

Traumatic Brain Injuries Among Arizona Residents, 2010

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Executive Summary

Traumatic brain injuries (TBI) were the cause of death for 1,314 Arizona residents in 2010. Males ages 85 years and older had the highest rate of TBI deaths with 206.7 deaths per 100,000 residents. TBI death rates were highest among American Indians (31.2 per 100,000 residents) and Non-Hispanic Whites (21.6 per 100,000 residents). Forty-two percent of TBI deaths in 2009 were due to unintentional injuries (n=559); 41 percent were due to suicides (n=541); and 11 percent were due to homicides (n=140). The most common causes of TBI deaths of any intent were firearms (51 percent, n=667), falls (22 percent, n=295), and motor vehicle traffic crashes (16 percent, n=206).

In 2010, there were 6,940 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 641.3 hospitalizations per 100,000 residents. The rate for females 85 years and older was 590.9 hospitalizations per 100,000 residents. Age-adjusted TBI inpatient hospitalization rates were highest among American Indians (228.0 per 100,000 residents) and Non-Hispanic Whites (116.7 per 100,000 residents). Unintentional injuries accounted for 87 percent of TBI hospitalizations (n=6,008) and assaults comprised an additional 12 percent (n=844). Falls were the most common cause of TBI hospitalizations (43 percent, n=2,982), followed by motor vehicle traffic crashes (30 percent, n=2,049). Total hospital charges for non-fatal inpatient hospitalizations due to TBIs were more than \$451.6 million.

In 2010, there were 44,507 non-fatal TBI emergency department visits among Arizona residents. Almost half of TBI emergency department visits were among children ages 19 years and younger (45 percent, n=20,002), 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 2,254.0 visits per 100,000 residents, and males younger than one year of age had a rate of 1,722.4 visits per 100,000 residents. The majority of TBI emergency department visits were due to unintentional injuries (89 percent, n=39,574), and 11 percent were due to assaults (n=4,725). The leading causes of TBI emergency department visits were falls (51 percent, n=22,675), struck by/against injuries (24 percent, n=10,838), and motor vehicle traffic crashes (12 percent, n=5,518). Total hospital charges for non-fatal emergency department visits due to TBIs were more than \$205.1 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 towards 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, Arizona, 2010

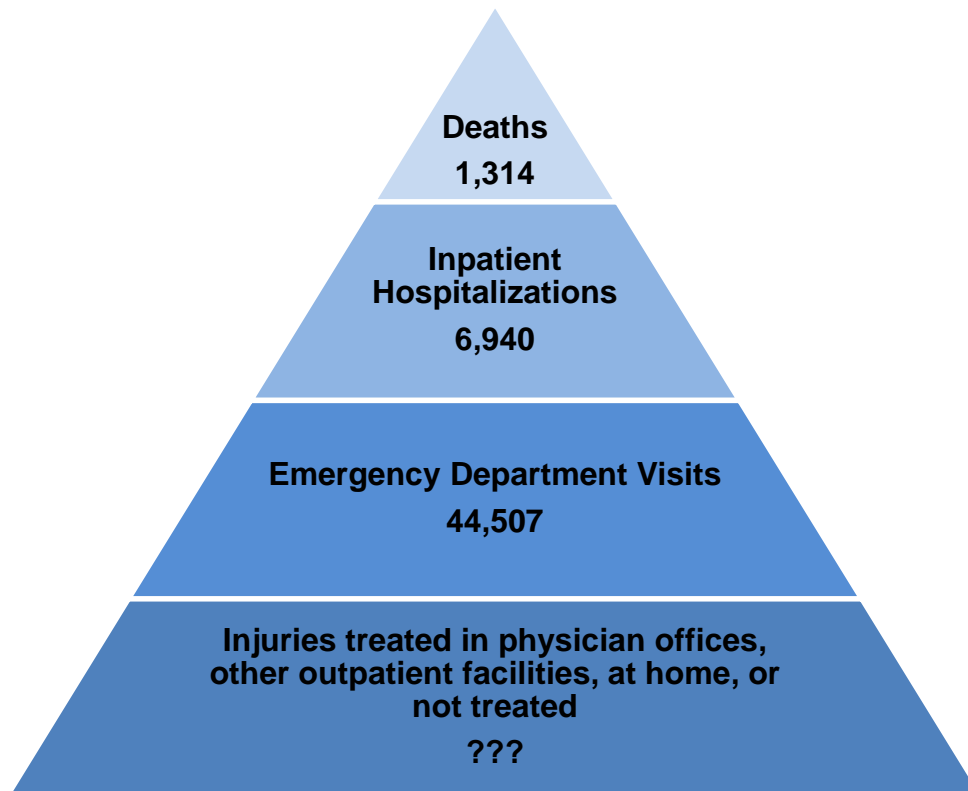


Figure 1 shows a TBI pyramid for Arizona in 2010. This pyramid shows that deaths represent the smallest proportion of injuries. The proportions increase towards the foundation of the pyramid, which is comprised of hospital discharges, emergency department visits, and self-care. Although TBIs that do not require medical treatment may be the most numerous, no existing datasets capture these types of injuries.

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

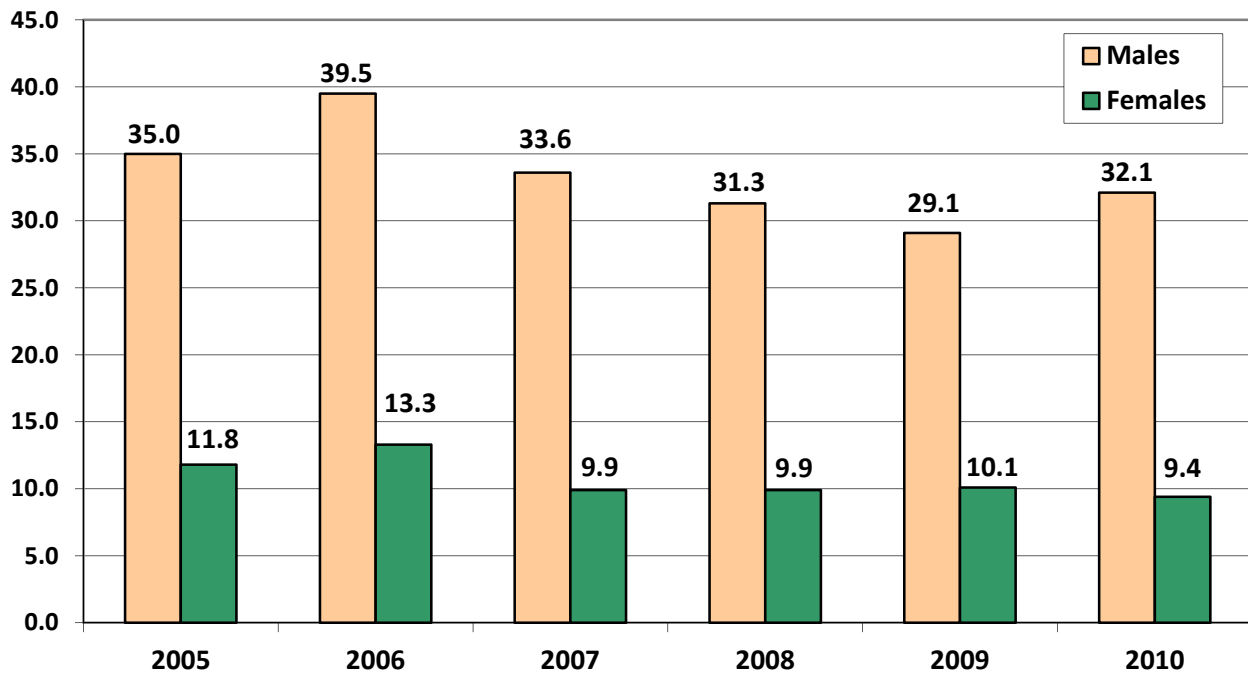
³ Thurman D, Alverson C, Dunn K, Guerrero J, Snizek J. Traumatic brain injury in the United States: a public health perspective. *Journal of Head Trauma Rehabilitation* 1999;14(6):602–15.

Trends in Traumatic Brain Injuries among Arizona Residents, 2005-2010

Mortality

Between 2005 and 2010, the age-adjusted mortality rate of traumatic brain injury decreased 12 percent, from 23.1 deaths per 100,000 Arizona residents in 2005 to 20.4 deaths per 100,000 residents in 2010. Age-adjusted mortality rates among males were more than double the rates among females. Rates for males decreased 8 percent from 2005 through 2010, and rates for females decreased 20 percent. Figure 2 shows age-adjusted TBI mortality rates by sex from 2005 through 2010.

Figure 2. Age-Adjusted TBI Mortality Rates by Sex, Arizona, 2005-2010



While total age-adjusted TBI mortality rates declined from 2005 through 2010, changes in rates varied by manner and mechanism of injury. Age-adjusted rates of unintentional TBI-related deaths continued to decrease in 2010, but suicide rates increased to their highest point in the six years surveyed. 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, 2005-2010

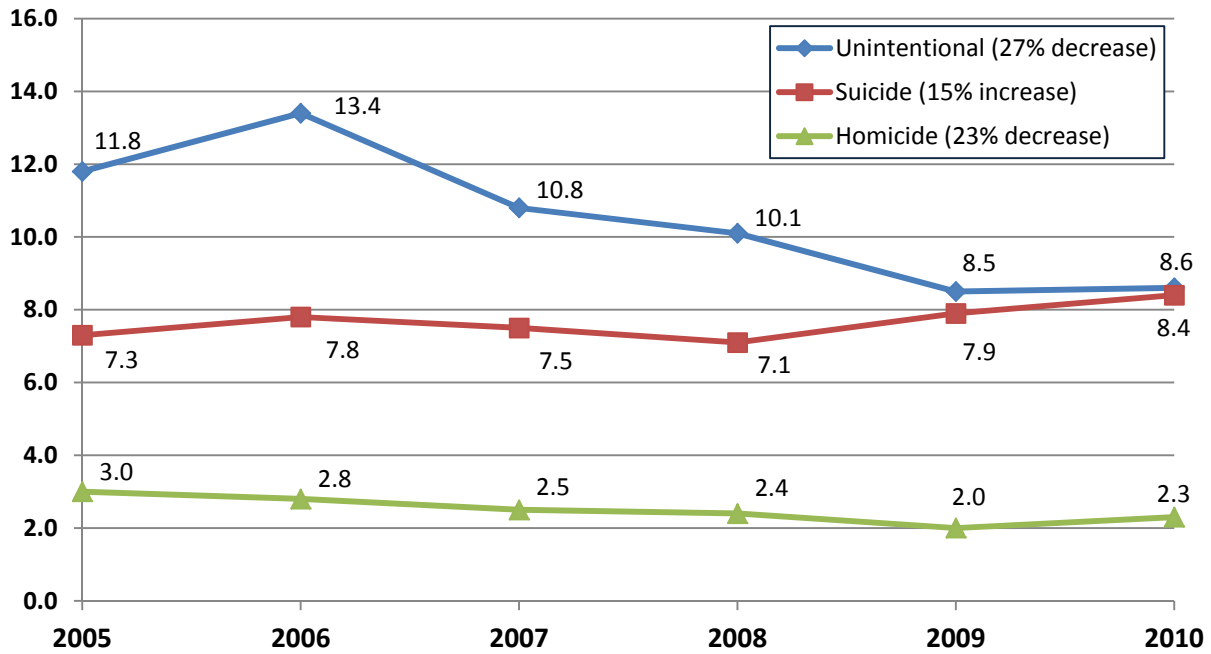
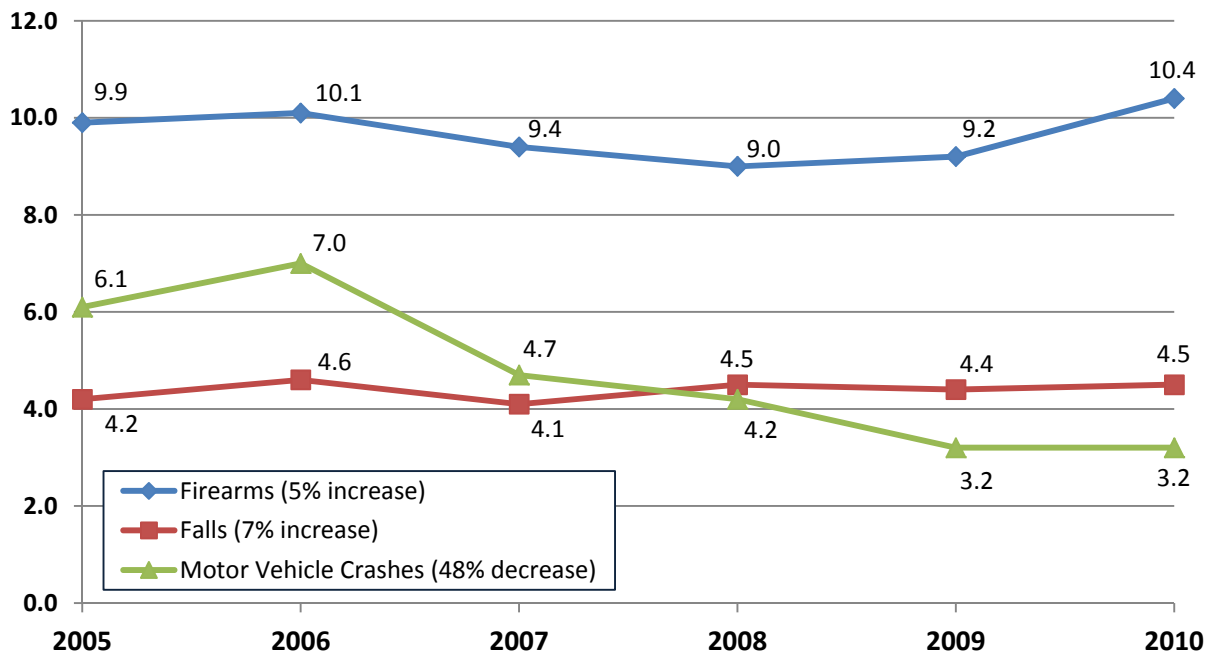


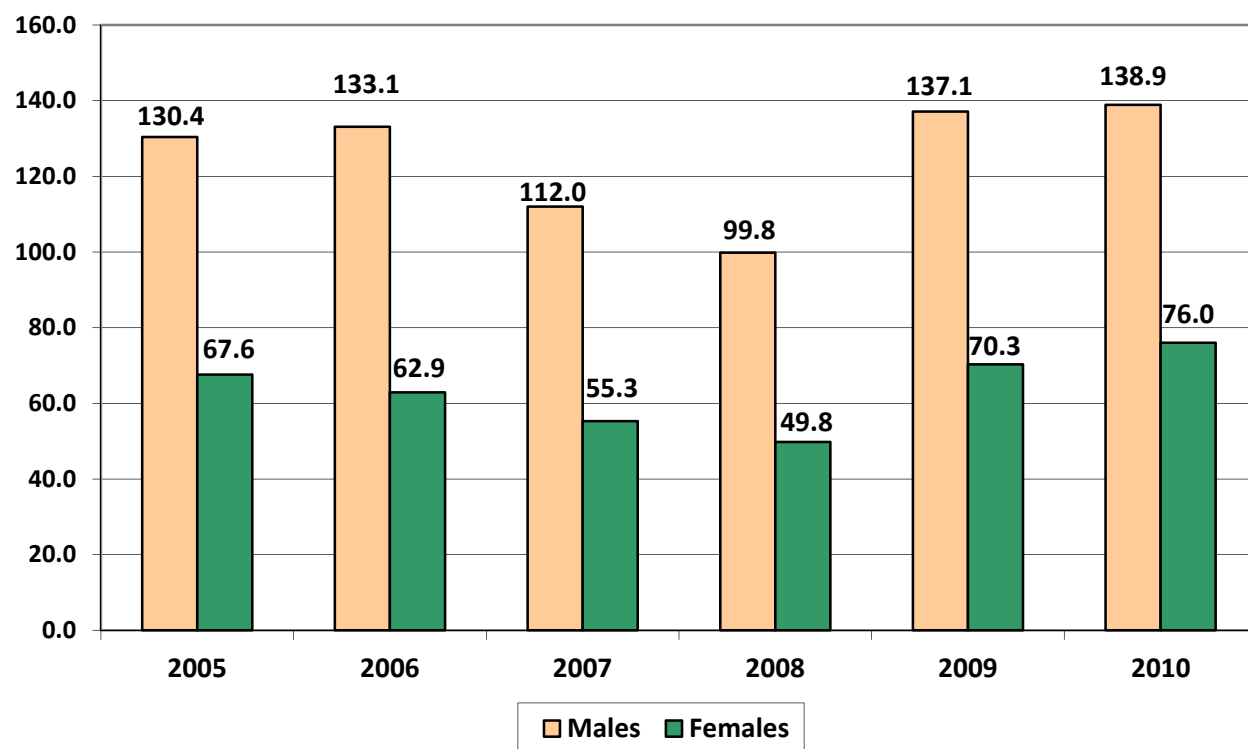
Figure 4. Age-Adjusted TBI Mortality Rates per 100,000 Residents by Selected Cause of Death, Arizona, 2005-2010



Non-Fatal Inpatient Hospitalizations

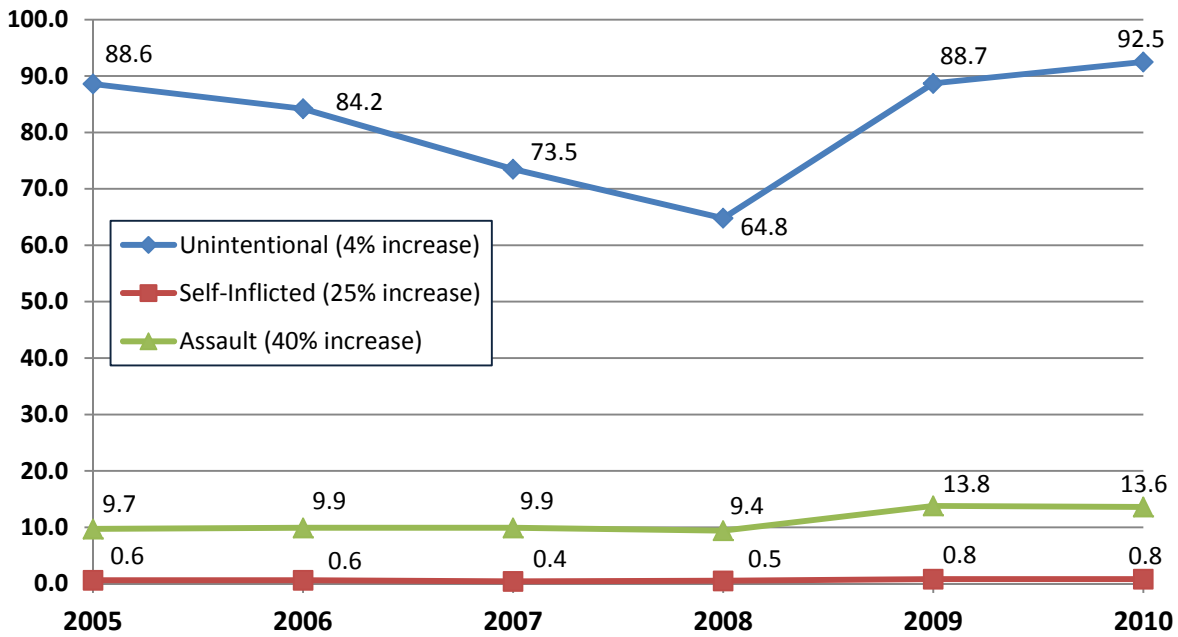
Between 2005 and 2010, the age-adjusted rate of TBI-related inpatient hospitalizations increased eight percent, from 99.5 hospitalizations per 100,000 Arizona residents in 2005 to 107.5 hospitalizations per 100,000 residents in 2010. Age-adjusted hospitalization rates among males were almost double the rates among females. Rates for males increased seven percent from 2005 through 2010, and rates for females increased 12 percent. Figure 5 shows age-adjusted non-fatal TBI-related inpatient hospitalization rates by sex from 2005 through 2010. Please refer to the Data Notes Section of this report for additional information regarding increased inpatient hospitalization rates beginning in 2009.

Figure 5. Age-Adjusted Non-Fatal TBI-Related Inpatient Hospitalization Rates by Sex, Arizona, 2005-2010



While total age-adjusted TBI-related inpatient hospitalization rates increased from 2005 through 2010, 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, 2005-2010



From 2005 through 2010, the rate of non-fatal inpatient hospitalizations due to fall-related traumatic brain injuries increased 57 percent, from 28.8 hospitalizations per 100,000 residents in 2005 to 45.1 hospitalizations per 100,000 residents in 2010. 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 29 percent in the six years from 2005 through 2010. There was an overall decrease in the rate from 2005 through 2008, followed by a slight increase in the rate from 2008 through 2010. 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 32.2 hospitalizations per 100,000 residents in 2010. 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 and 2010, however, the rate of motor vehicle crash-related TBI hospitalizations was lower than the rate of fall-related cases (45.1 fall-related hospitalizations in 2010, 32.2 motor vehicle crash-related hospitalizations in 2010). Figure 7 shows the trend of fall-related TBI hospitalizations by sex from 2005 through 2010, and Figure 8 shows the trend of motor vehicle crash-related TBI hospitalizations by sex from 2005 through 2010.

Figure 7. Age-Adjusted Non-Fatal Fall-Related TBI Inpatient Hospitalization Rates per 100,000 Residents by Manner of Injury, Arizona, 2005-2010

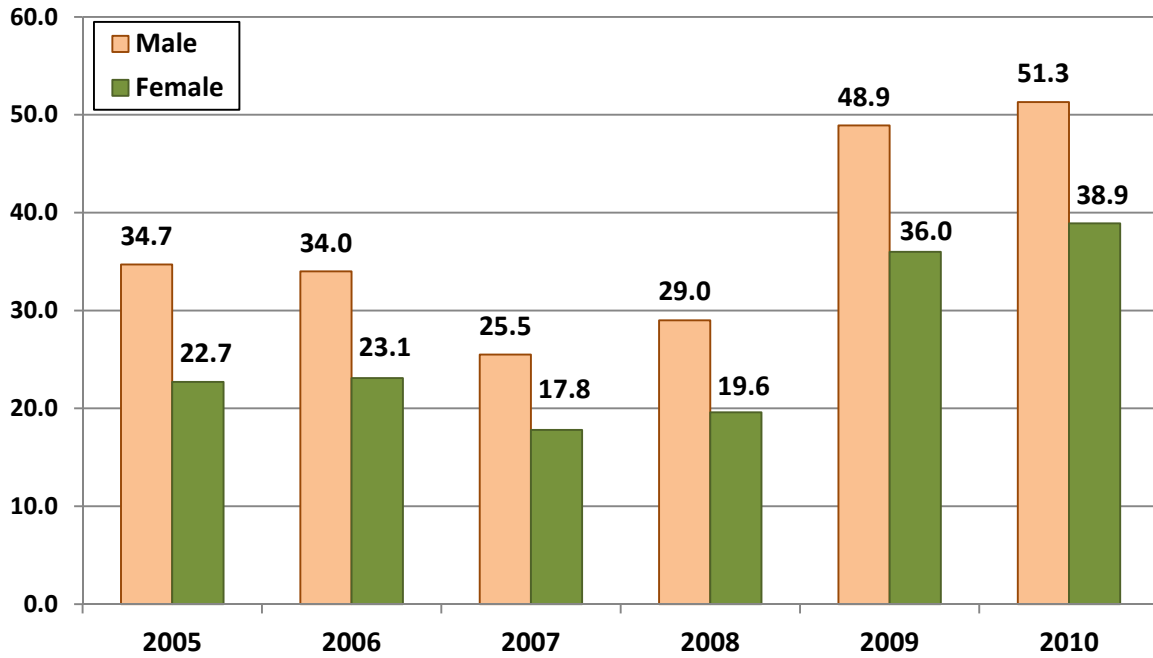
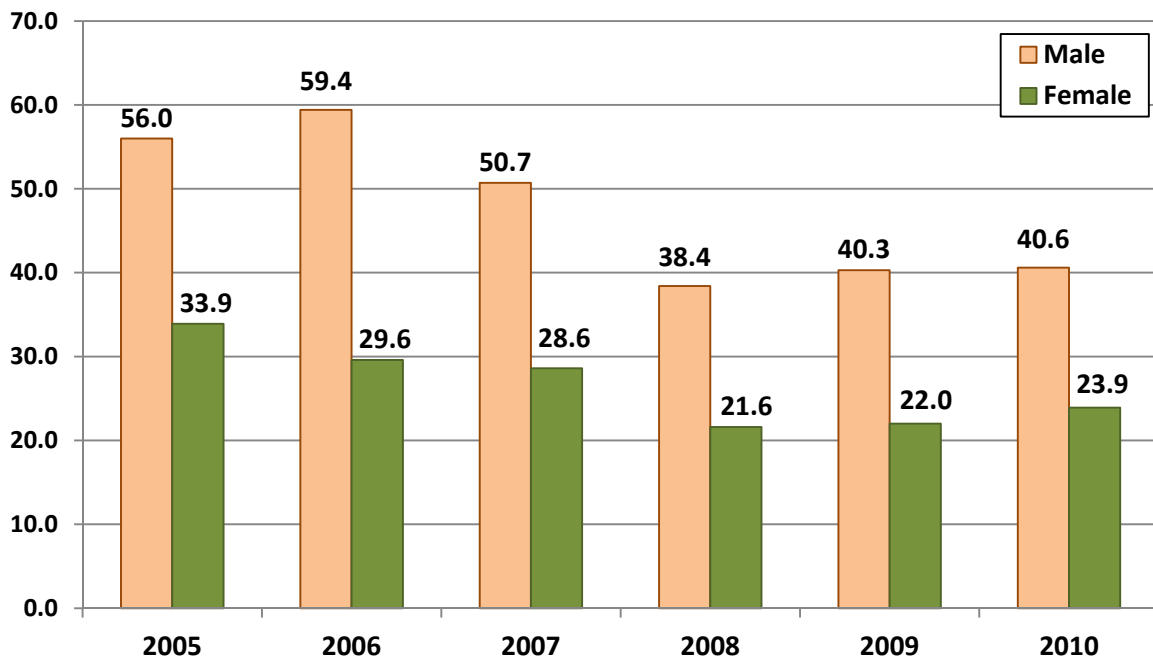


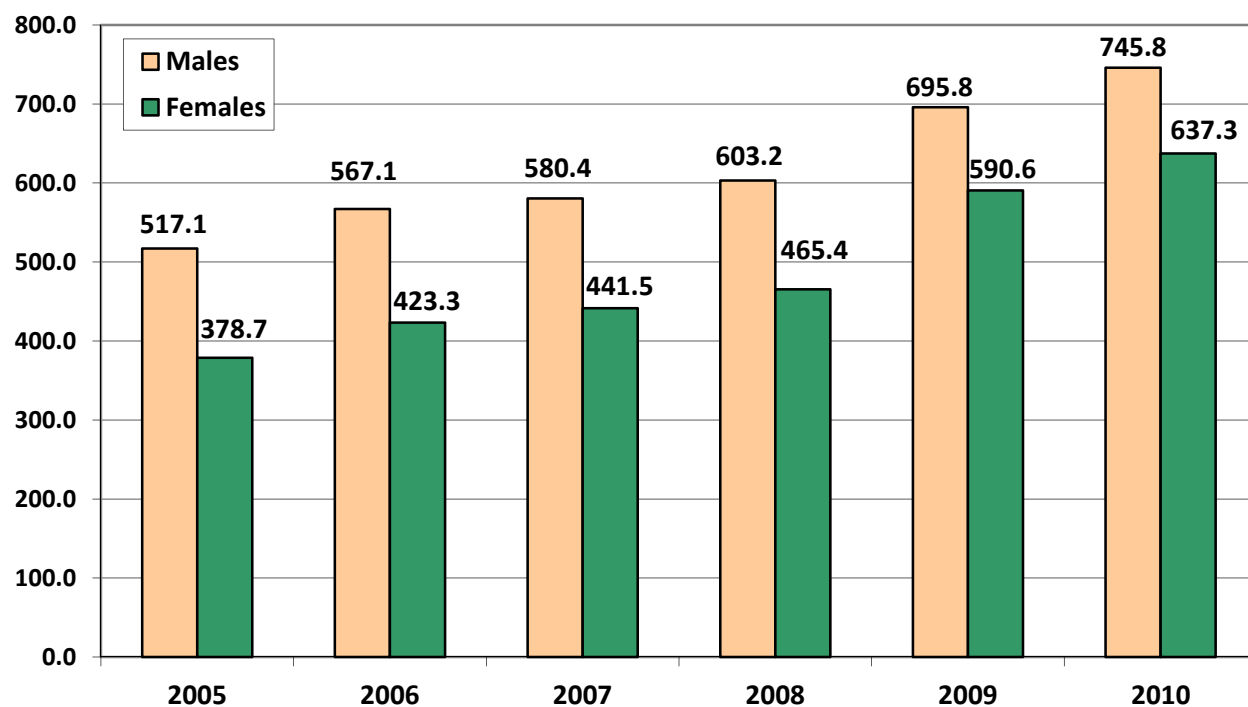
Figure 8. Age-Adjusted Non-Fatal Motor Vehicle Crash-Related TBI Inpatient Hospitalization Rates per 100,000 Residents by Manner of Injury, Arizona, 2005-2010



Non-Fatal Emergency Department Visits

From 2005 through 2010, the age-adjusted rate of non-fatal TBI-related emergency department visits increased 54 percent, from 450.9 visits per 100,000 Arizona residents in 2005 to 695.7 visits per 100,000 residents in 2010. Age-adjusted emergency department visit rates among males were higher than rates among females. Rates for males increased 44 percent from 2005 through 2010, and rates for females increased 68 percent. Figure 9 shows age-adjusted TBI-related emergency department visit rates by sex from 2005 to 2010. Please refer to the Data Notes Section of this report for additional information regarding increased emergency department visit rates beginning in 2009.

Figure 9. Age-Adjusted Non-Fatal TBI-Related Emergency Department Visit Rates by Sex, Arizona, 2005-2010



While total age-adjusted TBI-related emergency department visit rates increased from 2005 through 2010, 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 2010. 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 35 percent, from 0.78 visits per 100,000 residents in 2005 to 1.05 visits per 100,000 residents in 2010.

Figure 10. Age-Adjusted Non-Fatal TBI-Related Emergency Department Visit Rates per 100,000 Residents by Manner of Injury, Arizona, 2005-2010

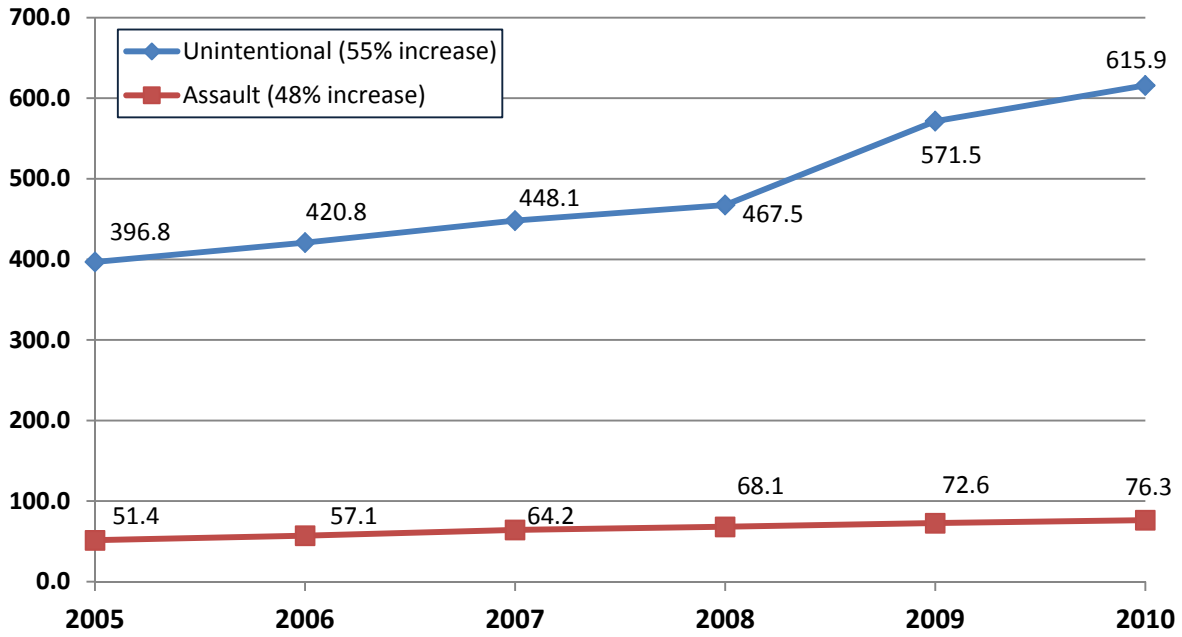
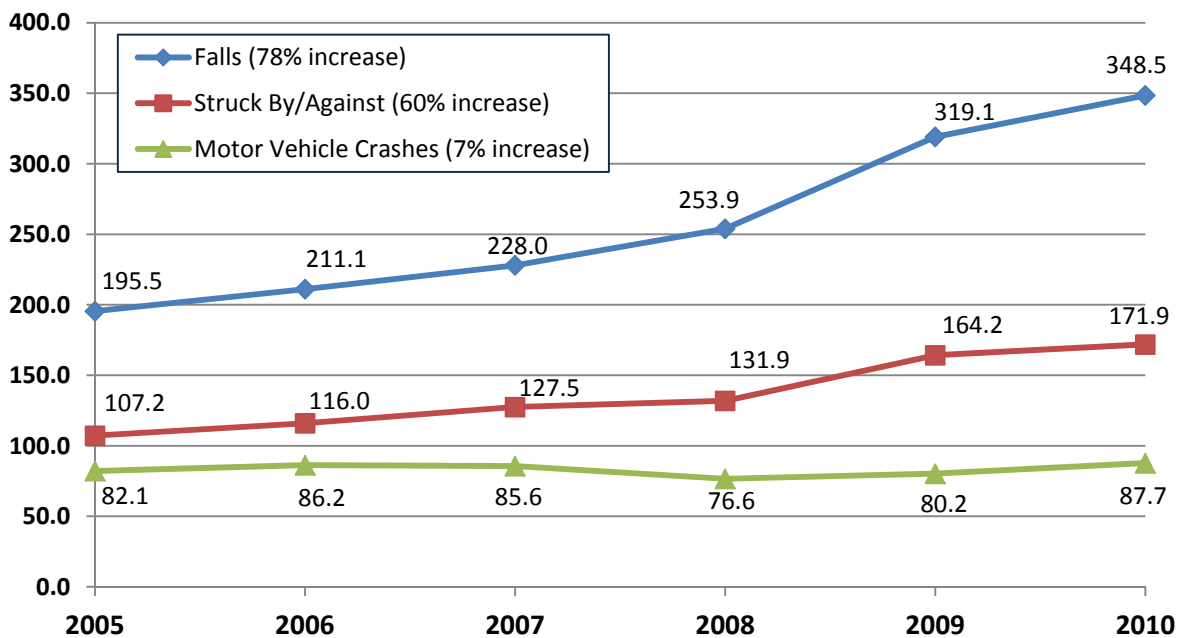


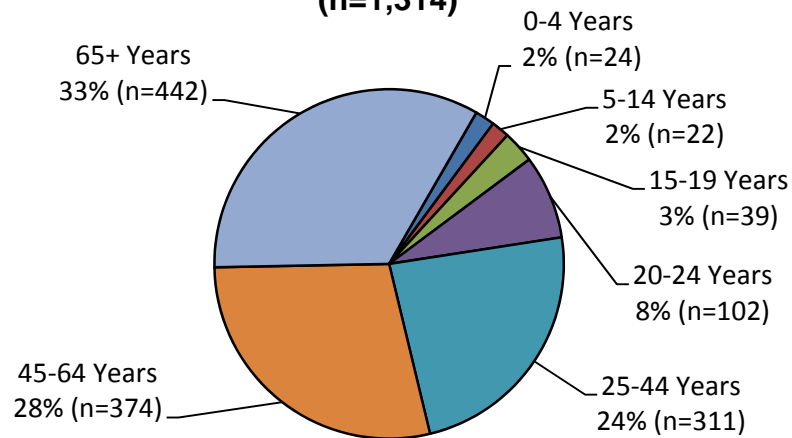
Figure 11. Age-Adjusted Non-Fatal TBI-Related Emergency Department Visit Rates per 100,000 Residents by Selected Cause of Injury, Arizona, 2005-2010



Deaths among Arizona Residents During 2010

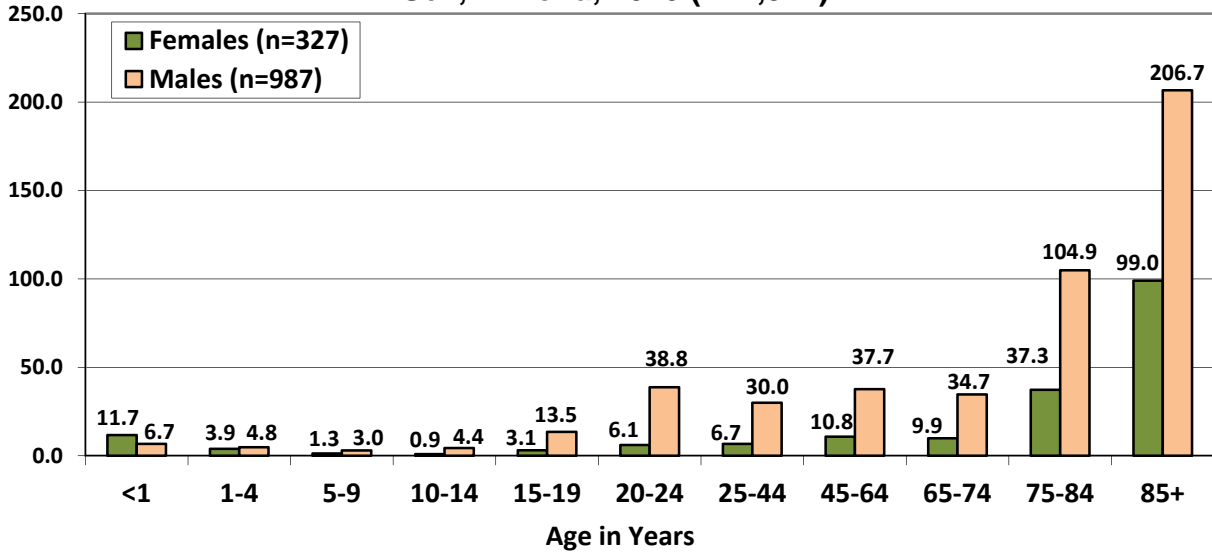
In 2010, 1,314 Arizona residents died as a result of TBI. The majority of deaths were among males (75 percent, n=987), while females accounted for 25 percent of TBI deaths (n=327). The largest percentage of deaths was among individuals ages 65 years and older (33 percent, n=442). Children ages 19 years and younger accounted for seven percent of TBI deaths in 2010 (n=85). Age distributions are shown in Figure 12.

**Figure 12. TBI Deaths by Age Group, Arizona, 2010
(n=1,314)**



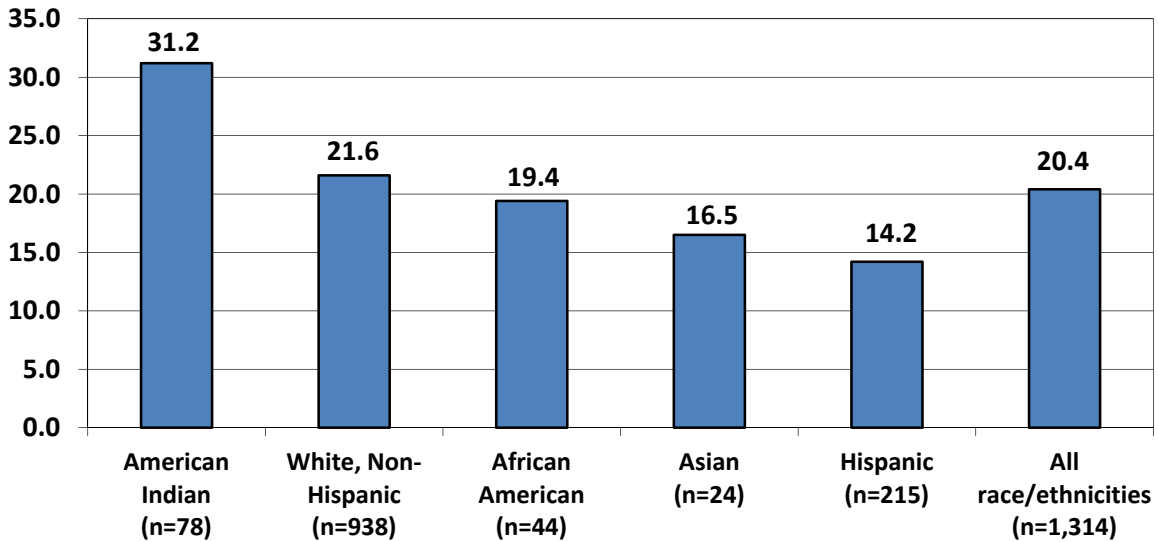
Males 85 years and older accounted for 78 deaths and had the highest rate of TBI deaths in 2010 (206.7 per 100,000 residents). Among adults 85 years and older, 72 percent of TBI deaths were due to unintentional falls (n=103). Unlike injuries related to motor vehicle crashes or firearms, injuries related to falls among older adults may not prove immediately fatal. Rather, the initial injury from a fall frequently leads to a fear of falling again. This fear, coupled with decreased health following the initial fall-related injury, may cause the adult to curtail their physical activity, increasing the risk of a future fall and setting the stage for a more difficult recovery. Fall-related TBI deaths among older adults may also result from a single catastrophic medical event, such as a stroke or heart attack, in which the adult falls and hits their head. While the medical event alone may be survivable, the added traumatic brain injury results in a prolonged recovery, and ultimately, impaired balance, vision, and cognition that may contribute to a fatal injury. Figure 13 shows the 2010 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, 2010 (n=1,314)



Age-adjusted TBI death rates were highest among American Indians (31.2 deaths per 100,000 residents) and Non-Hispanic Whites (21.6 deaths per 100,000 residents). Figure 14 shows the 2010 age-adjusted TBI death rates by race/ethnicity in Arizona.

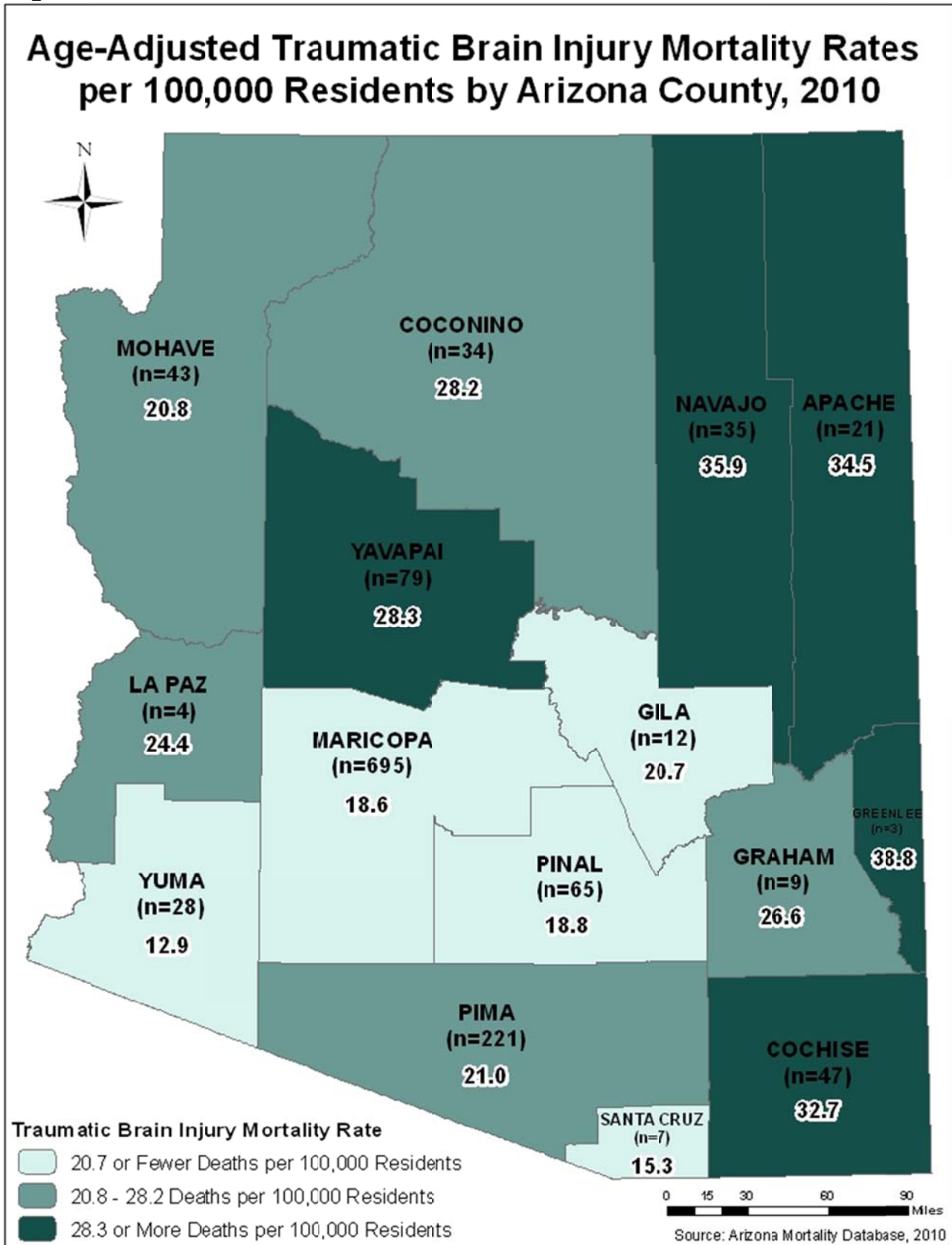
Figure 14. Age-Adjusted TBI Mortality Rates per 100,000 by Race/Ethnicity, Arizona, 2010 (n=1,314)



15 deaths were among individuals of other or unknown race/ethnicity

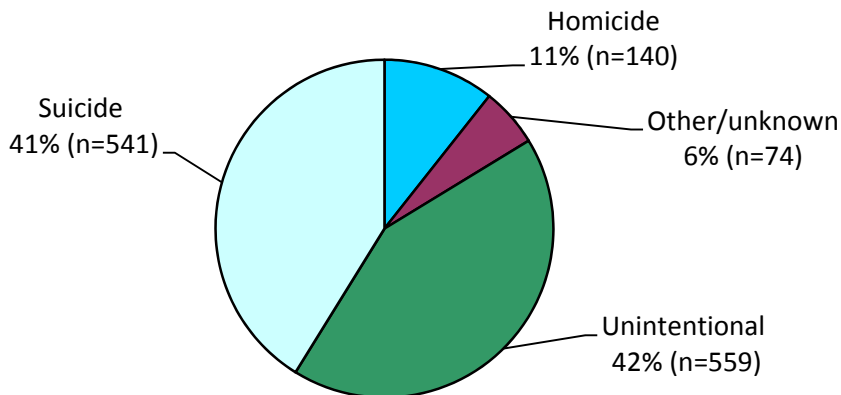
Age-adjusted TBI mortality rates were highest among residents of rural counties, with the highest rates in Greenlee, Navajo, and Apache Counties. Figure 15 shows age-adjusted mortality rates by county of residence. Rates may be unstable for counties with fewer than 20 TBI-related deaths.

Figure 15.



Forty-two percent of the TBI deaths in 2010 were due to unintentional injuries (n=559); 41 percent were due to suicides (n=541); and 11 percent were due to homicides (n=140). Figure 16 shows TBI deaths by manner of injury during 2010 in Arizona.

Figure 16. TBI Deaths by Manner of Injury, Arizona, 2010 (n=1,314)

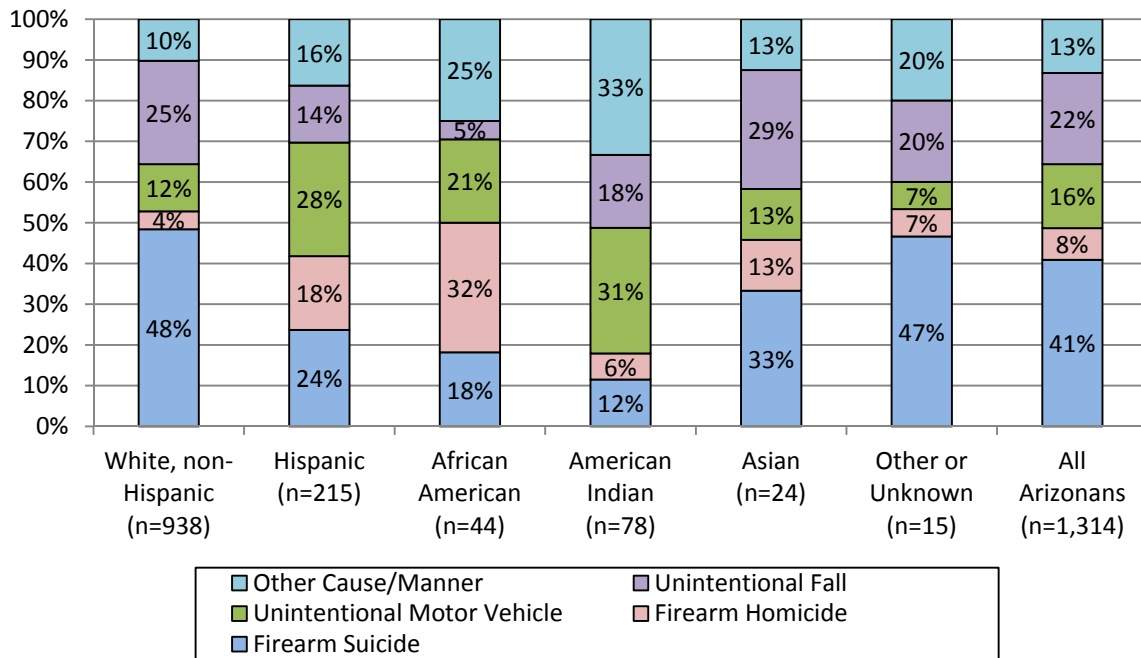


The most common causes of deaths were firearms (51 percent, n=667), falls (22 percent, n=295), and motor vehicle traffic crashes (16 percent, n=206). Causes of TBI deaths during 2010 in Arizona are shown in Table 1. Descriptions of these causes are given in Appendix A.

Cause	Number	Percentage
Firearm	667	51%
Fall	295	22%
Motor vehicle traffic	206	16%
Other/unspecified	101	8%
Unknown cause	27	2%
Other land transport	9	<1%
Other pedestrian	9	<1%
Total	1,288	100%

TBI mortality by cause and manner of death varied greatly by race/ethnicity. Firearm suicides and unintentional falls were the leading causes and manners of death for White, non-Hispanic Arizonans, while the leading cause and manner of TBI-related death among American Indian residents was unintentional motor vehicle crashes. Figure 17 shows the percentages of TBI-related deaths for each race/ethnicity by cause and manner of death.

Figure 17. Percentage of TBI Deaths by Race/Ethnicity and Cause and Manner of Death, Arizona, 2010



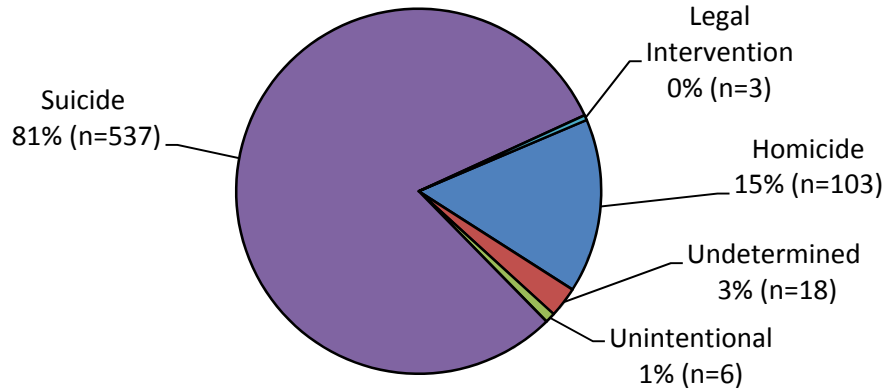
Firearm-Related TBI Mortality

Among the 667 Arizona residents who died as a result of a firearm-related TBI, the majority were male (86 percent, n=571) and 14 percent were female (n=96). Five percent of TBI deaths due to firearms were among children 19 years and younger (n=31). Ten percent of the deaths were among individuals ages 20 through 24 years (n=69); 65 percent were among individuals ages 25 through 64 years (n=431); and 20 percent were among individuals 65 years and older (n=136).

The highest age-adjusted rate of firearm-related TBI deaths was among White Non-Hispanics (n=510). This population had a rate of 12.5 deaths per 100,000 residents. The second highest rate was among African Americans, who accounted for 23 deaths, or 8.5 deaths per 100,000 residents.

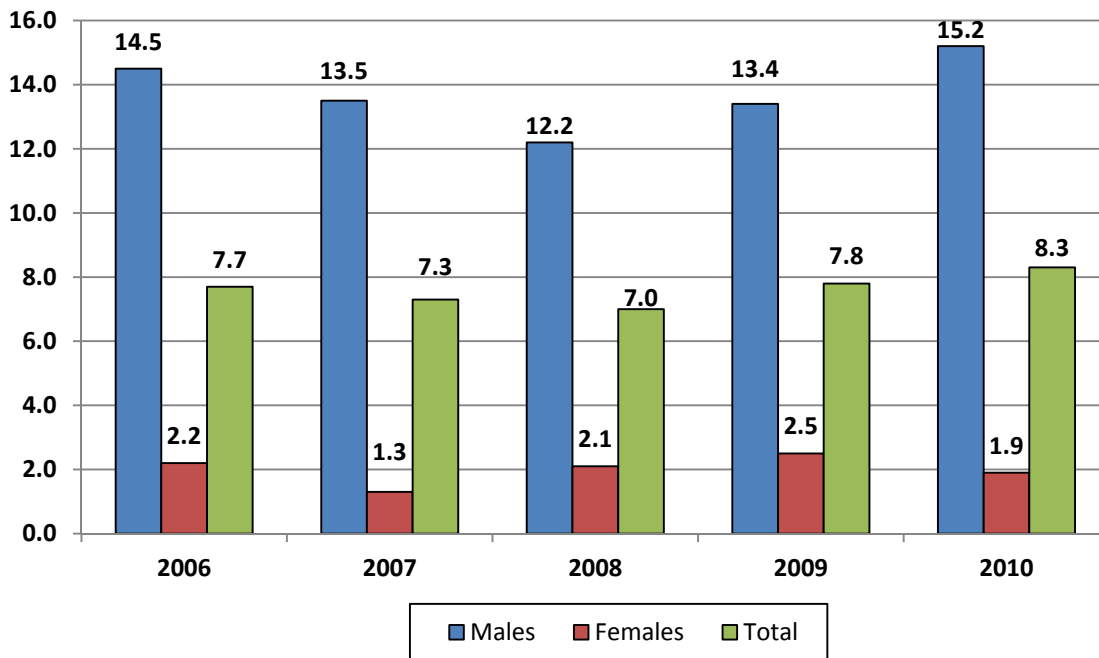
The majority of firearm-related TBI deaths were suicides (81 percent, n=537). Fifteen percent of the deaths were due to homicides (n=103); three percent were of undetermined intent (n=18); and one percent were due to unintentional injuries (n=6). There were three firearm-related TBI deaths resulting from legal intervention. Figure 18 shows TBI deaths due to firearms by manner of injury.

Figure 18. TBI Deaths due to Firearms by Manner of Injury, Arizona, 2010 (n=667)



Among the 537 TBI deaths resulting from firearm-related suicides, 88 percent were among males (n=472) and 12 percent were among females (n=65). The highest percentage of deaths were among individuals ages 45 through 64 years (39 percent, n=207). The age-adjusted rate of TBI deaths resulting from firearm-related suicides was 8.3 deaths per 100,000 residents, the highest rate of such deaths over the previous five years. Age-adjusted rates were substantially higher among males than among females over each of the years from 2006-2010. Figure 19 shows the age-adjusted rate of TBI deaths resulting from firearm-related suicides by sex and year from 2006 through 2010.

Figure 19. Age-Adjusted TBI Mortality Rate due to Firearm Suicides by Sex and Year, Arizona, 2006-2010



The highest age-adjusted rate of firearm-related TBI suicides was among White Non-Hispanics (n=454). This population had a rate of 10.9 deaths per 100,000 residents, and the extremely high mortality rate coupled with the large population drove up the age-adjusted mortality rate for

the total population. Age-adjusted rates among all other race/ethnicities ranged from 2.8 deaths per 100,000 African American residents to 3.9 deaths per 100,000 Asian residents.

Fall-Related TBI Mortality

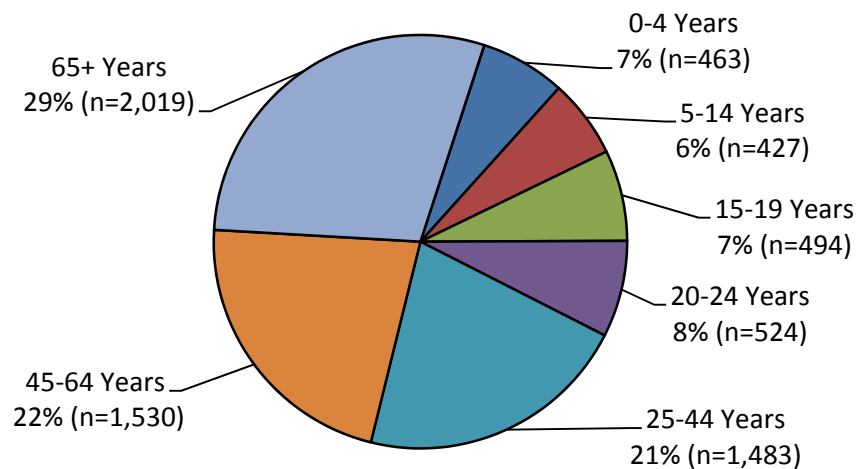
Of the 295 TBI deaths due to falls, 57 percent were among males (n=167) and 43 percent were among females (n=128). All but one of the falls were unintentional. Less than one percent of TBI-related fall deaths were among children and young adults ages 24 years and younger (n=1). Twenty percent of the deaths were among adults ages 25 through 64 years (n=58); and 80 percent were among adults 65 years and older (n=236).

The highest age-adjusted rate of fall-related TBI deaths was among American Indians, who accounted for 14 deaths, or 8.5 deaths per 100,000 residents. The second highest rate was among Asians (7.3 deaths per 100,000 residents, n=7). The age-adjusted mortality rate for fall-related TBI deaths among all races/ethnicities was 4.5 deaths per 100,000 residents.

Non-Fatal Inpatient Hospitalizations among Arizona Residents During 2010

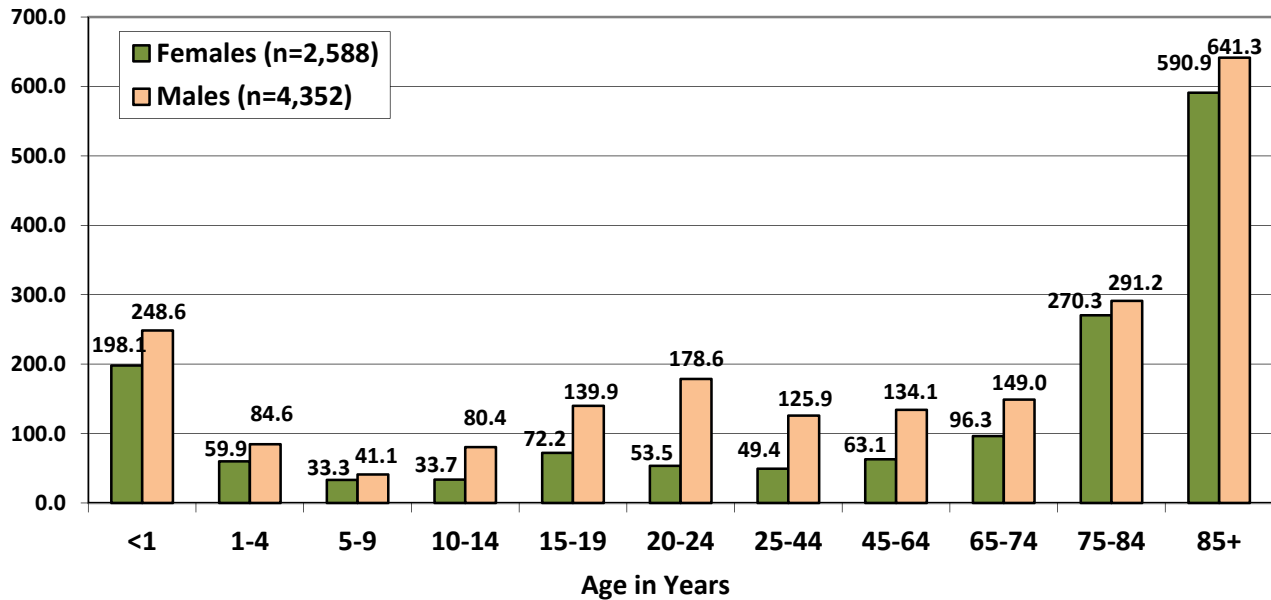
In 2010, 6,940 Arizona residents were hospitalized due to non-fatal TBIs. Males comprised 63 percent of total TBI hospitalizations (n=4,352) and females accounted for 37 percent (n=2,588). Twenty percent of TBI inpatient hospitalizations were among children ages 19 years and younger (n=1,384). The age distribution for non-fatal TBI-related inpatient hospitalizations is shown in Figure 20.

Figure 20. TBI Inpatient Hospitalizations by Age Group, Arizona, 2010 (n=6,940)



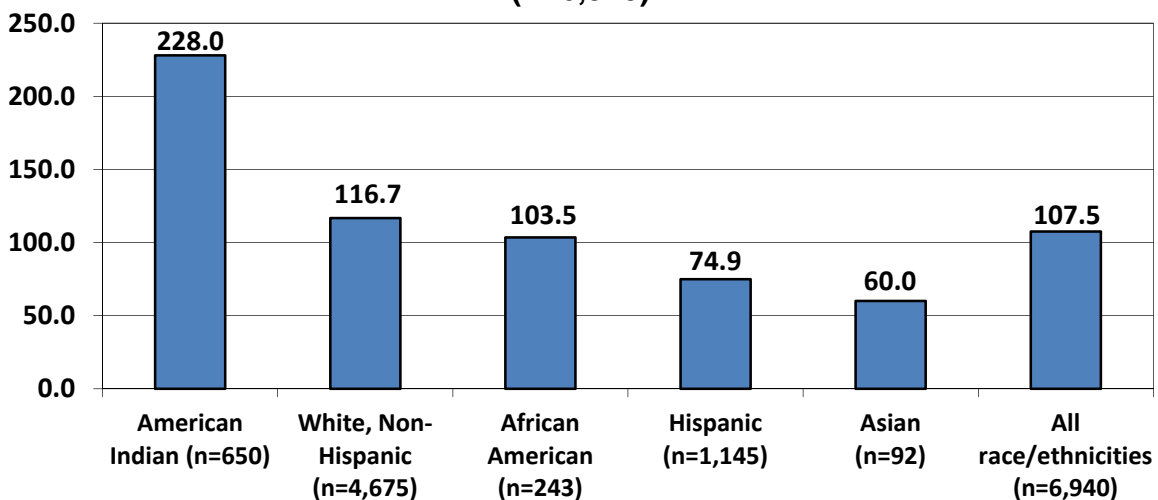
Adults 85 years and older had the highest rates of TBI inpatient hospitalizations in 2010. Males 85 years and older had a rate of 641.3 hospitalizations per 100,000 residents (n=242), and the rate for females 85 years and older was 590.9 hospitalizations per 100,000 residents (n=388). For adults 85 years and older, 90 percent of hospitalizations were due to unintentional falls (n=567). Figure 21 shows the 2010 TBI inpatient hospitalization rates by age group and sex for Arizona residents.

Figure 21. TBI Inpatient Hospitalization Rates per 100,000 by Age Group and Sex, Arizona, 2010 (n=6,940)



Age-adjusted TBI inpatient hospitalization rates were highest among American Indians (228.0 hospitalizations per 100,000 residents) and Non-Hispanic Whites (116.7 hospitalizations per 100,000 residents). Figure 22 shows the 2010 age-adjusted TBI inpatient hospitalization rates by race/ethnicity in Arizona.

Figure 22. Age-Adjusted TBI Inpatient Hospitalizations Rates per 100,000 by Race/Ethnicity, Arizona, 2010 (n=6,940)

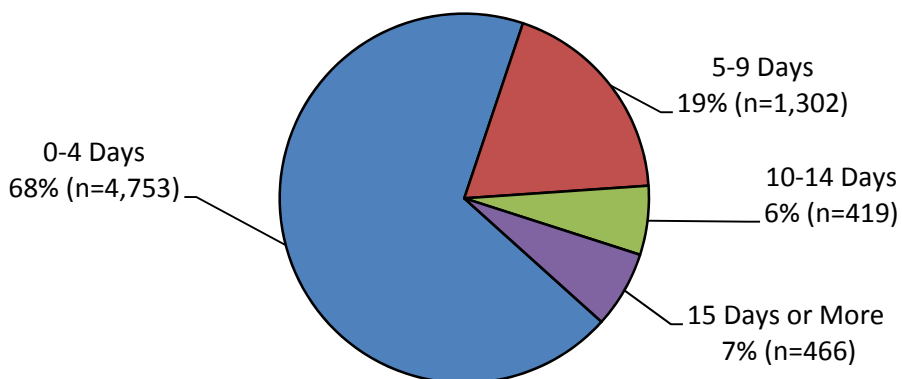


135 hospitalizations were among individuals of other or unknown race/ethnicity

For TBI inpatient hospitalizations, the average length of stay was five days, with the majority of stays less than five days (68 percent, n=4,753). The median length of stay was three days, and

hospital stays due to TBI ranged from less than one full day to 165 days. Figure 23 shows TBI inpatient hospitalizations by length of stay.

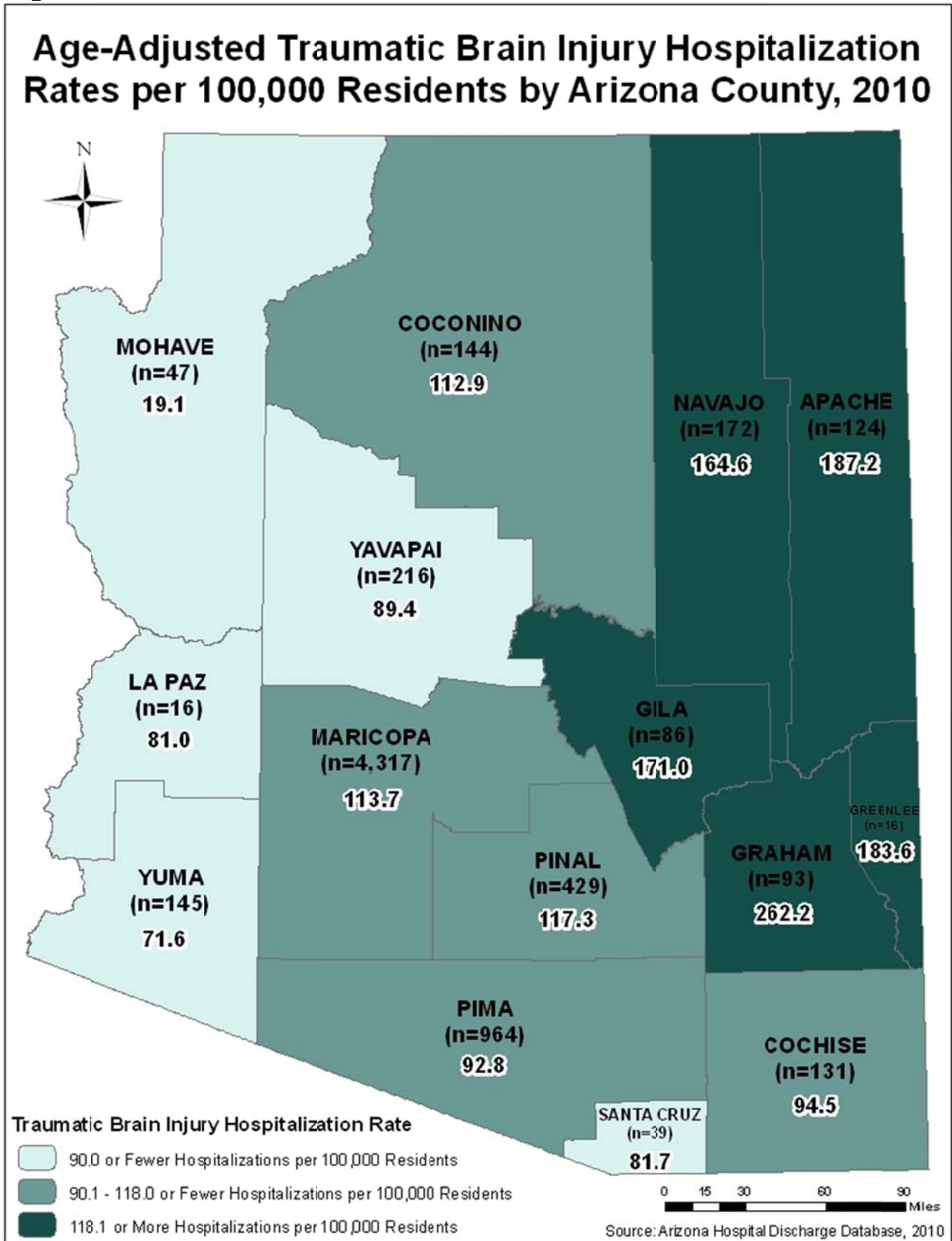
Figure 23. TBI Inpatient Hospitalizations by Length of Stay, Arizona, 2010 (n=6,940)



TBI inpatient hospitalization charges in 2010 totaled more than \$451.6 million, with 53 percent paid by the Arizona Health Care Cost Containment System (AHCCCS)/Medicaid and Medicare (n=3,647 cases, over \$241.0 million). This total does not include costs related to physician care, rehabilitation, lost wages, or long-term costs of disability.

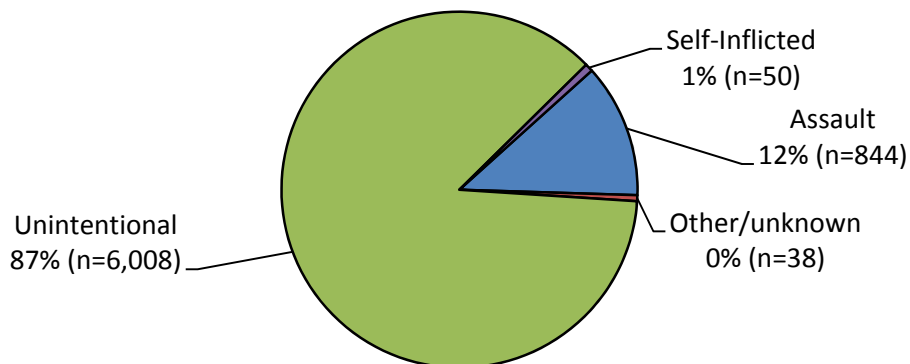
Age-adjusted TBI hospitalization rates were highest among residents of rural counties, with the highest rates in Graham, Apache, and Greenlee Counties. While Mohave County had an extremely low rate of hospitalizations for non-fatal TBIs, this may be due to the fact that severely injured patients are transported for treatment at trauma centers in Nevada. Because these patients are not treated at Arizona facilities, data on these patients are not available. Figure 24 shows age-adjusted hospitalization rates by county of residence. Rates may be unstable for counties with fewer than 20 TBI-related hospitalizations.

Figure 24.



Unintentional injuries accounted for 87 percent of TBI hospitalizations (n=6,008). There were 50 self-inflicted TBI hospitalizations (one percent) and 844 assaults (12 percent). Figure 25 shows the TBI inpatient hospitalizations by manner of injury for Arizona in 2010.

Figure 25. TBI Inpatient Hospitalizations by Manner of Injury, Arizona, 2010 (n=6,940)



Fall-related injuries were the most common cause of TBI hospitalizations (43 percent, n=2,982), followed by motor vehicle traffic injuries (30 percent, n=2,049). Table 2 shows causes of TBI inpatient hospitalizations in Arizona during 2010. Descriptions of these causes are given in Appendix A.

Cause	Number	Percentage
Fall	2,982	43%
Motor vehicle traffic	2,049	30%
Struck by/against	797	11%
Other/unspecified	499	7%
Transport	368	5%
Other pedal cycle	190	3%
Firearm	55	1%
Cut/pierce	30	<1%
Total	6,940	100%

Non-Fatal Fall-Related TBI Inpatient Hospitalizations

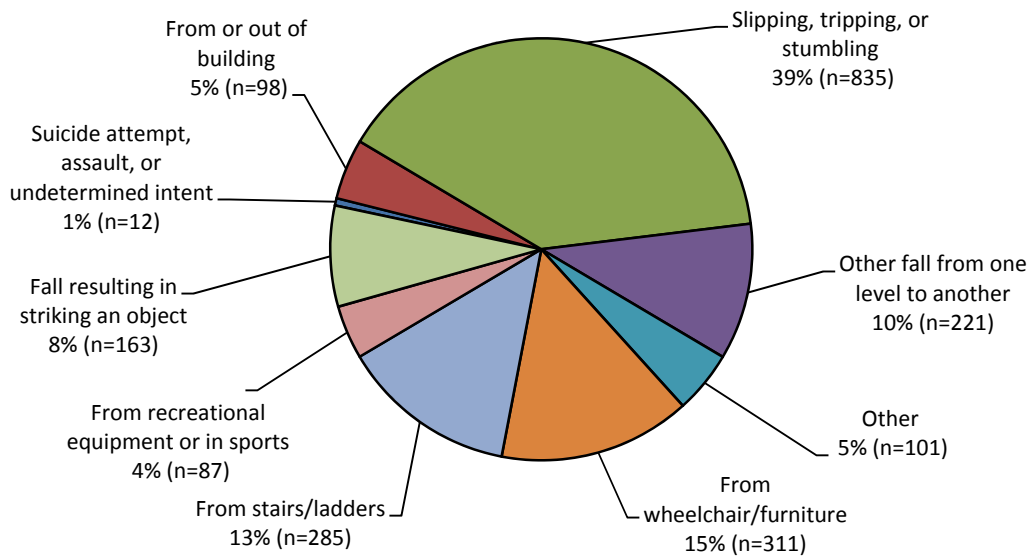
There were 2,982 inpatient hospitalizations due to fall-related TBI. Fifty-three percent were among males (n=1,577) and 47 percent were among females (n=1,405). Sixteen percent of the hospitalizations were among children 19 years and younger (n=492), and 55 percent of the hospitalizations were among adults 65 years and older (n=1,627). Almost all of these falls were unintentional (n=2,970), but 12 were self-inflicted or from assaults or undetermined intents.

American Indians had the highest age-adjusted rate of fall-related TBI hospitalizations with 63.7 hospitalizations per 100,000 residents (n=154). The second highest rate was among Non-Hispanic Whites (49.3 hospitalizations per 100,000 residents; n=2,254). The age-adjusted rate

for non-fatal fall-related inpatient hospitalizations among all Arizonans was 45.1 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 (29 percent, n=869). The most frequently specified contributing events were slipping, tripping, or stumbling (39 percent of specified events, n=835) and falls from wheelchairs, beds, or other furniture (15 percent of specified events, n=311). Figure 26 shows TBI inpatient hospitalizations due to falls by specified contributing event.

Figure 26. TBI Inpatient Hospitalizations due to Falls by Specified Contributing Event (All Manners), Arizona, 2010 (n=2,113)



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

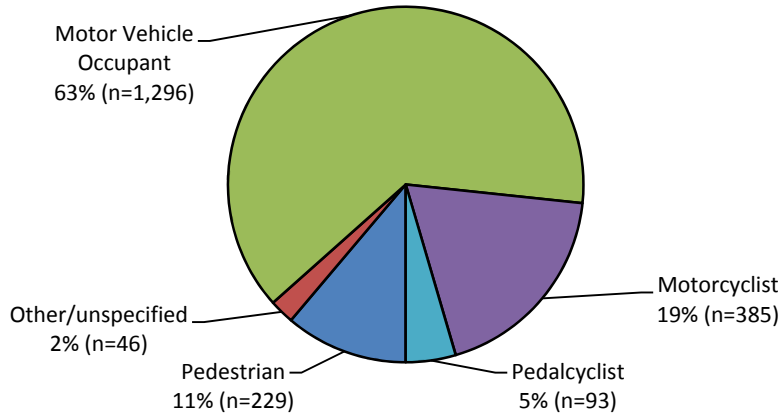
Of the 2,049 TBI hospitalizations due to motor vehicle traffic crashes, 63 percent were among males (n=1,288) and 37 percent were among females (n=761). Seven of the crashes were not unintentional. Twenty percent of TBI hospitalizations due to motor vehicle traffic crashes were among children 19 years and younger (n=416); 12 percent were among individuals ages 20 through 24 years (n=253); 56 percent were among individuals 25 through 64 years (n=1,149); and 11 percent were among adults 65 years and older (n=231).

American Indians had the highest rate of TBI hospitalizations for motor vehicle traffic crashes (63.0 hospitalizations per 100,000 residents; n=193). With 35.5 hospitalizations per 100,000 residents, Non-Hispanic Whites had the second highest rate (n=1,300). The age-adjusted rate for non-fatal motor vehicle traffic-related inpatient hospitalizations among all Arizonans was 32.2 hospitalizations per 100,000 residents.

The majority of TBI inpatient hospitalizations due to motor vehicle traffic collisions were among occupants of motor vehicles (63 percent, n=1,296). Nineteen percent were motorcyclists (n=385); 11 percent were pedestrians (n=229); and five percent were pedal cyclists (n=93). Two

percent were of another or unspecified position in relation to the vehicle (n=46). Figure 27 shows TBI inpatient hospitalizations due to motor vehicle traffic crashes by injured person.

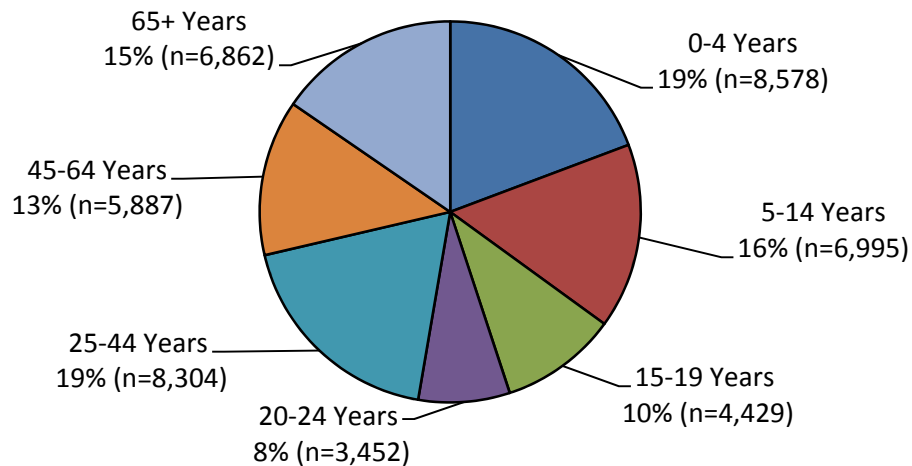
Figure 27. TBI Inpatient Hospitalizations due to Motor Vehicle Traffic Crashes by Injured Person (All Manners), Arizona, 2010 (n=2,049)



Non-Fatal Emergency Department Visits among Arizona Residents During 2010

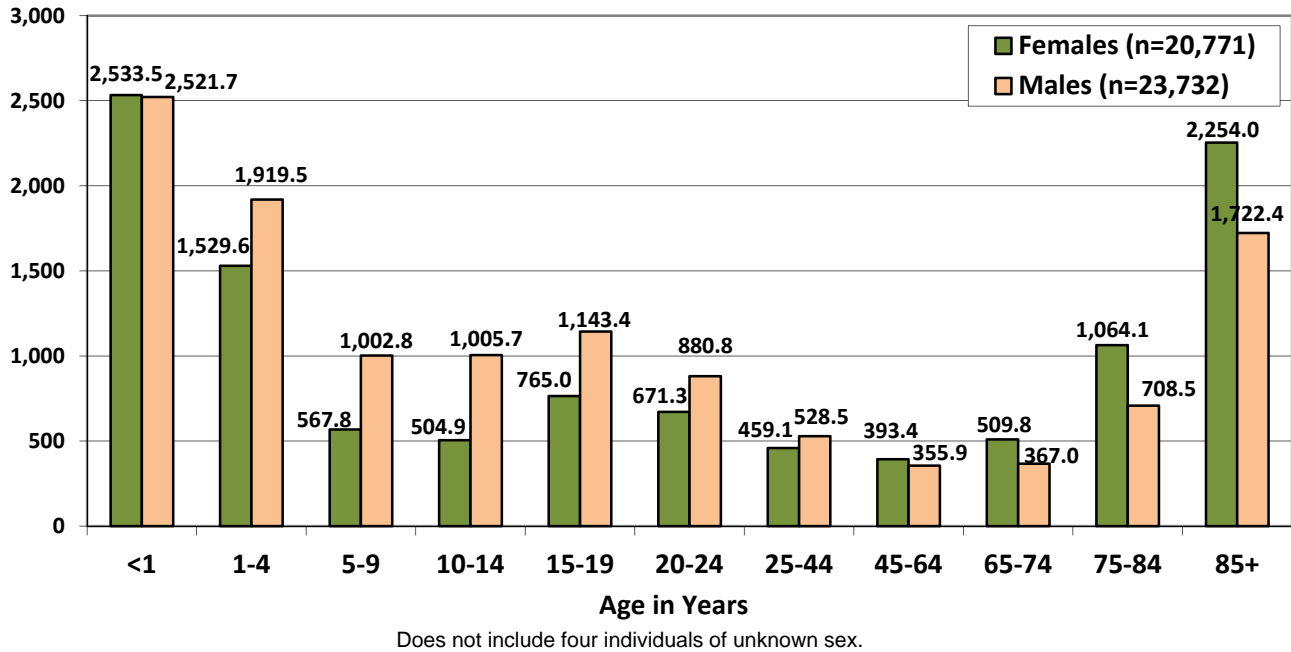
In 2010, there were 44,507 TBI emergency department visits among Arizona residents. Males accounted for more than half of TBI emergency department visits (53 percent, n=23,732), while females accounted for 47 percent of visits (n=20,771). There were four cases among individuals of unknown sex. Forty-five percent of TBI emergency department visits were among children ages 19 years and younger (n=20,002). Emergency department visits by age group are shown in Figure 28.

Figure 28. TBI Emergency Department Visits by Age Group, Arizona, 2010 (n=44,507)



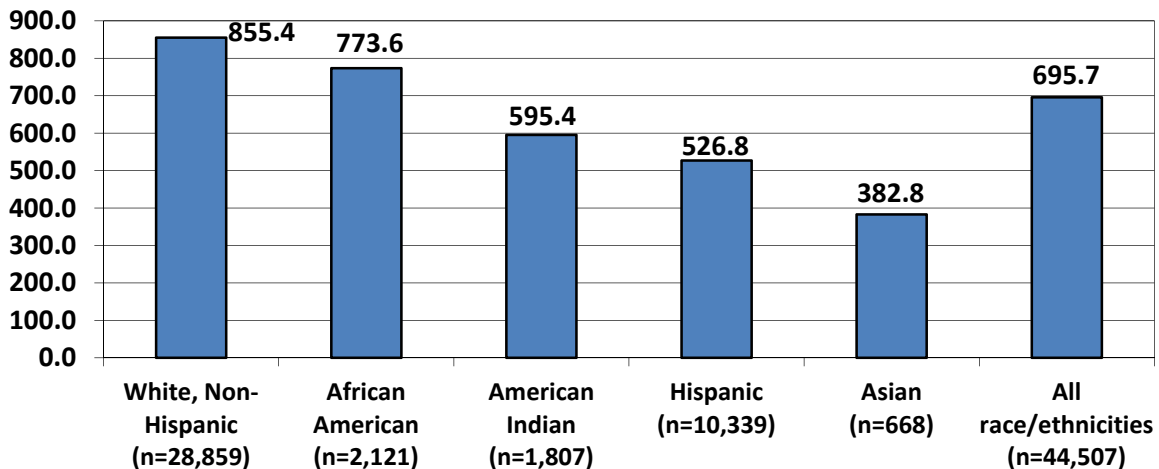
TBI emergency department visit rates were highest among children younger than one year of age. There were 1,087 emergency department visits among females younger than one year of age (a rate of 2,533.5 visits per 100,000 residents), and 1,126 visits among males younger than one year of age (a rate of 2,521.7 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=1,899). Unintentional fall-related injuries and their sequelae, such as traumatic brain injuries, are common among young children, whose disproportionately large heads, relatively weak neck muscles, and developing sense of balance create a high risk for minor falls. Young children also account for a large percentage of traumatic brain injuries ED visits for struck by and against injuries. As children learn to explore their environment by crawling and walking, they frequently collide with stationary objects, such as furniture, sliding glass doors, and bathroom fixtures. Figure 29 shows the 2010 TBI emergency department visit rates per 100,000 Arizona residents.

Figure 29. TBI Emergency Department Visit Rates per 100,000 by Age Group and Sex, Arizona, 2010 (n=44,507)



Age-adjusted TBI emergency department visit rates were highest among Non-Hispanic Whites (855.4 visits per 100,000 residents) and African Americans (773.6 visits per 100,000 residents). Figure 30 shows the 2010 age-adjusted TBI emergency department visit rates by race/ethnicity in Arizona.

Figure 30. Age-Adjusted TBI Emergency Department Visit Rates per 100,000 by Race/Ethnicity, Arizona, 2010 (n=44,507)



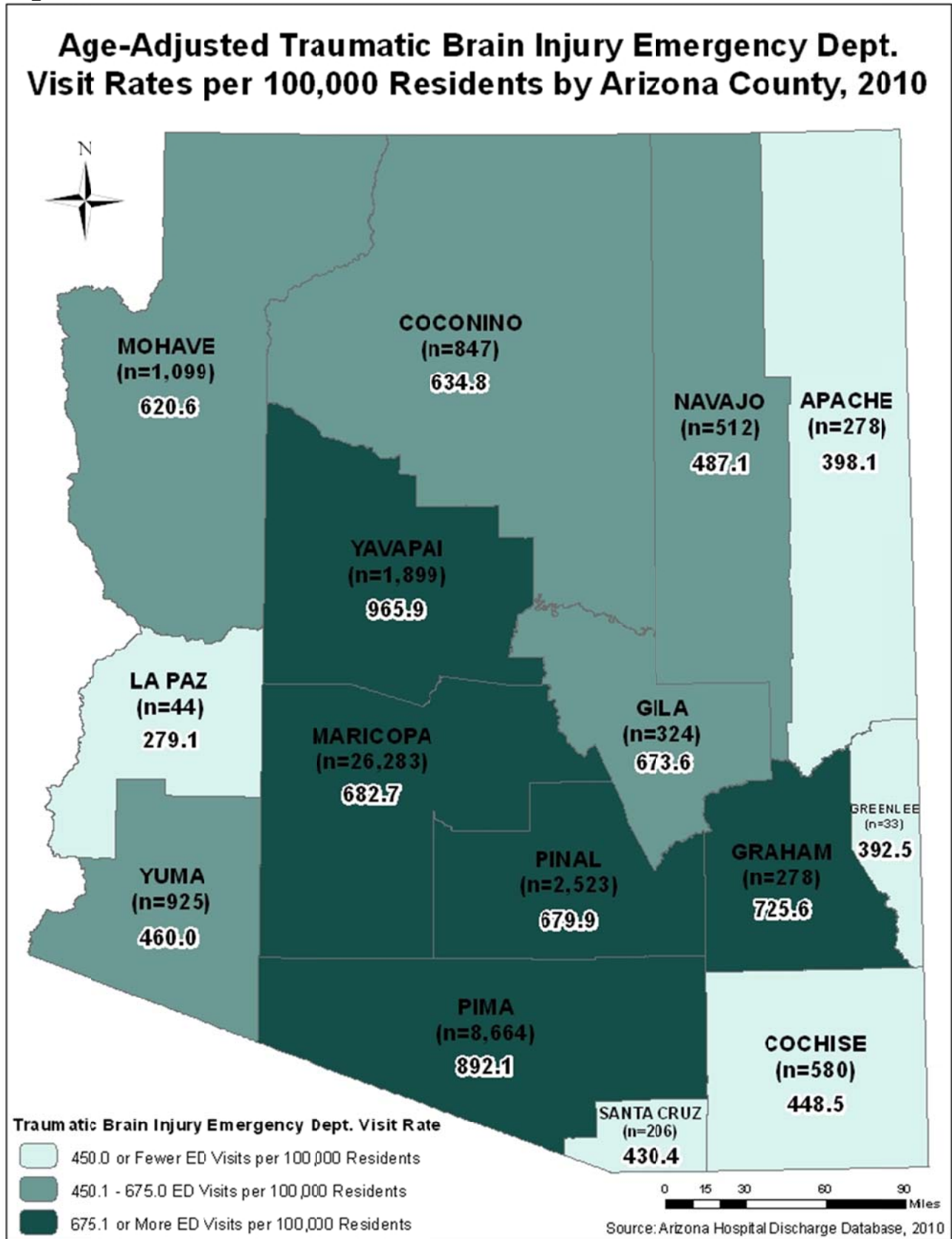
713 emergency department visits were among individuals of other or unknown race/ethnicity

TBI emergency department charges in 2010 totaled more than \$205.1 million, with 45 percent paid by the Arizona Health Care Cost Containment System (AHCCCS)/Medicaid and Medicare

(n=20,539 cases, over \$93.0 million). This total does not include costs related to physician care, rehabilitation, lost wages, or long-term costs of disability.

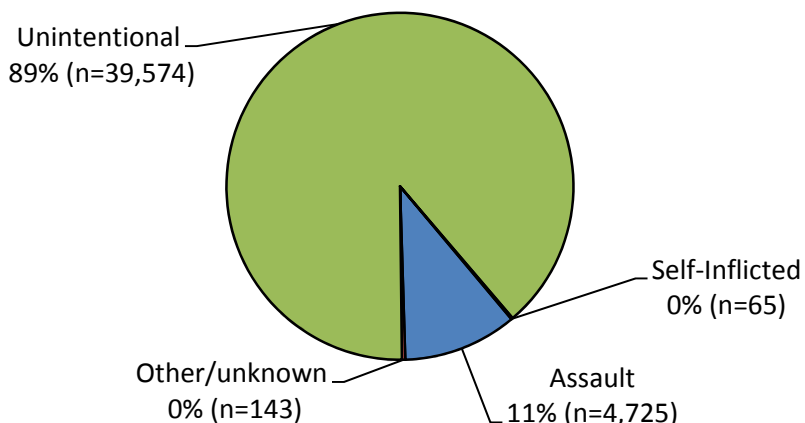
Unlike with mortality and hospitalization rate, age-adjusted TBI emergency department visit rates were highest among residents of Yavapai County, with the next highest rates in Pima and Graham Counties. Apache and Navajo Counties have lower rates of TBI-related non-fatal emergency department rates than 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 31 shows age-adjusted emergency department visit rates by county of residence.

Figure 31.



The majority of TBI emergency department visits were due to unintentional injuries (89 percent, n=39,574), and 11 percent were assaults (n=4,725). Figure 32 shows TBI emergency department visits by intent during 2010 in Arizona.

Figure 32. TBI Emergency Department Visits by Manner of Injury, Arizona, 2010 (n=44,507)



The leading causes of TBI emergency department visits were falls (51 percent, n=22,675), struck by/against injuries (24 percent, n=10,838), and motor vehicle traffic-related injuries (12 percent, n=5,518). Table 3 shows TBI emergency department visits by cause for Arizona in 2010. Descriptions of these causes are given in Appendix A.

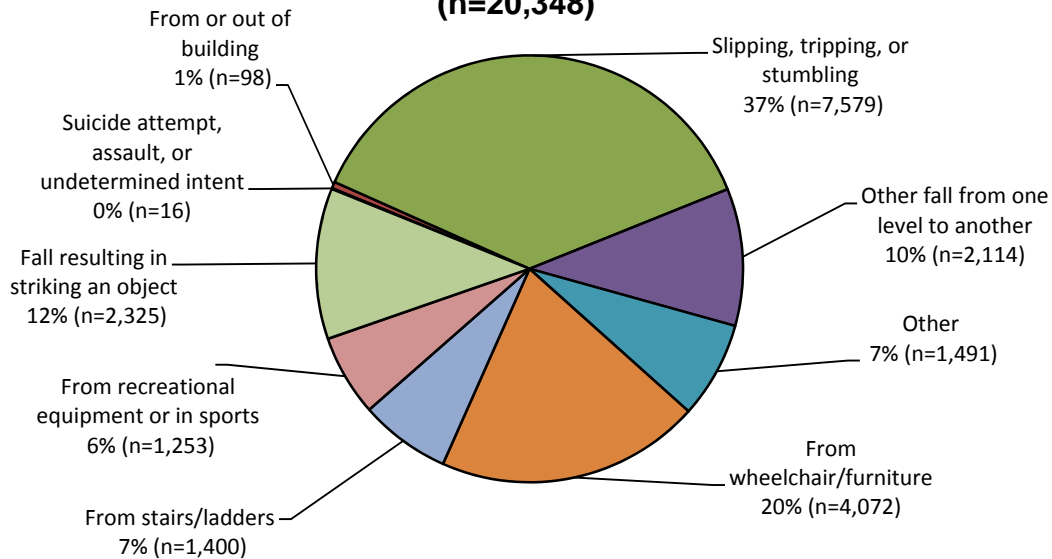
Cause	Number	Percentage
Fall	22,675	51%
Struck by/against	10,838	24%
Motor vehicle traffic	5,518	12%
Other/unspecified	3,160	7%
Transport	1,219	3%
Other pedal cycle	1,097	2%
Total	44,507	100%

Non-Fatal Fall-Related Emergency Department Visits

There were 22,675 emergency department visits due to fall-related TBI. Forty-seven percent were among males (n=10,701) and 53 percent were among females (n=11,971). Nearly all of these falls were unintentional (n=22,659). Forty-eight percent of TBI emergency department visits due to falls were among individuals 19 years and younger (n=10,874).

Ten percent of the falls did not have contributing event information specified in the hospital discharge database (n=2,327). The most frequently specified contributing events to fall-related TBI were slipping, tripping, or stumbling (37 percent of specified events, n=7,579) and falls from furniture or wheelchairs (20 percent of specified events, n=4,072). Figure 33 shows TBI emergency department visits due to falls by specified contributing event.

Figure 33. TBI Emergency Department Visits due to Falls by Specified Contributing Event (All Manners), Arizona, 2010 (n=20,348)

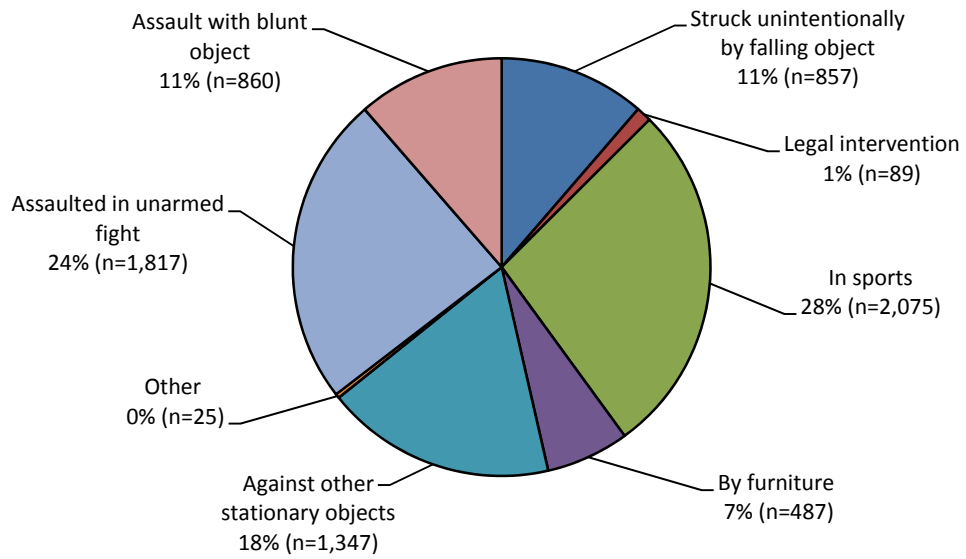


Non-Fatal Struck By/Against-Related TBI Emergency Department Visits

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 10,838 TBI emergency department visits due to struck by/against injuries, 63 percent were among males (n=6,789) and 37 percent were among females (n=4,049). Seventy-four percent of these injuries were unintentional (n=8,072), and 25 percent were assaults (n=2,677). One percent of emergency department visits resulted from struck by/against injuries due to legal intervention (n=89). Fifty-four percent of TBI emergency department visits from struck by/against injuries were among individuals 19 years and younger (n=5,808).

The emergency department discharge database did not include information regarding contributing event for 30 percent of the struck by/against injuries (n=3,281). The most frequently specified contributing events were unintentional blows while playing sports (28 percent of specified events, n=2,075) and assaults in unarmed fights (24 percent of specified events, n=1,817). Figure 34 shows TBI emergency department visits due to struck by/against injuries by specified contributing event.

Figure 34. TBI Emergency Department Visits due to Struck By/Against Injuries by Specified Contributing Event (All Manners), Arizona, 2010 (n=7,557)



Data Notes

All rates were calculated using the 2010 United States Decennial Census figures for Arizona, available on the internet from the U.S. Census Bureau's American FactFinder. 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 2010. Inpatient hospitalization and emergency department visit data were compiled from the 2010 Arizona Hospital 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 2010 and a subsequent increase in the rate of inpatient hospitalizations and emergency department visits for traumatic brain injuries since 2008.

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 of Injury	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.
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.
Unknown cause	Cause not listed.