3	20	11.8	22
Osceola	235.4	1	58.0	16	29.0	86
Page	781.7	70	28.1	5	14.4	29
Palo Alto	345.0	4	65.1	19	26.0	79
Plymouth	335.8	3	105.2	53	12.0	25
Pocahontas	572.4	31	120.7	69	31.6	91
Polk	737.7	63	103.8	48	20.3	66

(Table Continued)

County	Emergency Department (rate per 100,000 Population)	Emergency Department Rank	Hospitalizations (rate per 100,000 Population)	Hospitalizations Rank	Deaths (rate per 100,000 population)	Deaths Rank
Pottawattamie	895.5	86	86.7	32	14.6	31
Poweshiek	802.6	76	117.7	65	9.6	11
Ringgold	766.8	65	142.3	90	31.6	93
Sac	437.4	11	152.4	96	17.3	49
Scott	1405.2	99	119.6	68	18.9	62
Shelby	622.2	42	90.1	36	31.3	90
Sioux	347.8	5	41.2	10	11.6	19
Story	450.1	13	75.7	23	7.5	3
Tama	1,027.1	91	129.2	77	10.3	14
Taylor	488.5	19	48.2	13	24.1	76
Union	739.9	64	97.1	42	17.5	50
Van Buren	872.3	84	158.8	99	16.8	47
Wapello	1,140.0	94	139.8	88	15.3	37
Warren	557.5	30	102.6	47	8.8	8
Washington	629.3	44	123.5	70	11.8	21
Wayne	770.4	66	144.1	91	15.7	42
Webster	1,162.1	96	112.8	61	16.6	46
Winnebago	400.0	8	88.7	33	9.4	9
Winneshiek	682.7	54	30.6	7	8.0	4
Woodbury	597.3	37	124.8	73	28.9	84
Worth	483.9	17	108.4	58	23.1	75
Wright	868.4	82	132.9	80	26.3	80

Appendix B: Data Sources

Data Source	Website
Iowa Department of Public Health	https://idph.iowa.gov/PublicHealthData

Appendix C: Definitions

Assault: Injury from an act of violence where physical force by one or more persons is used with the intent of causing harm, injury, or death to another person; or an intentional poisoning by another person.

Age-Adjusted Rate: A weighted average of the age-specific (crude) rates, where the weights are the proportions of persons in the corresponding age groups of a standard population.

Age-Specific Rate: A rate for a specified age group, in which the numerator and denominator refer to the same age group.

American Indian or Alaskan Native: A person having origins in any of the original peoples of North and South America (including Central America), and who maintain tribal affiliation or community attachment.

Asian: A person having origins in any of the original peoples of the Far East, Southeast Asia, or the Indian subcontinent including, for example, Cambodia, China, India, Japan, Korea, Malaysia, Pakistan, the Philippine Islands, Thailand, and Vietnam.

Black: A person having origins in any of the black racial groups of Africa.

Drowning: Suffocation (asphyxia) resulting from submersion in water or another liquid.

Fall: Injury received when a person descends abruptly due to the force of gravity and strikes a surface at the same or lower level.

Firearm: Injuries or deaths from handguns, shotguns, or BB guns.

Homicide - Injuries inflicted by another person with intent to injure or kill, by any means.

Motor Vehicle Traffic: Collisions that occur on public highways and streets. These may include pedestrians, pedal cyclists, motorcyclists, and occupants of motor vehicles.

Poisoning: Ingestion, inhalation, absorption through the skin, or injection of so much of a drug, toxin (biologic or non-biologic), or other chemical that a harmful effect results, such as drug overdoses.

Struck by / against: Injury resulting from being struck by (hit) or crushed by a human, animal, or inanimate object or force other than a vehicle or machinery; injury caused by striking (hitting) against a human, animal, or inanimate object or force other than a vehicle or machinery.

Suicide Death caused by self-directed injurious behavior with an intent to die as a result of the behavior.

Suicide attempt: A non-fatal, self-directed, potentially injurious behavior with an intent to die as a result of the behavior; might not result in injury.

White: A person having origins in any of the original peoples of Europe, the Middle East, or North Africa.

References

Centers for Disease Control and Prevention. (n.d.). Definitions for WISQARS nonfatal. Retrieved from https://www.cdc.gov/ncipc/wisqars/nonfatal/definitions.htm

Centers for Disease Control and Prevention. (n.d.). Definitions for WISQARS fatal injury. Retrieved from https://www.cdc.gov/injury/wisqars/fatal_help/definitions_fatal.html