

Traumatic Brain Injuries Among Arizona Residents, 2009

Resources for the development of this report were provided through funding to the Arizona Department of Health Services from the Centers for Disease and Control and Prevention, Cooperative Agreement 5U17CE924770-04, Integrated Core Injury Prevention and Control Program.

Permission to quote from or reproduce materials from this publication is granted when acknowledgment is made.



Prepared by: Alana Shacter, MPH
150 North 18th Avenue, Suite 320
Phoenix, AZ 85007
Injury Prevention Program
Bureau of Women's and Children's Health
Arizona Department of Health Services
July 2010

Table of Contents

Executive Summary	2
Trends in Traumatic Brain Injuries among Arizona Residents, 2005-2009	5
<i>Mortality</i>	<i>5</i>
<i>Non-Fatal Inpatient Hospitalizations</i>	<i>7</i>
<i>Non-Fatal Emergency Department Visits.....</i>	<i>10</i>
Deaths among Arizona Residents During 2009	12
<i>Firearm-Related TBI Mortality.....</i>	<i>15</i>
<i>Fall-Related TBI Mortality</i>	<i>16</i>
Non-Fatal Inpatient Hospitalizations among Arizona Residents During 2009	17
<i>Non-Fatal Fall-Related TBI Inpatient Hospitalizations</i>	<i>21</i>
<i>Non-Fatal Motor Vehicle Traffic Crash-Related TBI Inpatient Hospitalizations.....</i>	<i>22</i>
Non-Fatal Emergency Department Visits among Arizona Residents During 2009	24
<i>Non-Fatal Fall-Related Emergency Department Visits</i>	<i>28</i>
<i>Non-Fatal Struck By/Against-Related TBI Emergency Department Visits</i>	<i>29</i>
Data Notes	31
Appendix A. Definitions of Mechanisms of Injury	32

Executive Summary

Traumatic brain injuries (TBI) were the cause of death for 1,288 Arizona residents in 2009. Males ages 85 years and older had the highest rate of TBI deaths with 211.4 deaths per 100,000 residents. TBI death rates were highest among American Indians (30.3 per 100,000 residents) and Non-Hispanic Whites (19.1 per 100,000 residents). Forty-four percent of TBI deaths in 2009 were due to unintentional injuries (n=578); 41 percent were due to suicides (n=523); and 10 percent were due to homicides (n=127). The most common causes of TBI deaths of any intent were firearms (47 percent, n=610), falls (24 percent, n=310), and motor vehicle traffic crashes (16 percent, n=206).

In 2009, there were 6,943 non-fatal inpatient hospitalizations due to TBI. Adults 85 years and older had the highest rates of TBI inpatient hospitalizations. Males 85 years and older had a rate of 564.5 hospitalizations per 100,000 residents. The rate for females 85 years and older was 477.7 hospitalizations per 100,000 residents. Age-adjusted TBI inpatient hospitalization rates were highest among American Indians (175.9 per 100,000 residents) and Non-Hispanic Whites (106.2 per 100,000 residents). Unintentional injuries accounted for 85 percent of TBI hospitalizations (n=4,945) and assaults comprised an additional 13 percent (n=898). Falls were the most common cause of TBI hospitalizations (42 percent, n=2,896), followed by motor vehicle traffic crashes (30 percent, n=2,053). Total hospital charges for non-fatal inpatient hospitalizations due to TBIs were \$433 million.

In 2009, there were 43,369 non-fatal TBI emergency department visits among Arizona residents. Almost half of TBI emergency department visits were among children ages 19 years and younger (46 percent, n=20,120), as a result of physical and mental factors that make children and young adults more susceptible to TBIs and more likely to engage in activities that have a high risk for TBIs. TBI emergency department visit rates were highest among children younger than one year of age. Females younger than one year of age had a rate of 2,233.8 visits per 100,000 residents, and males younger than one year of age had a rate of 2,620.7 visits per 100,000 residents. The majority of TBI emergency department visits were due to unintentional injuries (89 percent, n=38,424), and 11 percent were due to assaults (n=4,733). The leading causes of TBI emergency department visits were falls (50 percent, n=21,755), struck by/against injuries (25 percent, n=10,849), and motor vehicle traffic crashes (12 percent, n=5,273). Total hospital charges for non-fatal emergency department visits due to TBIs were \$178 million.

The data presented in this report show that TBI is a public health problem that impacts the lives of thousands of Arizona residents each year. The effects of TBI can include chronic pain, disability, large medical bills, changes in quality of life, and premature death. TBI can occur throughout the life span, and the repercussions of these injuries may be experienced for many years. The consequences of TBI can extend beyond the injured individuals to their families and communities. With non-fatal TBI, family members are often required to provide care, which can result in time away from work, loss of income, and increases in stress. Within a community, the financial costs of TBI include medical expenses, rehabilitation, lost wages, and lost productivity. **Most TBI injuries are predictable and preventable.** Understanding the causes of TBI is an important step towards educating and empowering communities and implementing effective prevention strategies.

Introduction

Traumatic brain injury (TBI) is defined as damage to the brain following a sudden blow or impact to the head or by shaking the head violently. TBI can also be caused by a penetrating head injury that disrupts brain function. An estimated 1.4 million Americans sustain these injuries each year, and of these, 50,000 die as a result of the trauma.¹ An additional 80,000 to 90,000 people experience permanent disability, and it is estimated that 5.3 million Americans are currently living with a TBI-related disability.^{2,3} TBI can cause cognitive function deficits, which can lead to depression and other secondary outcomes including problems working and performing daily activities such as completing school work, managing personal finances, or driving a vehicle.

Figure 1. Traumatic Brain Injury Pyramid, 2009

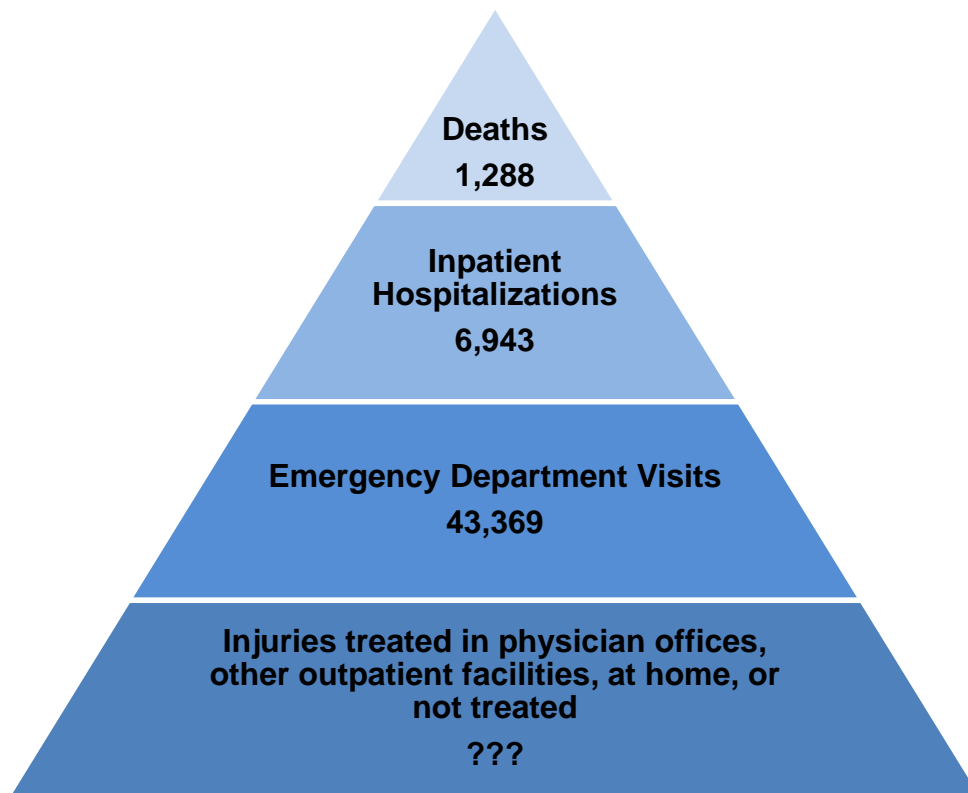


Figure 1 shows a TBI pyramid for Arizona in 2009. This pyramid shows that deaths represent the smallest proportion of injuries. The proportions increase towards the foundation of the pyramid, which is comprised of hospital discharges, emergency

¹ Langlois JA, Rutland-Brown W, Thomas KE. *Traumatic Brain Injury in the United States: Emergency Department Visits, Hospitalizations and Deaths*. Atlanta (GA): Centers for Disease Control and Prevention, National Center for Injury Prevention and Control; 2006

² Ibid

³ Thurman D, Alverson C, Dunn K, Guerrero J, Sniezek J. Traumatic brain injury in the United States: a public health perspective. *Journal of Head Trauma Rehabilitation* 1999;14(6):602–15.

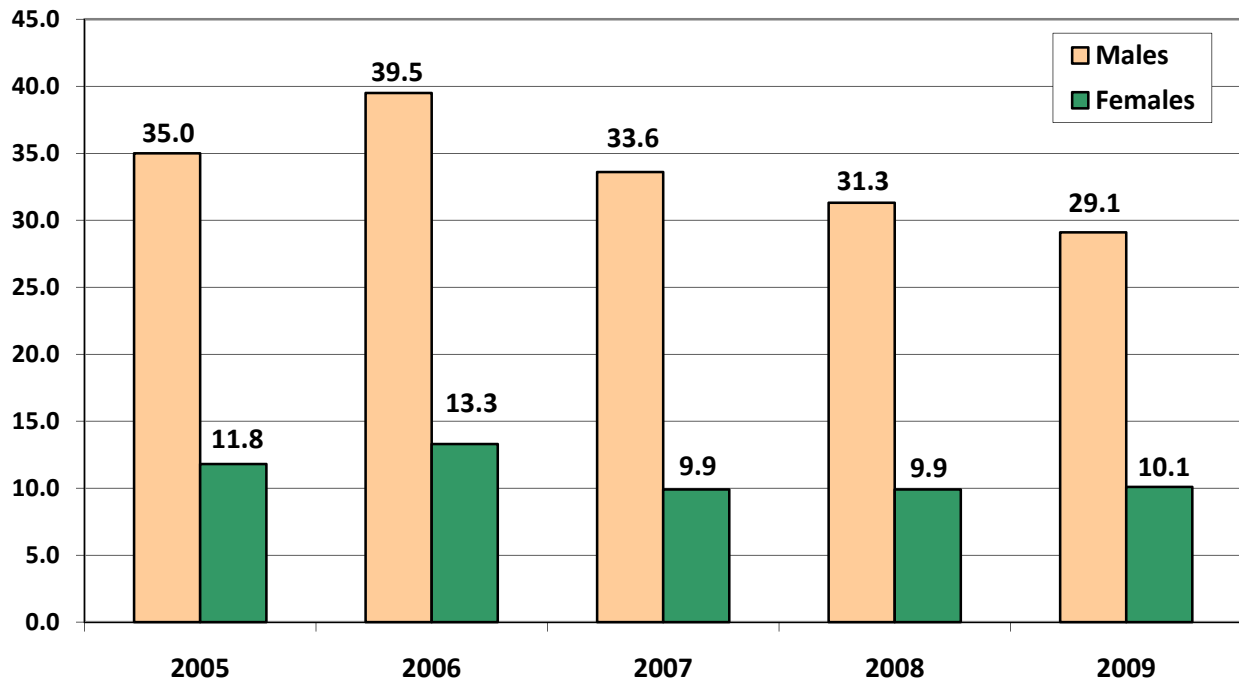
department visits, and self-care. Although TBIs that do not require medical treatment may be the most numerous, no existing datasets capture these types of injuries.

Trends in Traumatic Brain Injuries among Arizona Residents, 2005-2009

Mortality

Between 2005 and 2009, the age-adjusted mortality rate of traumatic brain injury decreased 17 percent, from 23.1 deaths per 100,000 Arizona residents in 2005 to 19.2 deaths per 100,000 residents in 2009. Age-adjusted mortality rates among males were more than double the rates among females. Rates for males decreased 17 percent from 2005 through 2009, and rates for females decreased 15 percent. Figure 2 shows age-adjusted TBI mortality rates by sex from 2005 through 2009.

Figure 2. Age-Adjusted TBI Mortality Rates by Sex, Arizona, 2005-2009



While total age-adjusted TBI mortality rates declined from 2005 through 2009, changes in rates varied by manner and mechanism of injury. Figures 3 and 4 show age-adjusted TBI mortality rates by manner and selected cause of injury.

Figure 3. Age-Adjusted TBI Mortality Rates per 100,000 Residents by Manner of Death, Arizona, 2005-2009

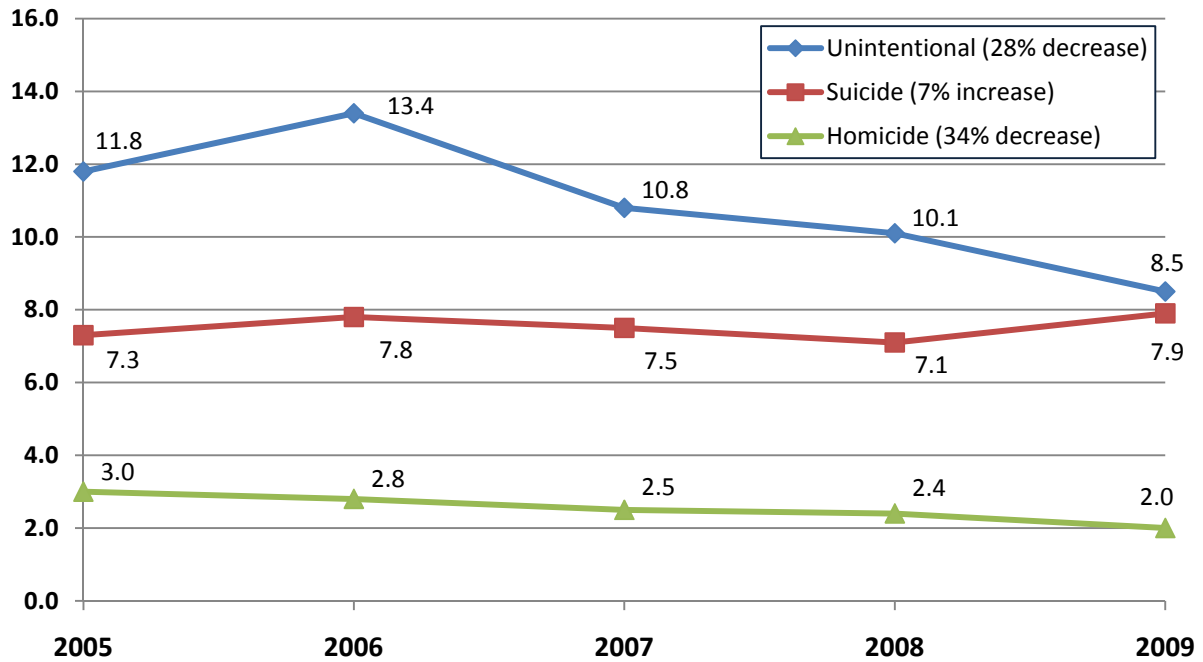
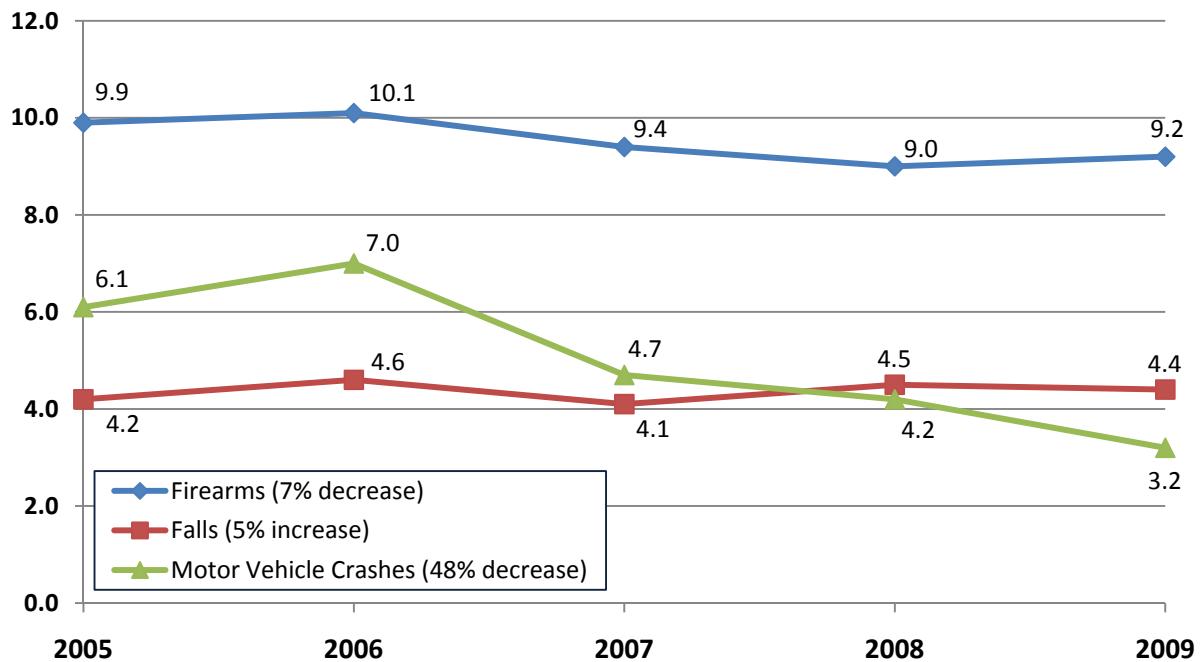


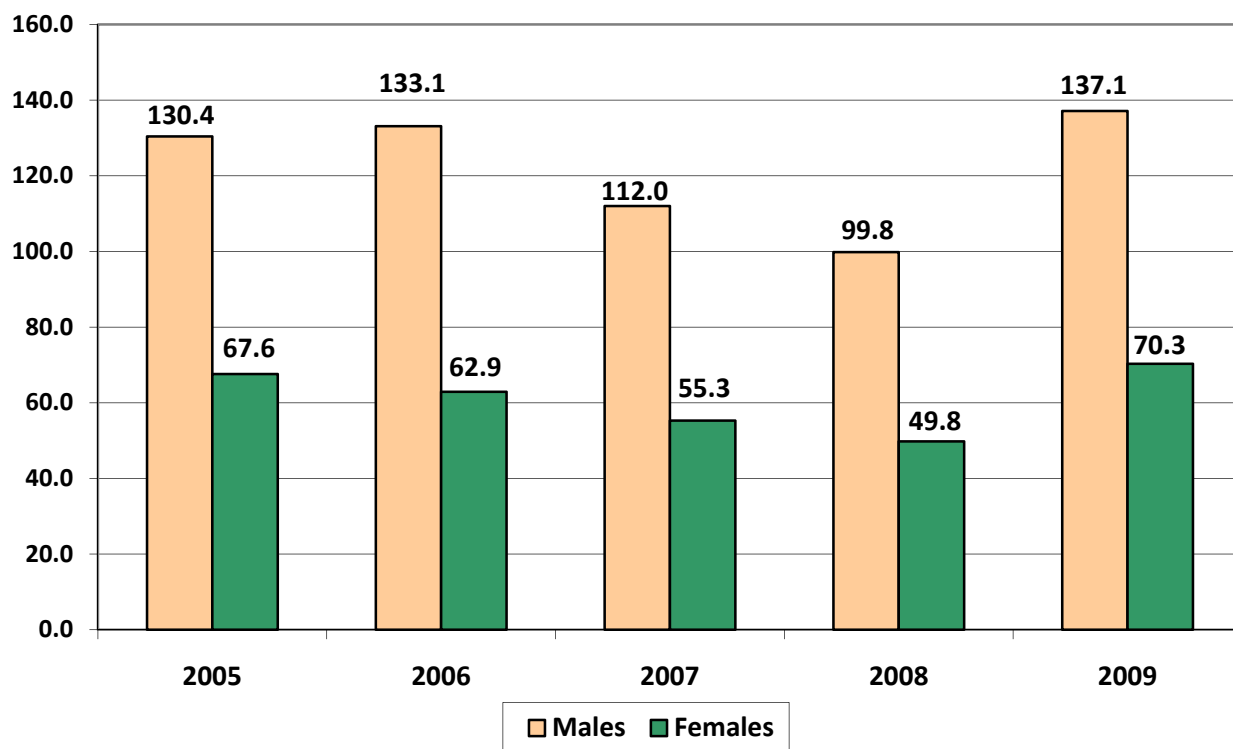
Figure 4. Age-Adjusted TBI Mortality Rates per 100,000 Residents by Selected Cause of Death, Arizona, 2005-2009



Non-Fatal Inpatient Hospitalizations

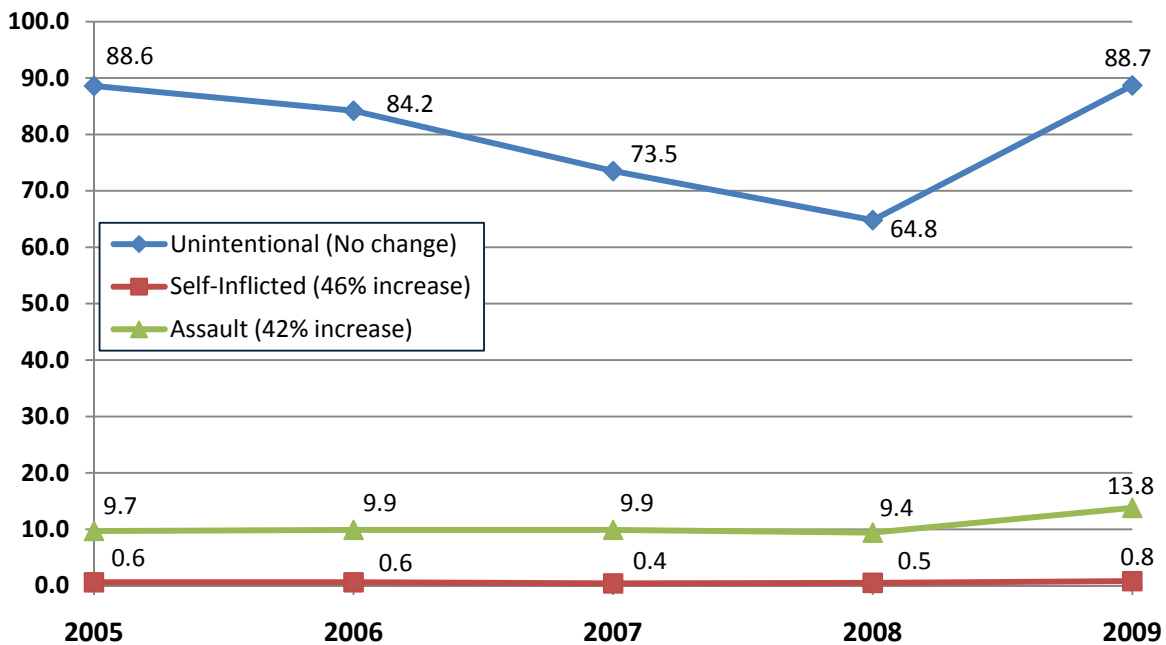
Between 2005 and 2009, the age-adjusted rate of TBI-related inpatient hospitalizations increased five percent, from 99.5 hospitalizations per 100,000 Arizona residents in 2005 to 104.1 hospitalizations per 100,000 residents in 2009. Age-adjusted hospitalization rates among males were almost double the rates among females. Rates for males increased five percent from 2005 through 2009, and rates for females increased four percent. Figure 5 shows age-adjusted non-fatal TBI-related inpatient hospitalization rates by sex from 2005 through 2009. Please refer to the Data Notes Section of this report for additional information regarding increased inpatient hospitalization rates in 2009.

Figure 5. Age-Adjusted Non-Fatal TBI-Related Inpatient Hospitalization Rates by Sex, Arizona, 2005-2009



While total age-adjusted TBI-related inpatient hospitalization rates increased from 2005 through 2009, changes in rates varied by manner and mechanism of injury. Figure 6 shows age-adjusted TBI hospitalization rates by manner of injury.

Figure 6. Age-Adjusted Non-Fatal TBI-Related Inpatient Hospitalization Rates per 100,000 Residents by Manner of Injury, Arizona, 2005-2009



From 2005 through 2009, the rate of non-fatal inpatient hospitalizations due to fall-related traumatic brain injuries increased 48 percent, from 28.8 hospitalizations per 100,000 residents in 2005 to 42.4 hospitalizations per 100,000 residents in 2009. Males had a higher rate of fall-related TBI hospitalizations than females in each of the five years examined.

While the rate of fall-related TBI hospitalizations increased since 2005, the rate of motor vehicle crash-related TBI hospitalizations decreased 31 percent. There was an overall decrease in the rate from 2005 through 2008, followed by a slight increase in the rate from 2008 through 2009. The rate of non-fatal inpatient hospitalizations for TBIs due to motor vehicle crashes decreased from 45.2 hospitalizations per 100,000 residents in 2005 to 31.2 hospitalizations per 100,000 residents in 2009. As with falls, males had a higher rate of motor vehicle crash-related TBI hospitalizations than females in each of the years examined.

From 2005 through 2008, the rate of fall-related TBI hospitalizations remained lower than the rate for TBI hospitalizations due to motor vehicle crashes. In 2009, however, the rate of motor vehicle crash-related TBI hospitalizations was lower than the rate of fall-related cases (42.4 fall-related hospitalizations in 2009, 31.2 motor vehicle crash-related hospitalizations in 2009). Figure 7 shows the trend of fall-related TBI hospitalizations by sex from 2005 through 2009, and Figure 8 shows the trend of motor vehicle crash-related TBI hospitalizations by sex from 2005 through 2009.

Figure 7. Age-Adjusted Non-Fatal Fall-Related TBI Inpatient Hospitalization Rates per 100,000 Residents by Manner of Injury, Arizona, 2005-2009

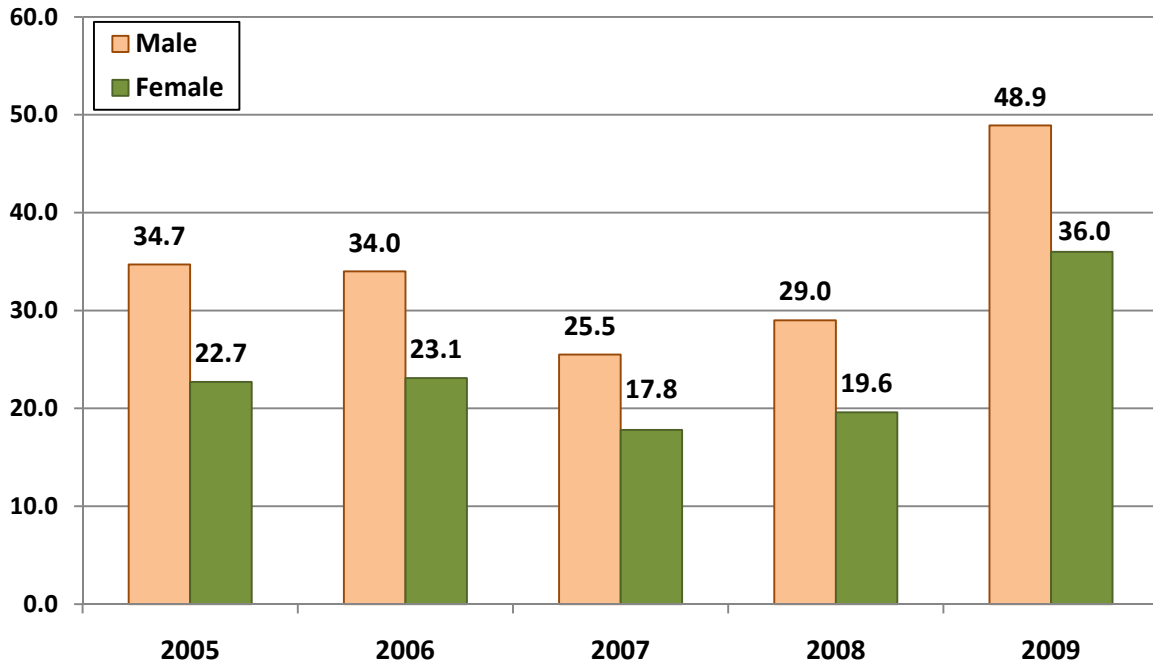
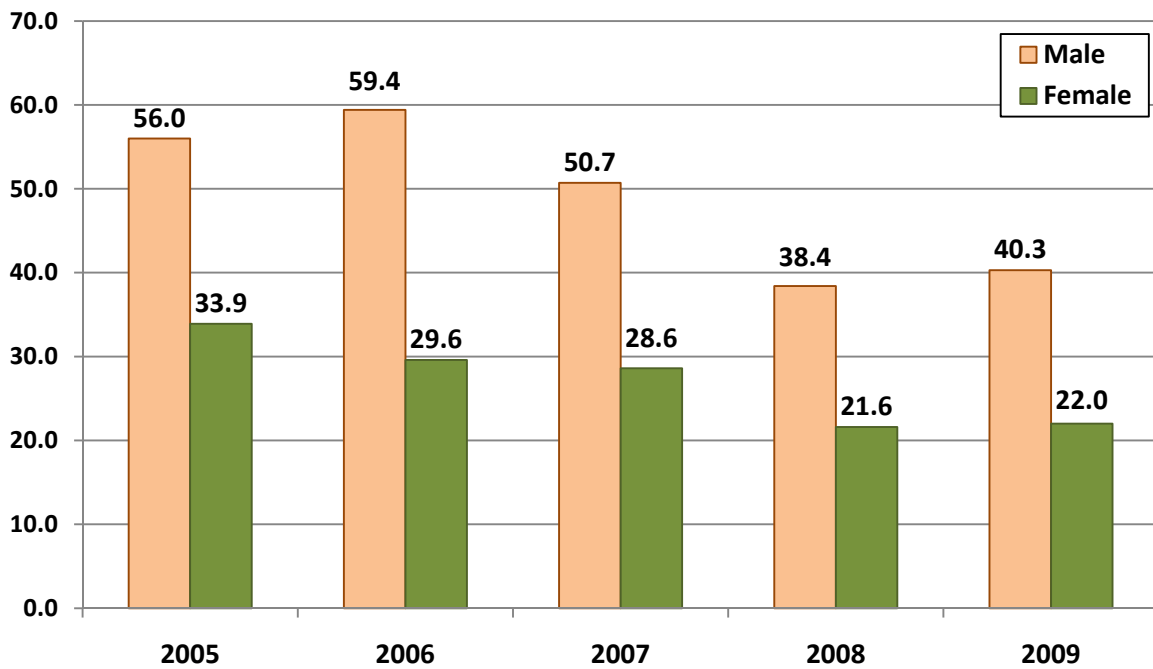


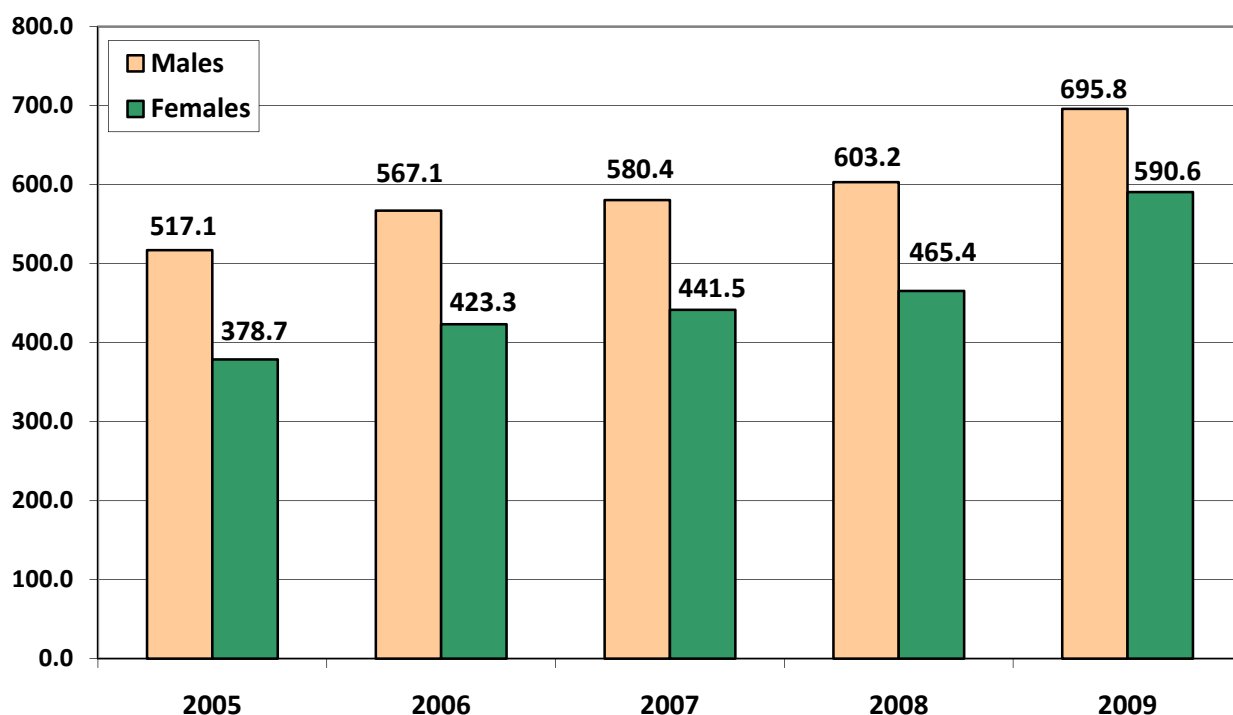
Figure 8. Age-Adjusted Non-Fatal Motor Vehicle Crash-Related TBI Inpatient Hospitalization Rates per 100,000 Residents by Manner of Injury, Arizona, 2005-2009



Non-Fatal Emergency Department Visits

From 2005 through 2009, the age-adjusted rate of non-fatal TBI-related emergency department visits increased 44 percent, from 450.9 visits per 100,000 Arizona residents in 2005 to 647.3 visits per 100,000 residents in 2009. Age-adjusted emergency department visit rates among males were higher than rates among females. Rates for males increased 35 percent from 2005 through 2009, and rates for females increased 56 percent. Figure 9 shows age-adjusted TBI-related emergency department visit rates by sex from 2005 to 2009. Please refer to the Data Notes Section of this report for additional information regarding increased emergency department visit rates in 2009.

Figure 9. Age-Adjusted Non-Fatal TBI-Related Emergency Department Visit Rates by Sex, Arizona, 2005-2009



While total age-adjusted TBI-related emergency department visit rates increased from 2005 through 2009, changes in rates varied by manner and mechanism of injury. Unintentional injuries, injuries related to self-harm, and injuries related to assaults increased at varying levels from 2005 through 2009. Figure 10 shows age-adjusted TBI emergency department visit rates by manner of injury, and Figure 11 shows age-adjusted rates for non-fatal TBI-related emergency department visits for selected causes of injury. Though not shown in Figure 10, the rate of emergency department visits related to self-harm increased 28 percent, from 0.78 visits per 100,000 residents in 2005 to 1.0 visits per 100,000 residents in 2009.

Figure 10. Age-Adjusted Non-Fatal TBI-Related Emergency Department Visit Rates per 100,000 Residents by Manner of Injury, Arizona, 2005-2009

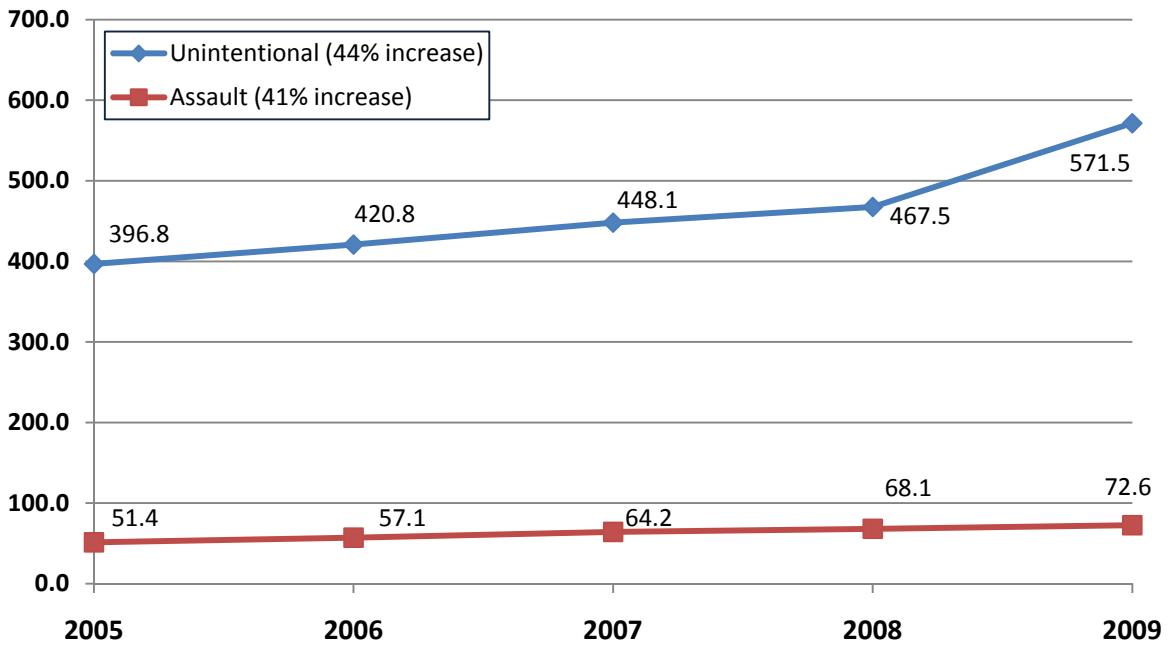
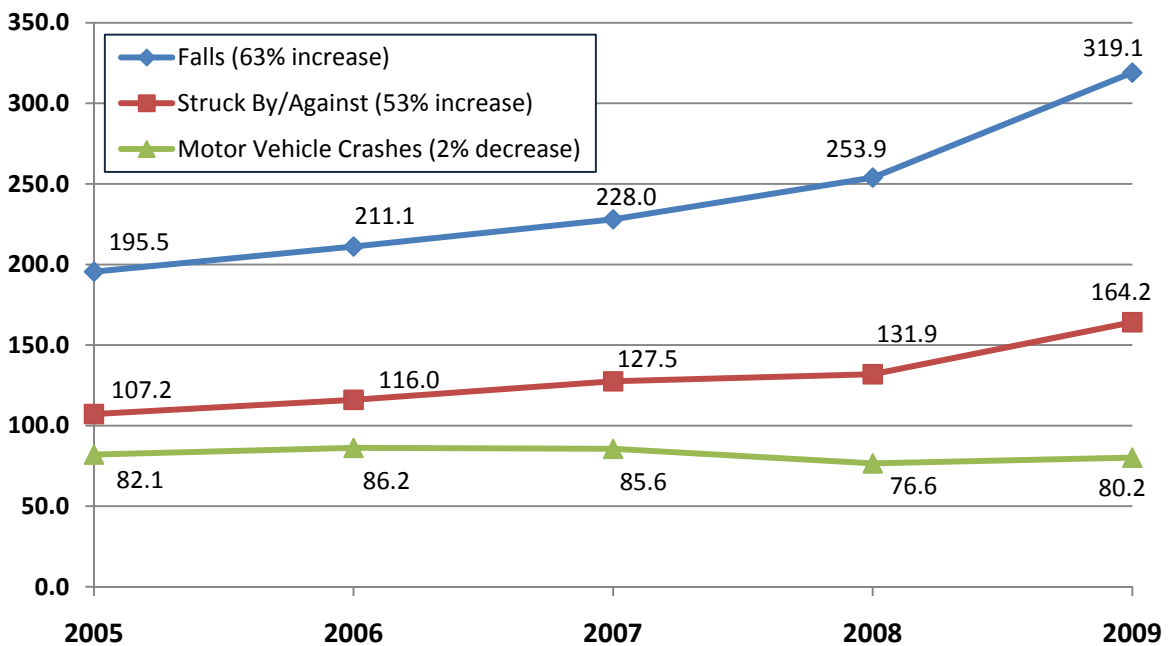


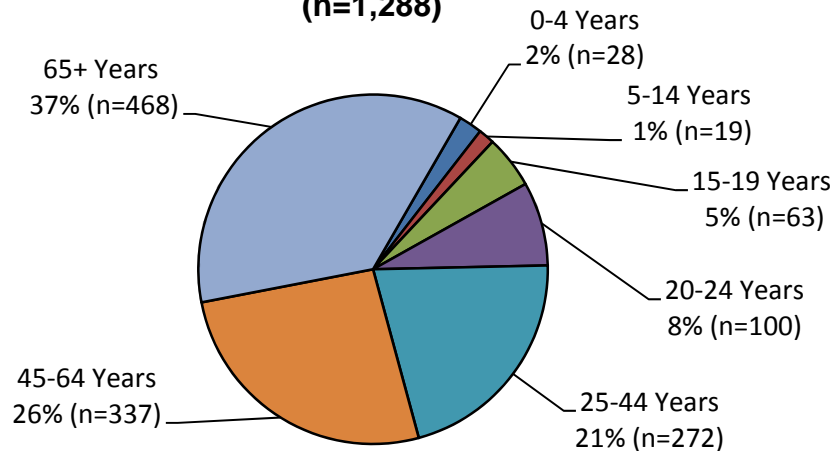
Figure 11. Age-Adjusted Non-Fatal TBI-Related Emergency Department Visit Rates per 100,000 Residents by Selected Cause of Injury, Arizona, 2005-2009



Deaths among Arizona Residents During 2009

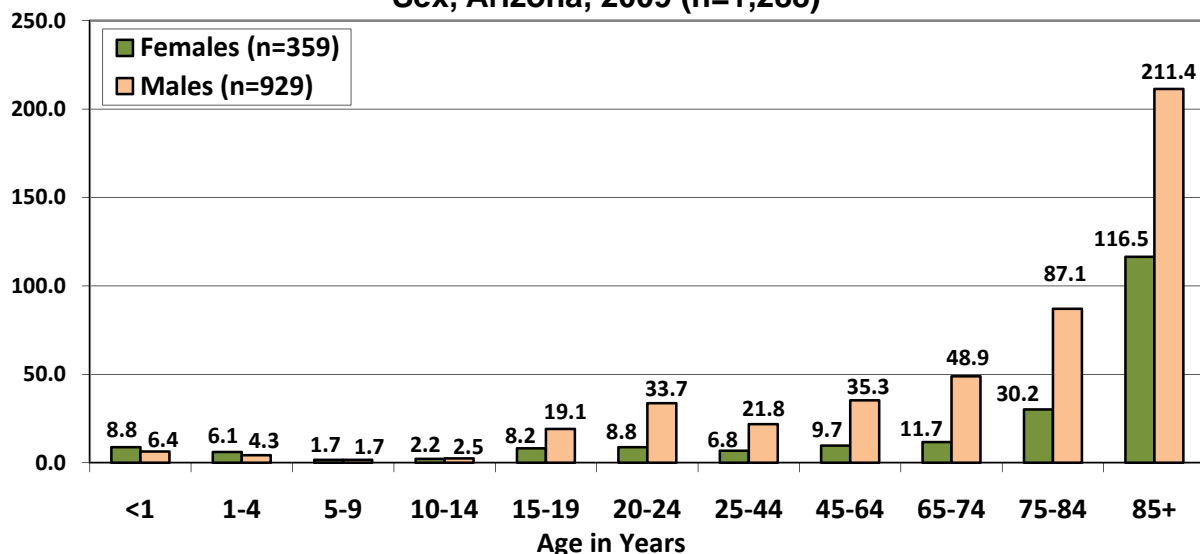
In 2009, 1,288 Arizona residents died as a result of TBI. The majority of deaths were among males (72 percent, n=929), while females accounted for 28 percent of TBI deaths (n=359). The largest percentage of deaths was among individuals ages 65 years and older (37 percent, n=468). Children ages 19 years and younger accounted for eight percent of TBI deaths in 2009 (n=110). Age distributions are shown in Figure 12.

Figure 12. TBI Deaths by Age Group, Arizona, 2009 (n=1,288)



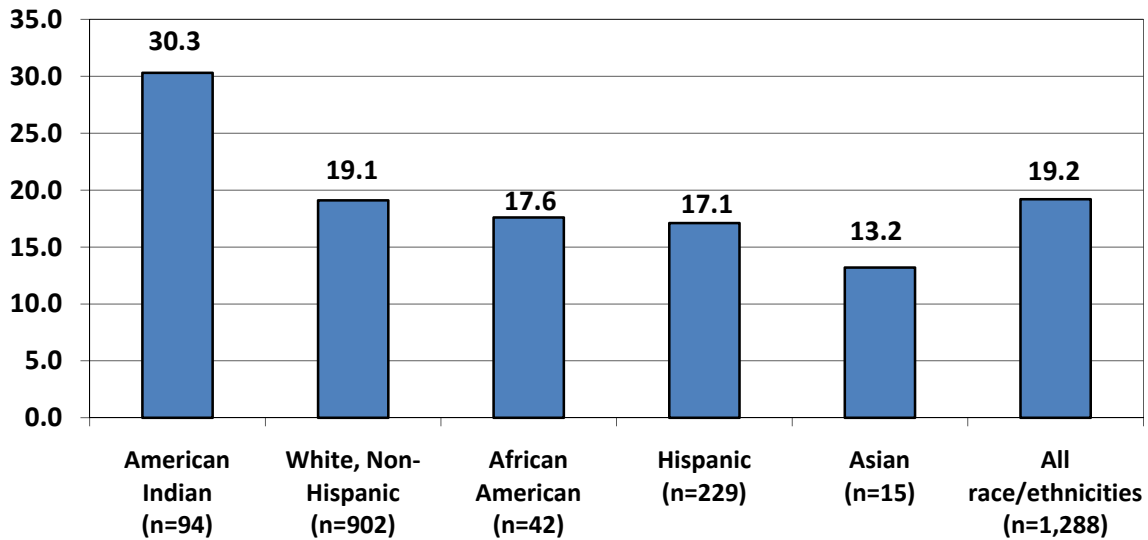
Males 85 years and older accounted for 88 deaths and had the highest rate of TBI deaths in 2009 (211.4 per 100,000 residents). For all adults 85 years and older, 71 percent of TBI deaths were due to unintentional falls (n=120). Figure 13 shows the 2009 TBI death rates by age group and sex for Arizona residents.

Figure 13. TBI Mortality Rates per 100,000 by Age Group and Sex, Arizona, 2009 (n=1,288)



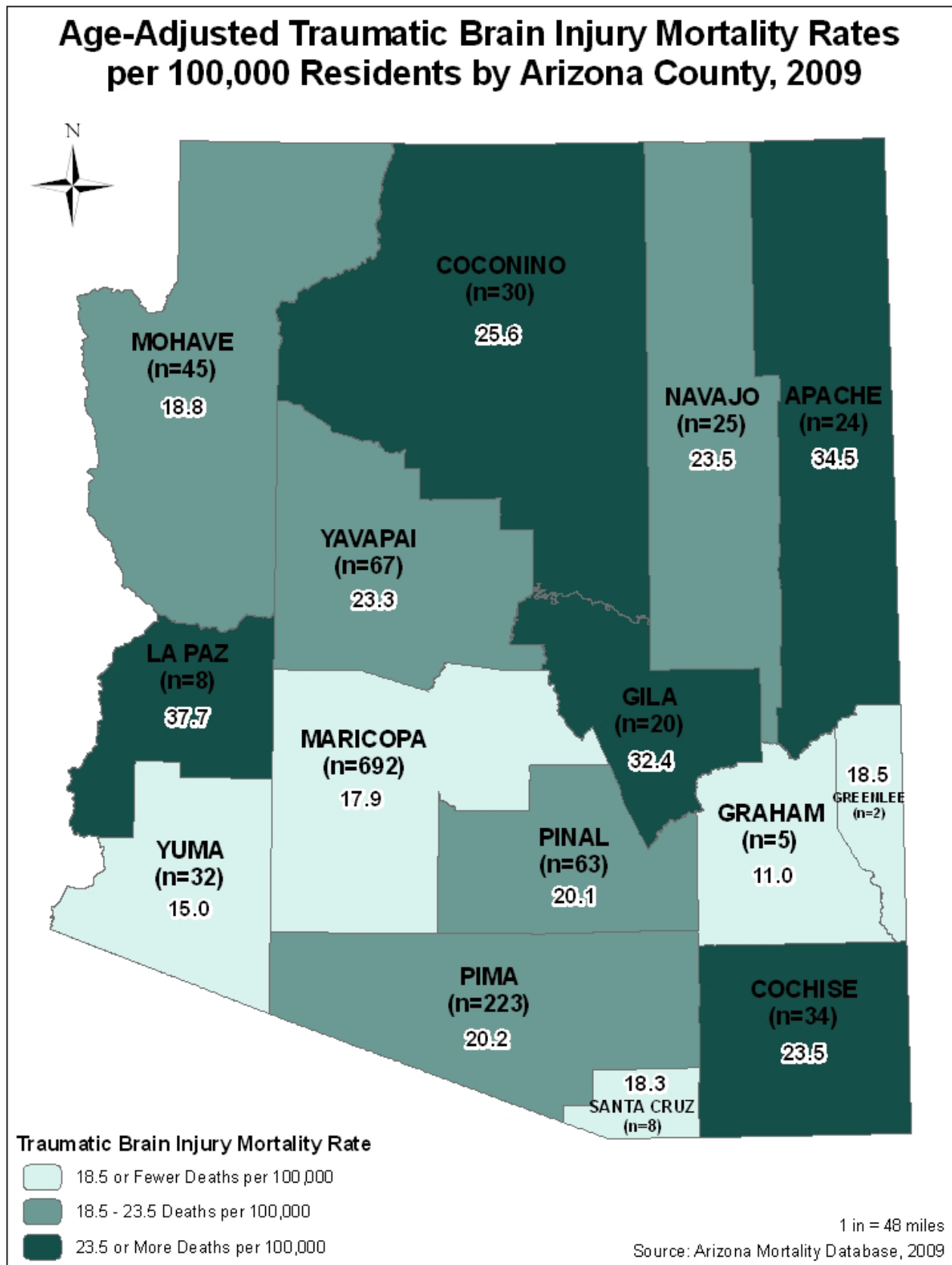
Age-adjusted TBI death rates were highest among American Indians (30.3 deaths per 100,000 residents) and Non-Hispanic Whites (19.1 deaths per 100,000 residents). Figure 14 shows the 2009 age-adjusted TBI death rates by race/ethnicity in Arizona.

Figure 14. Age-Adjusted TBI Mortality Rates per 100,000 by Race/Ethnicity, Arizona, 2009 (n=1,288)



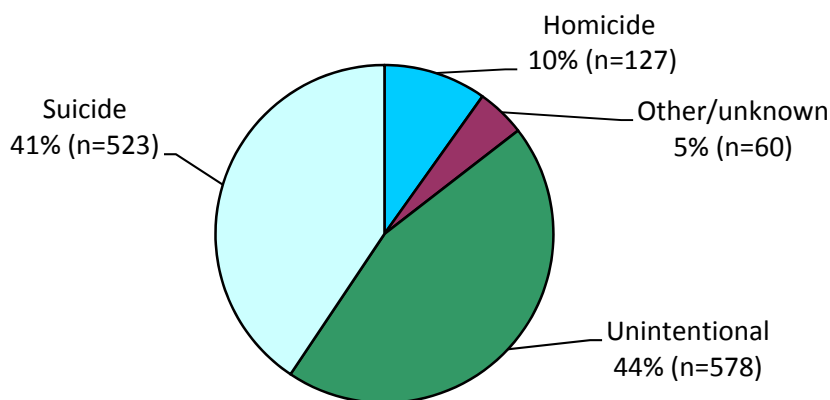
Age-adjusted TBI mortality rates were highest among residents of rural counties, with the highest rates in La Paz, Apache, and Gila Counties. Figure 15 shows age-adjusted mortality rates by county of residence. Rates may be unstable for counties with fewer than 20 TBI-related deaths.

Figure 15.



Forty-four percent of the TBI deaths in 2009 were due to unintentional injuries (n=578); 41 percent were due to suicides (n=523); and 10 percent were due to homicides (n=127). Figure 16 shows TBI deaths by manner of injury during 2009 in Arizona.

Figure 16. TBI Deaths by Manner of Injury, Arizona, 2009 (n=1,288)



The most common causes of deaths were firearms (47 percent, n=610), falls (24 percent, n=310), and motor vehicle traffic crashes (16 percent, n=206). Causes of TBI deaths during 2009 in Arizona are shown in Table 1. Descriptions of these causes are given in Appendix A.

Cause	Number	Percentage
Firearm	610	47%
Fall	310	24%
Motor vehicle traffic	206	16%
Other/unspecified	113	9%
Other land transport	19	1%
Unknown cause	30	2%
Total	1,288	100%

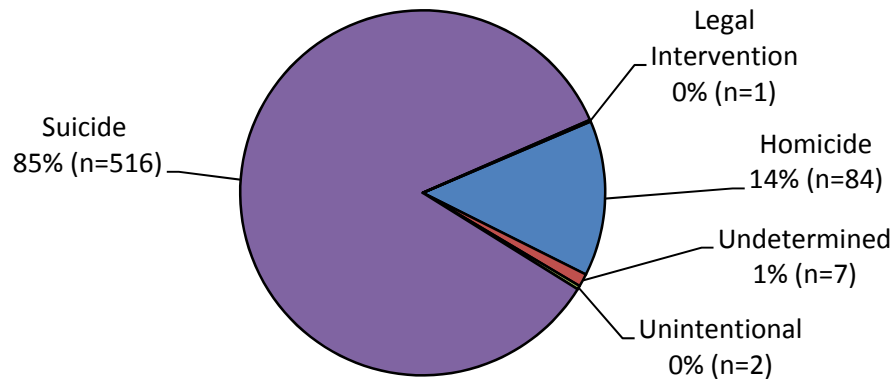
Firearm-Related TBI Mortality

Among the 610 Arizona residents who died as a result of firearm-related TBI, the majority were male (81 percent, n=496) and 19 percent were female (n=114). Six percent of TBI deaths due to firearms were among children 19 years and younger (n=34). Ten percent of the deaths were among individuals ages 20 through 24 years (n=62); 60 percent were among individuals ages 25 through 64 years (n=364); and 25 percent were among individuals 65 years and older (n=150).

The highest age-adjusted rate of firearm-related TBI deaths was among White Non-Hispanics (n=465). This population had a rate of 10.4 deaths per 100,000 residents. The second highest rate was among African Americans, who accounted for 22 deaths, or 8.0 deaths per 100,000 residents.

The majority of firearm-related TBI deaths were suicides (85 percent, n=516). Fourteen percent of the deaths were due to homicides (n=84); one percent were of undetermined intent (n=7); and less than one percent were due to unintentional injuries (n=2). There was one firearm-related TBI resulting from legal intervention. Figure 17 shows TBI deaths due to firearms by manner of injury.

Figure 17. TBI Deaths due to Firearms by Manner of Injury, Arizona, 2009 (n=610)



Fall-Related TBI Mortality

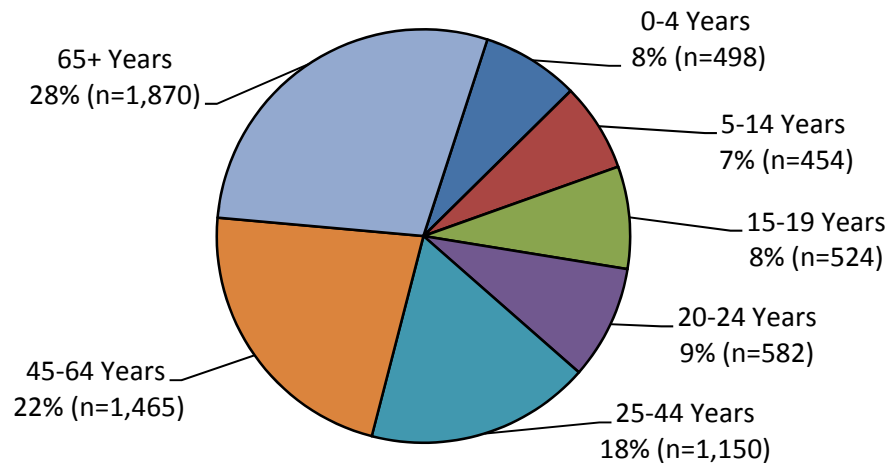
Of the 310 TBI deaths due to falls, 53 percent were among males (n=165) and 47 percent were among females (n=145). All but four of the falls were unintentional. Two percent of TBI deaths due to falls were among children and young adults ages 24 years and younger (n=6). Eighteen percent of the deaths were among adults ages 25 through 64 years (n=56); and 80 percent were among adults 65 years and older (n=248).

The highest age-adjusted rate of fall-related TBI deaths was among Asians, who accounted for six deaths, or 6.8 deaths per 100,000 residents. The second highest rate was among American Indians (6.2 deaths per 100,000 residents, n=13). The age-adjusted mortality rate for fall-related TBI deaths among all races/ethnicities was 4.4 deaths per 100,000 residents.

Non-Fatal Inpatient Hospitalizations among Arizona Residents During 2009

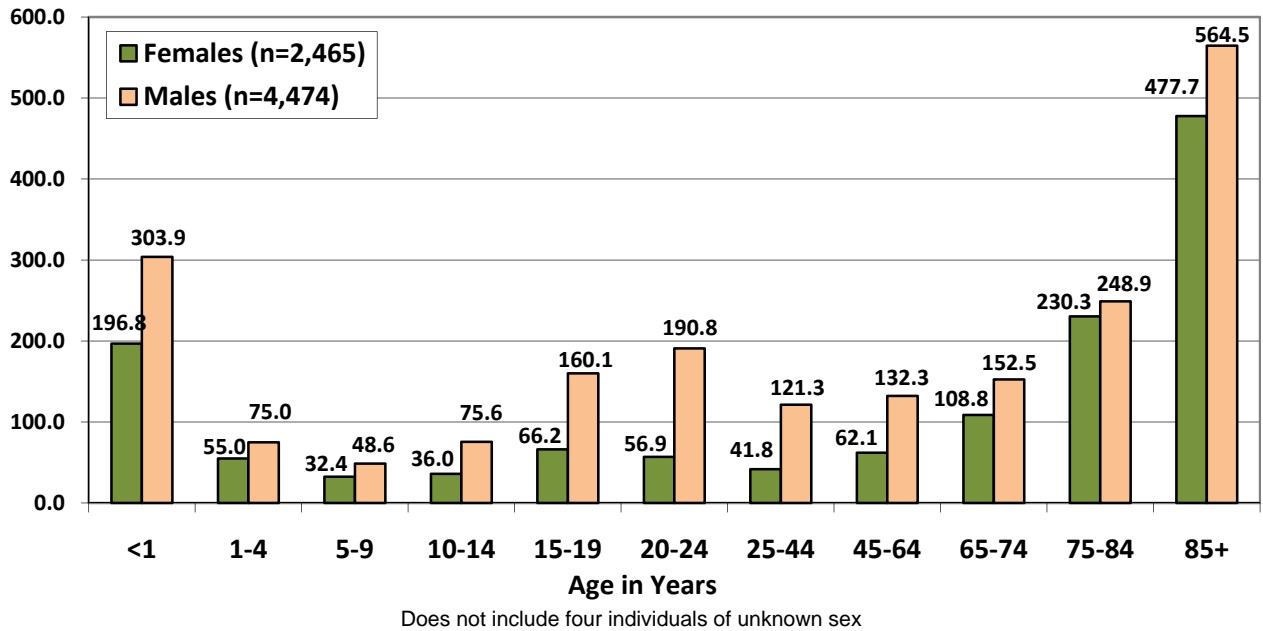
In 2009, 6,943 Arizona residents were hospitalized due to non-fatal TBIs. Males comprised 64 percent of total TBI hospitalizations (n=4,474) and females accounted for 36 percent (n=2,465). Four hospitalizations were among individuals of unknown sex. Twenty-three percent of TBI inpatient hospitalizations were among children ages 19 years and younger (n=1,476). The age distribution is shown in Figure 18.

Figure 18. TBI Inpatient Hospitalizations by Age Group, Arizona, 2009 (n=6,943)



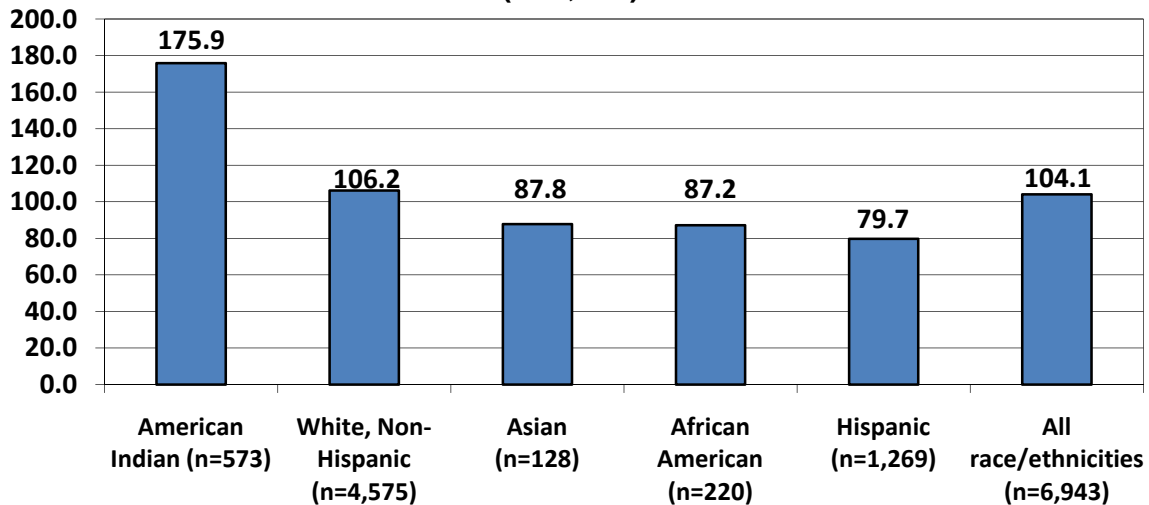
Adults 85 years and older had the highest rates of TBI inpatient hospitalizations in 2008. Males 85 years and older had a rate of 564.5 hospitalizations per 100,000 residents (n=235), and the rate for females 85 years and older was 477.7 hospitalizations per 100,000 residents (n=332). For adults 85 years and older, 90 percent of hospitalizations were due to unintentional falls (n=508). Figure 19 shows the 2009 TBI inpatient hospitalization rates by age group and sex for Arizona residents.

Figure 19. TBI Inpatient Hospitalization Rates per 100,000 by Age Group and Sex, Arizona, 2009 (n=6,943)



Age-adjusted TBI inpatient hospitalization rates were highest among American Indians (175.9 hospitalizations per 100,000 residents) and Non-Hispanic Whites (106.2 hospitalizations per 100,000 residents). Figure 20 shows the 2009 age-adjusted TBI inpatient hospitalization rates by race/ethnicity in Arizona.

Figure 20. Age-Adjusted TBI Inpatient Hospitalizations Rates per 100,000 by Race/Ethnicity, Arizona, 2009 (n=6,943)

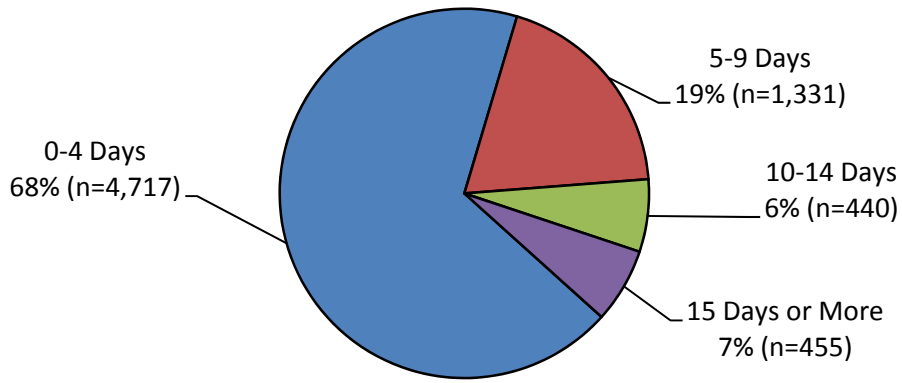


178 hospitalizations were among individuals of other or unknown race/ethnicity

For TBI inpatient hospitalizations, the average length of stay was five days, with the majority of stays less than five days (68 percent, n=4,717). Length of stay in hospitals

due to TBI ranged from less than one full day to 111 days. Figure 21 shows TBI inpatient hospitalizations by length of stay.

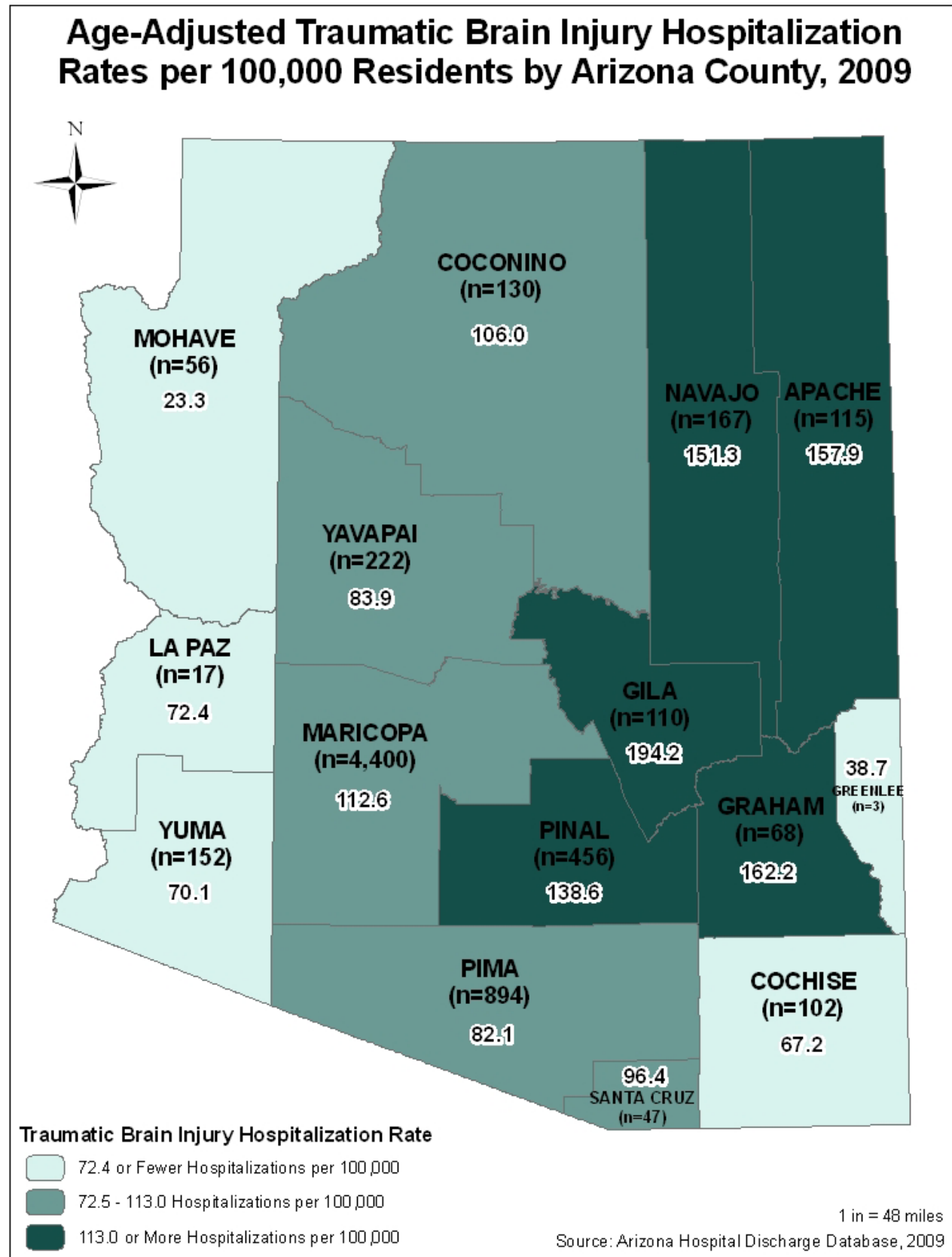
Figure 21. TBI Inpatient Hospitalizations by Length of Stay, Arizona, 2009 (n=6,943)



TBI inpatient hospitalization charges in 2009 totaled more than \$433 million, with 51 percent paid by the Arizona Health Care Cost Containment System (AHCCCS)/Medicaid and Medicare (n=3,537). This total does not include costs related to physician care, rehabilitation, lost wages, or long-term costs of disability.

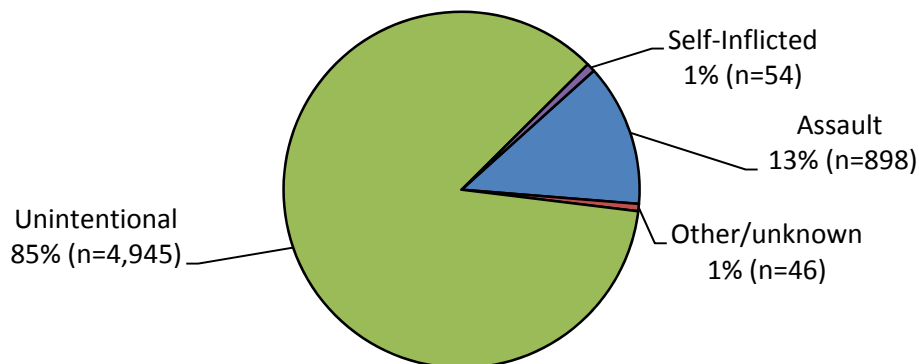
Age-adjusted TBI hospitalization rates were highest among residents of rural counties, with the highest rates in La Paz, Apache, and Gila Counties. While Mohave County had an extremely low rate of hospitalizations for non-fatal TBIs, this may be due to the fact that severely injured patients are transported for treatment at trauma centers in Nevada. Because these patients are not treated at Arizona facilities, data on these patients is not available. Figure 22 shows age-adjusted hospitalization rates by county of residence. Rates may be unstable for counties with fewer than 20 TBI-related hospitalizations.

Figure 22.



Unintentional injuries accounted for 85 percent of TBI hospitalizations (n=4,945). There were 54 self-inflicted TBI hospitalizations (one percent) and 898 assaults (13 percent). Figure 23 shows the TBI inpatient hospitalizations by manner of injury for Arizona in 2009.

Figure 23. TBI Inpatient Hospitalizations by Manner of Injury, Arizona, 2009 (n=6,943)



Fall-related injuries were the most common cause of TBI hospitalizations (42 percent, n=2,896), followed by motor vehicle traffic injuries (30 percent, n=2,053). Table 2 shows causes of TBI inpatient hospitalizations in Arizona during 2009. Descriptions of these causes are given in Appendix A.

Cause	Number	Percentage
Fall	2,896	42%
Motor vehicle traffic	2,053	30%
Struck by/against	829	12%
Other/unspecified	474	7%
Transport	416	6%
Other pedal cycle	167	2%
Firearm	65	1%
Cut/pierce	43	1%
Total	6,943	100%

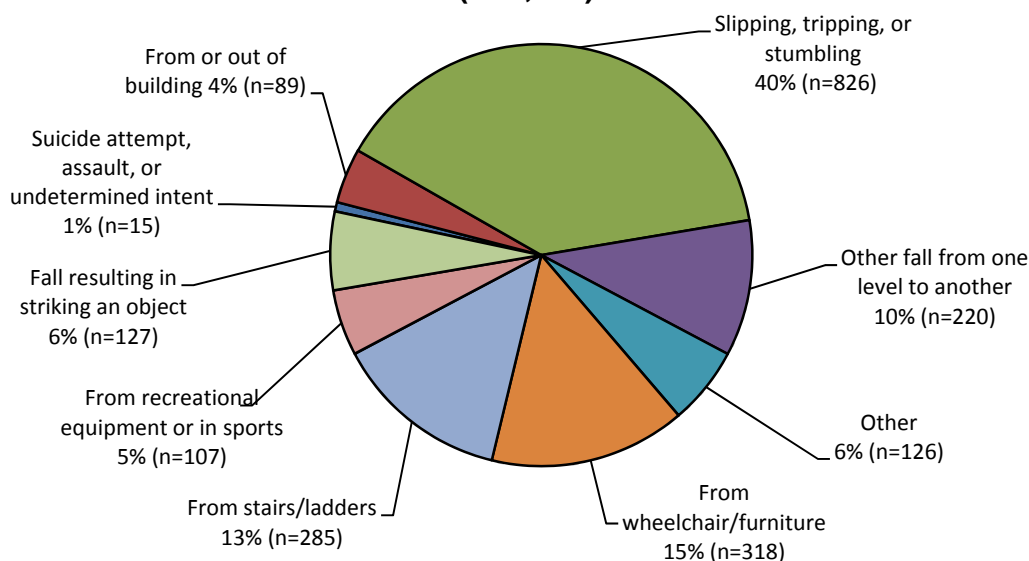
Non-Fatal Fall-Related TBI Inpatient Hospitalizations

There were 2,896 inpatient hospitalizations due to fall-related TBI. Fifty-four percent were among males (n=1,557) and 46 percent were among females (n=1,337). There were two cases among individuals of unknown sex. Nineteen percent of the hospitalizations were among children 19 years and younger (n=536), and 52 percent of the hospitalizations were among adults 65 years and older (n=1,514). Almost all of these falls were unintentional (n=2,881), but 15 were self-inflicted or from assaults or undetermined intents.

American Indians had the highest age-adjusted rate of fall-related TBI hospitalizations with 52.3 hospitalizations per 100,000 residents (n=137). The second highest rate was among Non-Hispanic Whites (44.8 hospitalizations per 100,000 residents; n=2,168). The age-adjusted rate for non-fatal fall-related inpatient hospitalizations among all Arizonans was 42.4 hospitalizations per 100,000 residents.

In more than one quarter of fall-related hospitalizations, the hospital discharge database did not contain any specific information about the events contributing to these falls (27 percent, n=783). The most frequently specified contributing events were slipping, tripping, or stumbling (40 percent of specified events, n=826) and falls from wheelchairs, beds, or other furniture (15 percent of specified events, n=318). Figure 24 shows TBI inpatient hospitalizations due to falls by specified contributing event.

Figure 24. TBI Inpatient Hospitalizations due to Falls by Specified Contributing Event (All Manners), Arizona, 2009 (n=2,113)



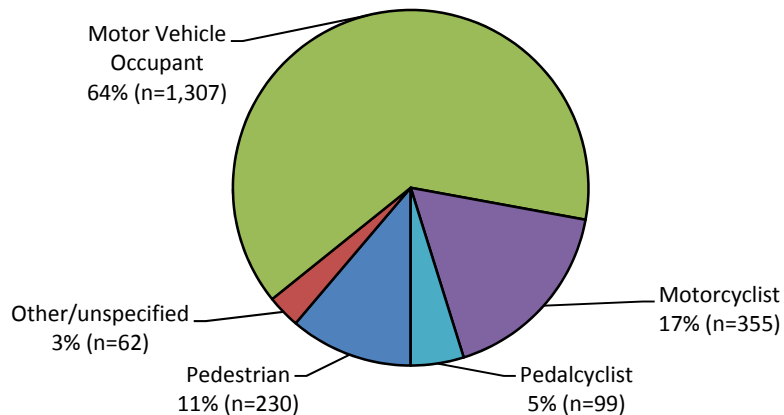
Non-Fatal Motor Vehicle Traffic Crash-Related TBI Inpatient Hospitalizations

Of the 2,053 TBI hospitalizations due to motor vehicle traffic crashes, 65 percent were among males (n=1,332) and 35 percent were among females (n=719). There were two non-fatal motor vehicle traffic-related inpatient hospitalizations among individuals of unknown sex. Almost all of the crashes were unintentional (n=2,045). Twenty-one percent of TBI hospitalizations due to motor vehicle traffic crashes were among children 19 years and younger (n=424); 14 percent were among individuals ages 20 through 24 years (n=280); 56 percent were among individuals 25 through 64 years (n=1,147); and 10 percent were among adults 65 years and older (n=202).

American Indians had the highest rate of TBI hospitalizations for motor vehicle traffic crashes (49.4 hospitalizations per 100,000 residents; n=173). With 31.3 hospitalizations per 100,000 residents, Non-Hispanic Whites had the second highest rate (n=1,252). The age-adjusted rate for non-fatal motor vehicle traffic-related inpatient hospitalizations among all Arizonans was 31.2 hospitalizations per 100,000 residents.

The majority of TBI inpatient hospitalizations due to motor vehicle traffic collisions were among occupants of motor vehicles (64 percent, n=1,258). Nineteen percent were motorcyclists (n=362); 11 percent were pedestrians (n=209); and four percent were pedal cyclists (n=82). Two percent were other/unspecified (n=45). Figure 25 shows TBI inpatient hospitalizations due to motor vehicle traffic crashes by injured person.

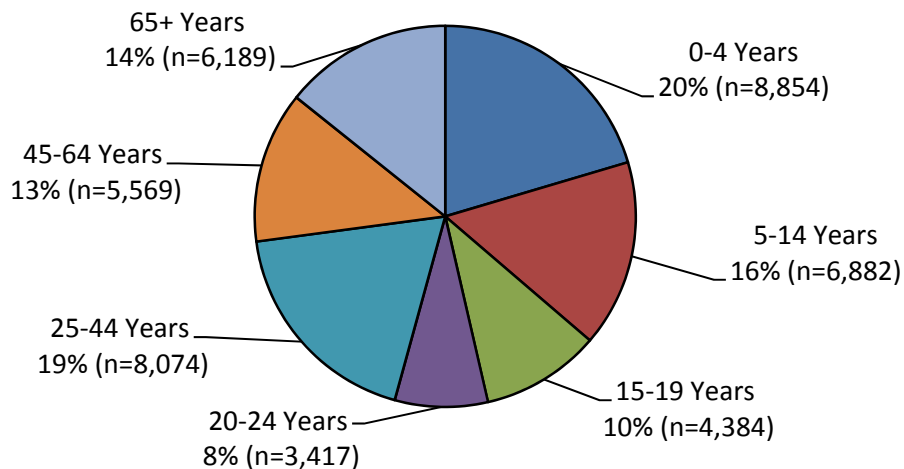
Figure 25. TBI Inpatient Hospitalizations due to Motor Vehicle Traffic Crashes by Injured Person (All Manners), Arizona, 2009 (n=2,053)



Non-Fatal Emergency Department Visits among Arizona Residents During 2009

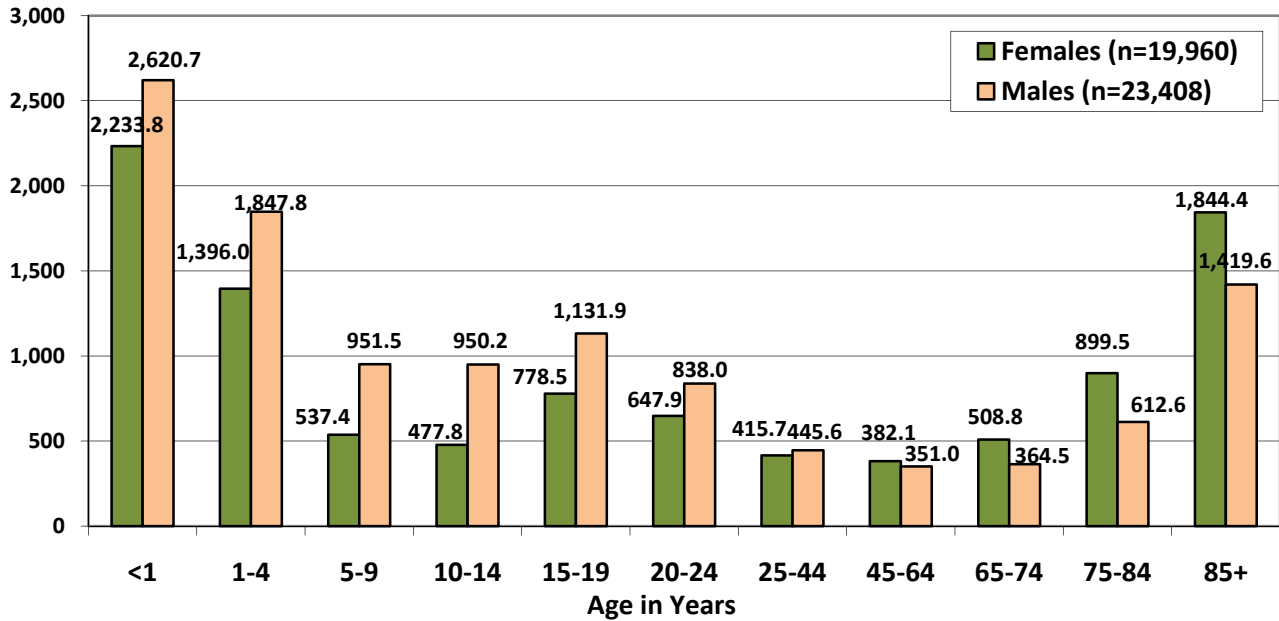
In 2009, there were 43,369 TBI emergency department visits among Arizona residents. Males accounted for more than half of TBI emergency department visits (54 percent, n=23,408), while females accounted for 46 percent of visits (n=19,960). There was one case among an individual of unknown sex. Forty-six percent of TBI emergency department visits were among children ages 19 years and younger (n=20,120). Emergency department visits by age group are shown in Figure 26.

Figure 26. TBI Emergency Department Visits by Age Group, Arizona, 2009 (n=43,369)



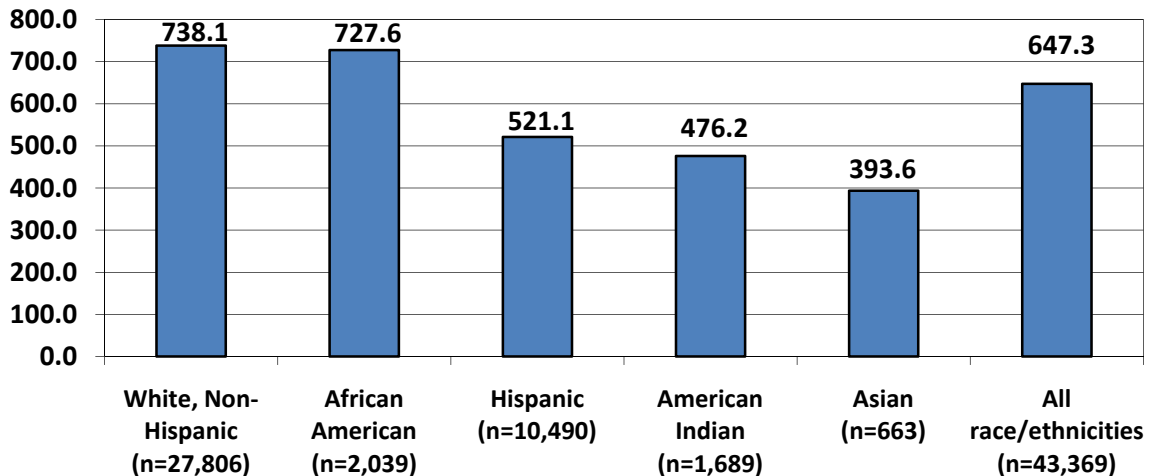
TBI emergency department visit rates were highest among children younger than one year of age. There were 1,010 emergency department visits among females younger than one year of age (a rate of 2,233.8 visits per 100,000 residents), and 1,233 visits among males younger than one year of age (a rate of 2,620.7 visits per 100,000 residents). For all children younger than one year of age, 86 percent of TBI emergency department visits were due to unintentional falls (n=1,927). Figure 27 shows the 2009 TBI emergency department visit rates per 100,000 Arizona residents.

Figure 27. TBI Emergency Department Visit Rates per 100,000 by Age Group and Sex, Arizona, 2009 (n=43,369)



Age-adjusted TBI emergency department visit rates were highest among Non-Hispanic Whites (738.1 visits per 100,000 residents) and African Americans (727.6 visits per 100,000 residents). Figure 28 shows the 2009 age-adjusted TBI emergency department visit rates by race/ethnicity in Arizona.

Figure 28. Age-Adjusted TBI Emergency Department Visit Rates per 100,000 by Race/Ethnicity, Arizona, 2009 (n=43,369)



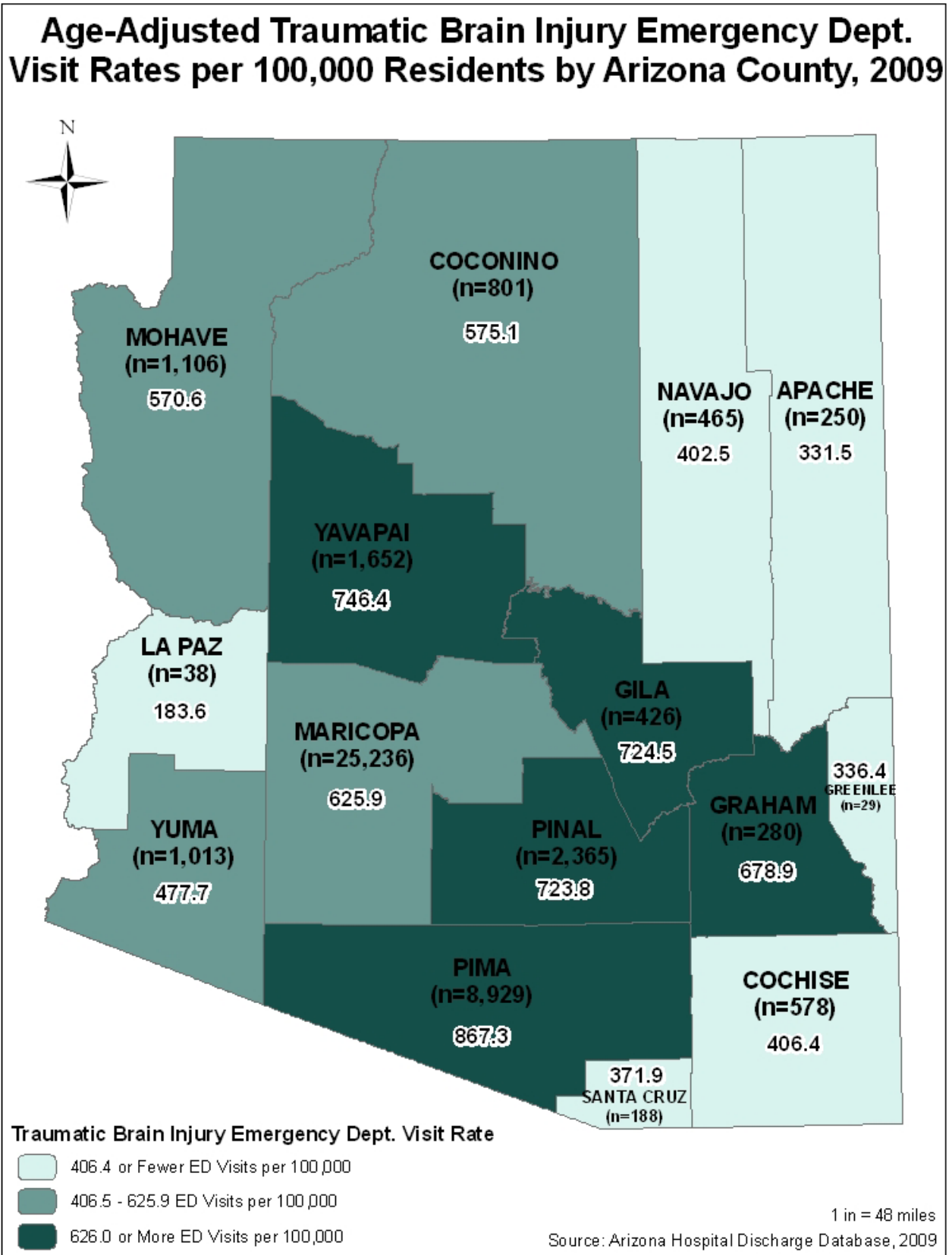
682 emergency department visits were among individuals of other or unknown race/ethnicity

TBI emergency department charges in 2009 totaled more than \$178 million, with 42 percent paid by the Arizona Health Care Cost Containment System

(AHCCCS)/Medicaid and Medicare. This total does not include costs related to physician care, rehabilitation, lost wages, or long-term costs of disability.

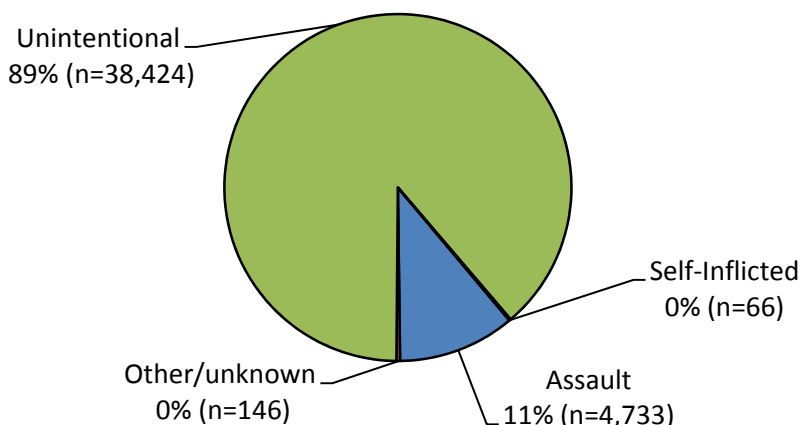
Unlike with mortality and hospitalization rate, age-adjusted TBI emergency department visit rates were highest among residents of Pima County, with the next highest rates in the central counties: Yavapai, Pinal, and Gila Counties. Apache and Navajo Counties have lower rates of TBI-related non-fatal emergency department rates than expected, but this is likely an artifact of the data rather than a truly low rate in these counties. A large area of the Navajo Nation is situated within the borders of Apache and Navajo Counties, and tribal residents tend to seek medical care for less severe injuries at local health facilities operated by the tribe or Indian Health Services (IHS). Since the Arizona Hospital Discharge Database only collects data from private, non-federal facilities, injuries seen exclusively at tribal or IHS facilities are not included in the data shown here, accounting for a potential undercount among tribal residents. Figure 29 shows age-adjusted emergency department visit rates by county of residence.

Figure 29.



The majority of TBI emergency department visits were due to unintentional injuries (89 percent, n=38,424), and 11 percent were assaults (n=4,733). Figure 30 shows TBI emergency department visits by intent during 2009 in Arizona.

Figure 30. TBI Emergency Department Visits by Manner of Injury, Arizona, 2009 (n=43,369)



The leading causes of TBI emergency department visits were falls (50 percent, n=21,755), struck by/against injuries (25 percent, n=10,849), and motor vehicle traffic-related injuries (12 percent, n=5,273). Table 3 shows TBI emergency department visits by cause for Arizona in 2009. Descriptions of these causes are given in Appendix A.

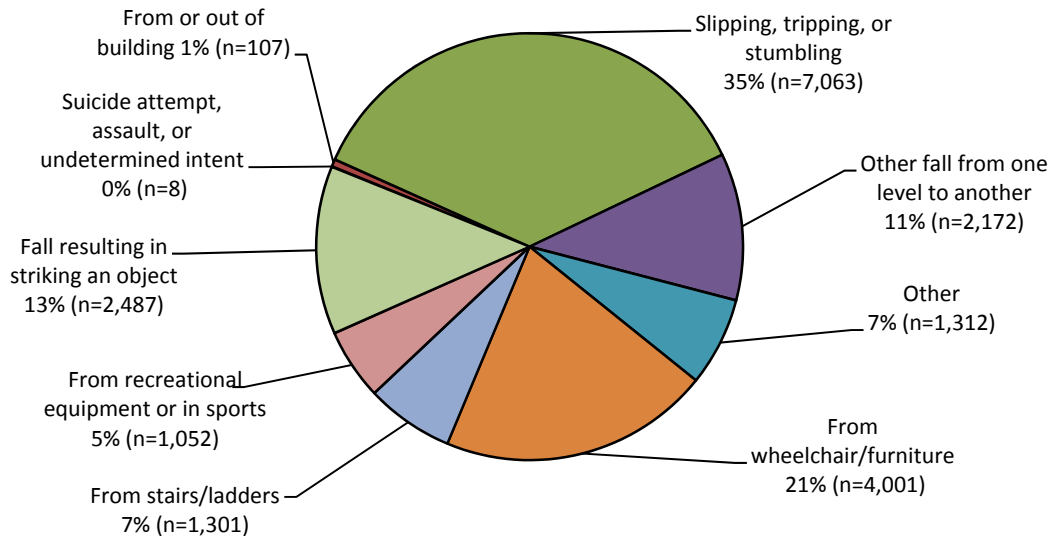
Cause	Number	Percentage
Fall	21,755	50%
Struck by/against	10,849	25%
Motor vehicle traffic	5,273	12%
Other/unspecified	2,850	7%
Transport	1,330	3%
Other pedal cycle	1,126	3%
Cut/pierce	216	< 1%
Total	43,369	100%

Non-Fatal Fall-Related Emergency Department Visits

There were 21,755 emergency department visits due to fall-related TBI. Forty-eight percent were among males (n=10,471) and 52 percent were among females (n=11,284). Nearly all of these falls were unintentional (n=21,747). Fifty percent of TBI emergency department visits due to falls were among individuals 19 years and younger (n=10,948).

Ten percent of the falls did not have contributing event information specified in the hospital discharge database (n=2,252). The most frequently specified contributing events to fall-related TBI were slipping, tripping, or stumbling (35 percent of specified events, n=7,063) and falls from furniture or wheelchairs (21 percent of specified events, n=4,001). Figure 31 shows TBI emergency department visits due to falls by specified contributing event.

Figure 31. TBI Emergency Department Visits due to Falls by Specified Contributing Event (All Manners), Arizona, 2009 (n=19,503)

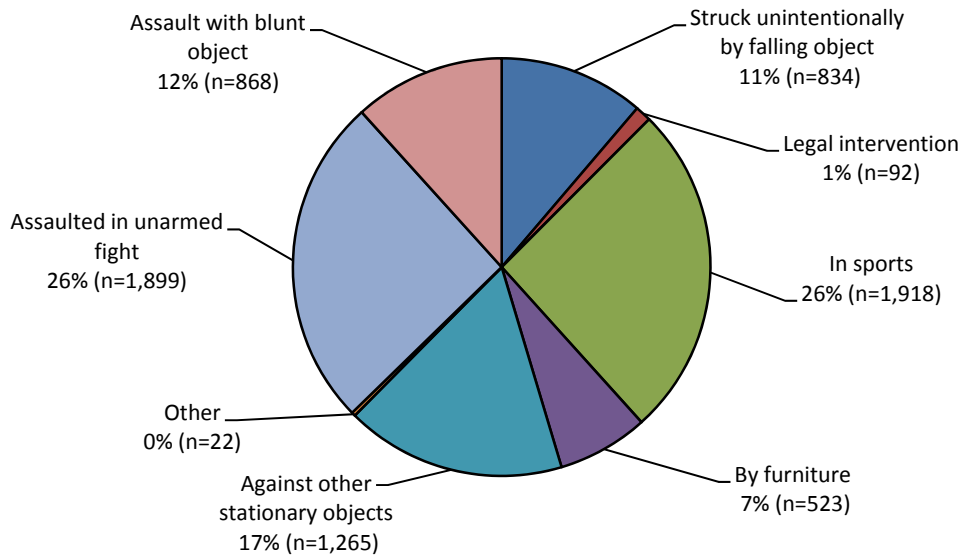


Non-Fatal Struck By/Against-Related TBI Emergency Department Visits

Struck by/against injuries include being struck by an object (such as falling furniture), striking against an object (such as the edge of a bathtub), or being struck by other people (such as when playing sports). Of the 10,849 TBI emergency department visits due to struck by/against injuries, 63 percent were among males (n=6,834) and 37 percent were among females (n=4,014). There was one case among an individual of unknown sex. Seventy-four percent of these injuries were unintentional (n=7,990), and 26 percent were assaults (n=2,767). Fifty-two percent of TBI emergency department visits from struck by/against injuries were among individuals 19 years and younger (n=5,689).

The emergency department discharge database did not include information regarding contributing event for 32 percent of the struck by/against injuries (n=3,428). The most frequently specified contributing events were unintentional blows while playing sports (26 percent of specified events, n=1,918) and assaults in unarmed fights (26 percent of specified events, n=1,899). Figure 32 shows TBI emergency department visits due to struck by/against injuries by specified contributing event.

Figure 32. TBI Emergency Department Visits due to Struck By/Against Injuries by Specified Contributing Event (All Manners), Arizona, 2009 (n=7,421)



Data Notes

All rates were calculated using the 2009 Arizona resident population estimates published by the Arizona Department of Health Services in *Arizona Health Status and Vital Statistics 2009*. Age-adjusted rates were standardized to the 2000 U.S. standard population using the direct standardization method. Age-adjusted rates have been presented when possible, as age-adjusting controls for the effects of age differences in populations (e.g., a large proportion of older adults or young children) and allows for more accurate rate comparisons.

Mortality data were tabulated from death certificates for Arizona residents who died in 2009. Inpatient hospitalization data were compiled from the 2009 Arizona Hospital Discharge Database. Emergency department visit data were compiled from the 2009 Arizona Emergency Department Discharge Database.

The discharge databases contain information from private, acute-care facilities in the state of Arizona, and do not include visits to federal facilities, such as Veterans' Affairs Hospitals or Indian Health Services facilities. The discharge databases do not contain data from urgent care facilities, private physician practices, or medical clinics. Additionally, discharge data include hospital transfers and readmissions. Therefore, a single injured individual may be counted more than once. These data should be interpreted as episodes of medical treatment, not individual injuries.

Hospital discharge data collected since January 1, 2008 are maintained in a different data layout from earlier hospital discharge data, and comparisons between data from each time period should be treated with caution. Enhanced understanding of the new data layout may have contributed to more thorough reporting of ICD-9-CM E-Codes in 2009 and a subsequent increase in the rate of inpatient hospitalizations and emergency department visits for traumatic brain injuries.

Codes from the International Classification of Diseases, Version 9, clinical modification (ICD-9-CM) were used for determining TBI cases among hospital and emergency department data. ICD-10 codes were used for mortality data. The specific codes used are described in *Traumatic Brain Injury in the United States: Emergency Department Visits, Hospitalizations and Deaths*, published in 2006 by the U.S. Centers for Disease Control and Prevention (CDC). Traumatic brain injury-related inpatient hospitalizations and emergency department visits resulting from medical misadventures have been excluded from this report.

Appendix A. Definitions of Mechanisms of Injury	
Cause	Definition
Fall	Includes falls from furniture, stairs, playground equipment, and those that occur while playing sports.
Firearm	Includes injuries from handguns, shotguns, BB guns, etc.
Unknown cause	Cause not listed.
Motor vehicle traffic	Includes collisions that occur on public highways and streets. These collisions may include pedestrians, pedal cyclists, motorcyclists, and occupants of motor vehicles.
Other land transport	Includes collisions involving railway transport or all-terrain vehicles operating off-road. This cause only applies to deaths and is not used in hospitalization or emergency department databases.
Other pedal cycle	Includes injured pedal cyclists struck by pedestrians, pedal cycles, or non-motorized vehicles.
Other/unspecified	Unspecified events or other rare events.
Struck by/against	Includes being struck by furniture, struck by other people while playing sports, or hit by objects while playing sports.
Transport	Other non-motorized, off-road vehicle, or rail transport. This cause only applies to hospitalization and emergency department databases and is not used on death certificates.