



## **TRAUMATIC BRAIN INJURIES**

### **ARIZONA RESIDENTS, 2012**



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# EXECUTIVE SUMMARY

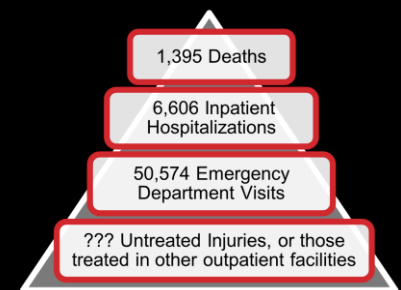
## ARIZONA RESIDENTS, 2012

Traumatic brain injuries (TBI) were the cause of death for 1,395 Arizona residents in 2012. Males ages 85 years and older had the highest rate of TBI deaths with 196.1 deaths per 100,000 residents. TBI death rates were highest among American Indians (32.8 per 100,000 residents) and Non-Hispanic Whites (21.5 per 100,000 residents). Forty-four percent of TBI deaths in 2012 were due to unintentional injuries (n=615); 40 percent were due to suicides (n=566); and nine percent were due to homicides (n=126). The most common causes of TBI deaths were firearms (47 percent, n=662), falls (25 percent, n=348), and motor vehicle traffic crashes (14 percent, n=194).

In 2012, there were 6,606 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 661.1 hospitalizations per 100,000 residents, and among females 85 years and older, the rate was 495.1 hospitalizations per 100,000 residents. Age-adjusted TBI inpatient hospitalization rates were highest among American Indians (251.5 per 100,000 residents) and Non-Hispanic Whites (100.9 per 100,000 residents). Unintentional injuries accounted for 85 percent of TBI hospitalizations (n=5,639). Falls were the most common cause of TBI hospitalizations (45 percent, n=2,942), followed by motor vehicle traffic crashes (28 percent, n=1,843). Total hospital charges for non-fatal inpatient hospitalizations due to TBIs were more than \$508.9 million, and Arizonans spent a total of 35,449 days hospitalized in 2012.

In 2012, there were 50,574 non-fatal TBI emergency department visits among Arizona residents. TBI emergency department visit rates were highest among children younger than one year of age for males and over 85 years of age for females. Males younger than one year of age had a rate of 2,839.2 visits per 100,000 residents, and females 85 years and older had a rate of 2,724.4 visits per 100,000 residents. Among children under one, 99.8 percent of the TBI-related emergency department visits were due to unintentional injuries. Overall, unintentional injuries accounted for 90 percent of the TBI emergency department visits. The leading causes of TBI emergency department visits were falls (52 percent, n=26,090), struck by/against injuries (24 percent, n=12,071), and motor vehicle traffic crashes (14 percent, n=6,841). Total hospital charges for non-fatal emergency department visits due to TBIs were more than \$275.7 million.

## TBI: AT A GLANCE



**For every TBI-related death in Arizona in 2012, there were:**

- 5 Non-fatal inpatient hospitalizations and**
- 36 Non-fatal emergency department visits,**
- Resulting in over \$784.6 million in hospital charges**

By Jennifer Dudek, MPH  
150 North 18<sup>th</sup> Avenue, Suite 320  
Phoenix, AZ 85007  
Office of Injury Prevention  
Bureau of Women's and Children's Health  
Arizona Department of Health Services  
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# 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. Approximately 1.4 million Americans sustain these injuries annually, 50,000 of whom die as a result of the trauma.<sup>1</sup> 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.<sup>2,3</sup> TBI can cause cognitive function deficits, which can lead to depression and other adverse secondary outcomes including problems working and performing daily activities such as completing academic assignments, managing personal finances, or driving a vehicle.

The data presented in this report illustrate the public health burden associated with TBI in Arizona. Besides the obvious impacts TBI can have on overall health, traumatic brain injuries often result in considerable medical expenses, quality of life changes, and lost wages. 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. For severe, but non-fatal TBI, families may be required to provide care, often resulting in time away from work, loss of income, and increases in stress. At the community level, the financial costs of TBI include medical expenses, rehabilitation, lost wages, and lost productivity. **Most TBI injuries are preventable.** Understanding the risk factors associated with TBI is an important step toward educating and empowering communities to implement effective prevention strategies.

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<sup>1</sup> 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

<sup>2</sup> Ibid

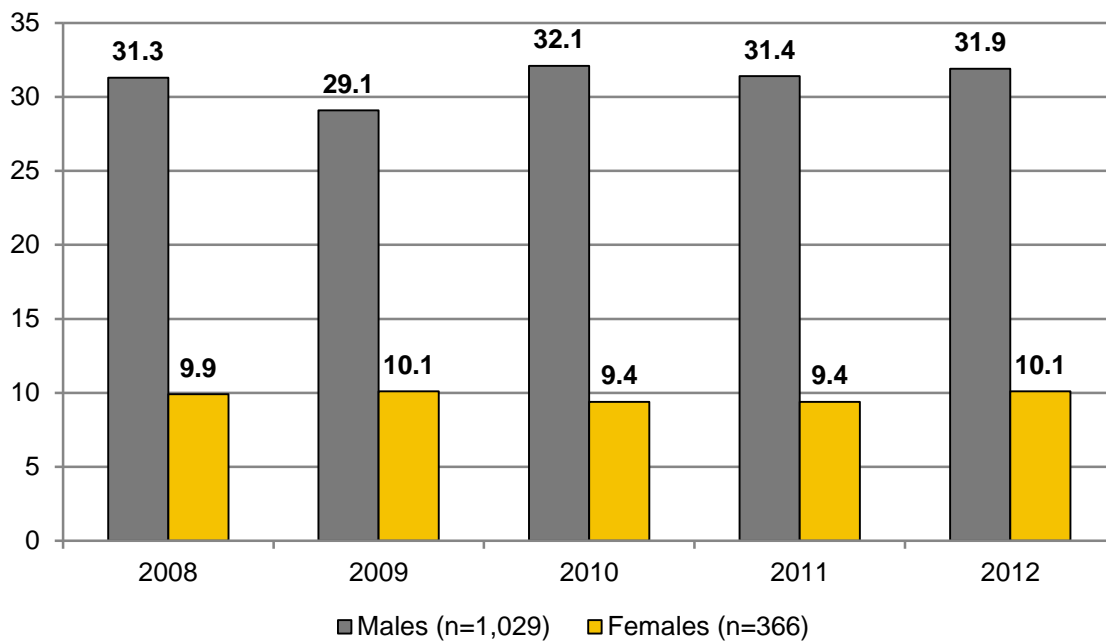
<sup>3</sup> Thurman D, Alverson C, Dunn K, Guerrero J, Sniezek J. Traumatic brain injury in the United States: a public health perspective. *Journal of Head Trauma Rehabilitation* 1999;14(6):602–15.

# TRENDS IN TRAUMATIC BRAIN INJURIES AMONG ARIZONA RESIDENTS, 2008-2012

## *Mortality*

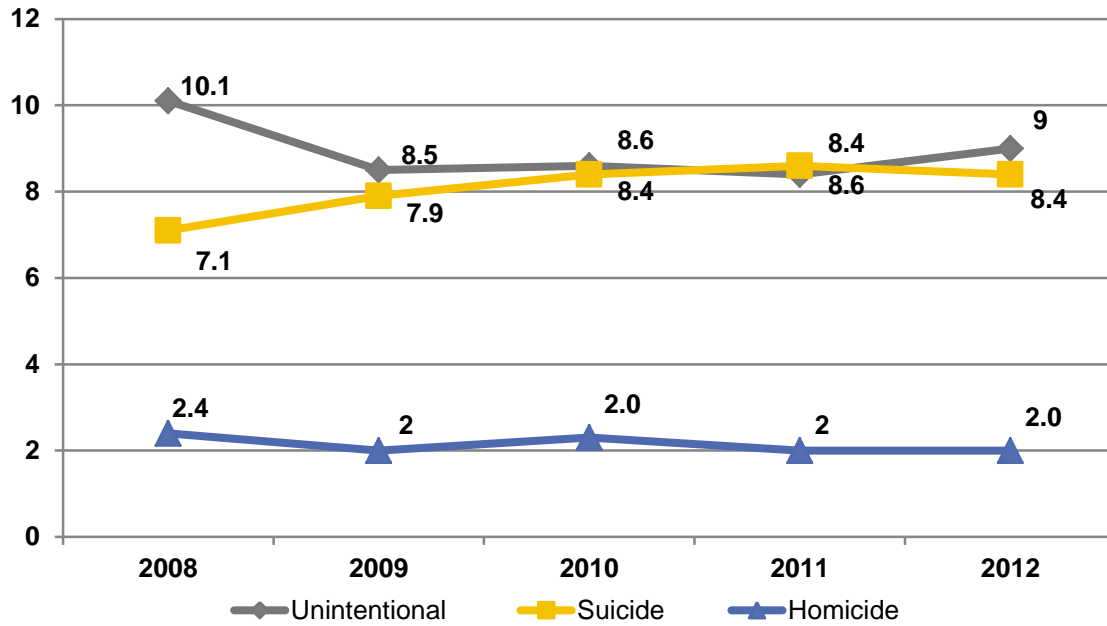
Between 2008 and 2012, the age-adjusted mortality rate of traumatic brain injury increased from 20.6 deaths per 100,000 Arizona residents in 2008 to 21.0 deaths per 100,000 residents in 2012. Age-adjusted mortality rates among males were more than double the rates among females. Rates for males and females increased 2 percent from 2008 through 2012. Figure 1 shows age-adjusted TBI mortality rates by sex from 2008 through 2012.

**Figure 1. Age-Adjusted TBI Mortality Rates by Sex, Arizona, 2008-2012**

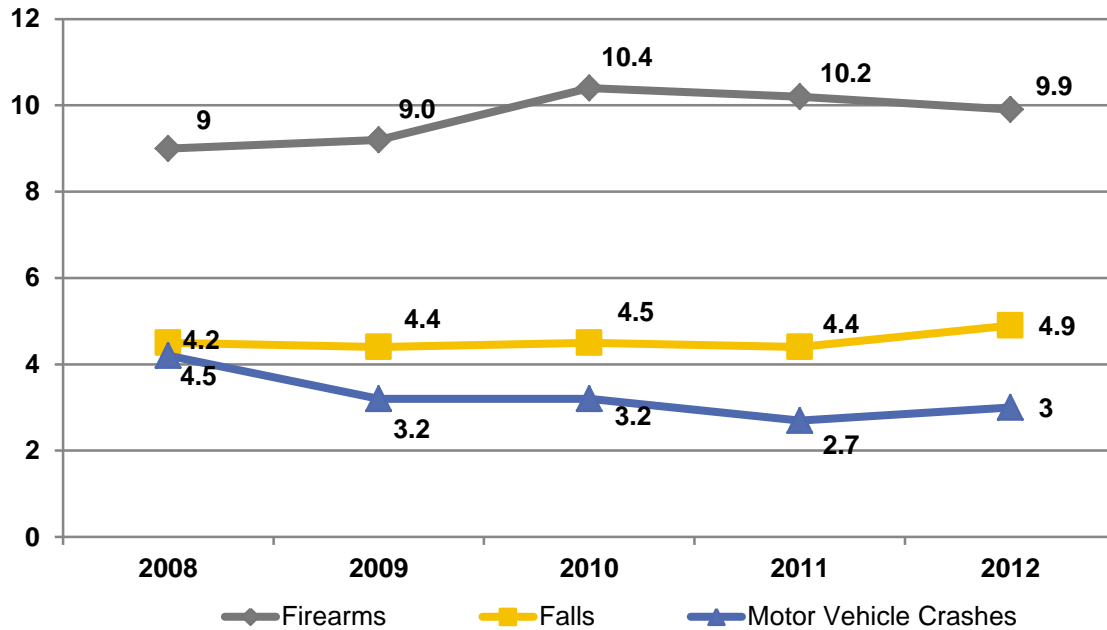


The 2012 age-adjusted rates of unintentional TBI-related deaths decreased by 11 percent from 2008 but increased by seven percent from 2011. Suicide rates increased 18 percent since 2008 but have decreased by two percent since 2011. Figure 2 shows age-adjusted TBI mortality rates by manner of death. The age-adjusted rates of motor vehicle crash TBI-related deaths have decreased 33 percent since 2008 while fall-related deaths increased 17 percent. Firearm-related TBI deaths also increased, by 10 percent, since 2008. Figure 3 shows age-adjusted TBI mortality rates by selected cause of injury.

**Figure 2. Age-Adjusted TBI Mortality Rates per 100,000 Residents by Manner of Death, Arizona, 2008-2012**



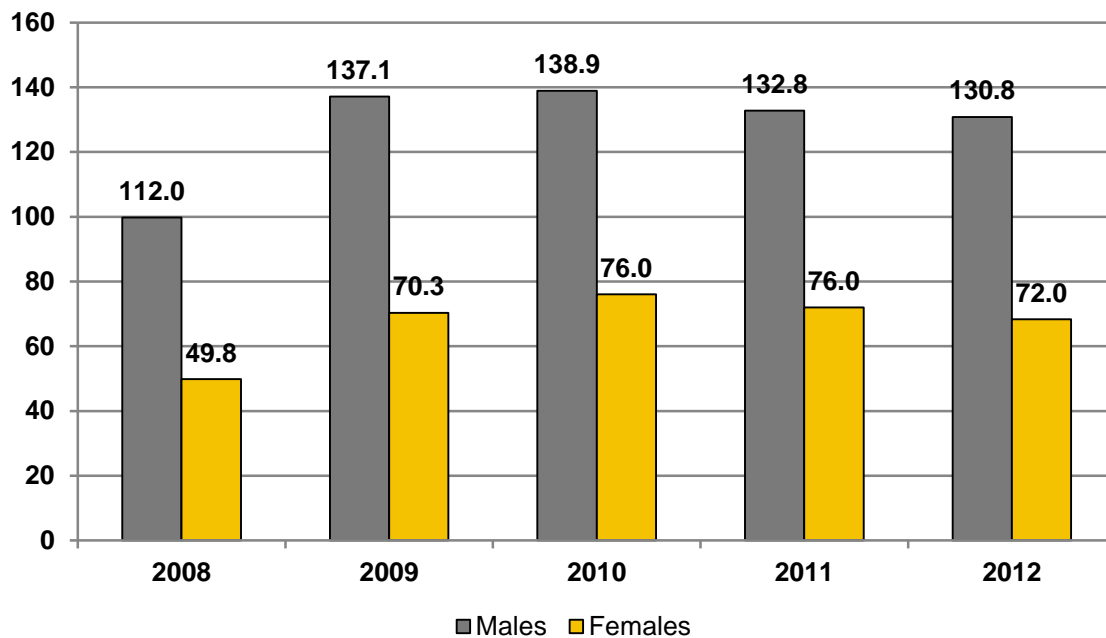
**Figure 3. Age-Adjusted TBI Mortality Rates per 100,000 Residents by Mechanism, Arizona, 2008-2012**



## ***Non-Fatal Inpatient Hospitalizations***

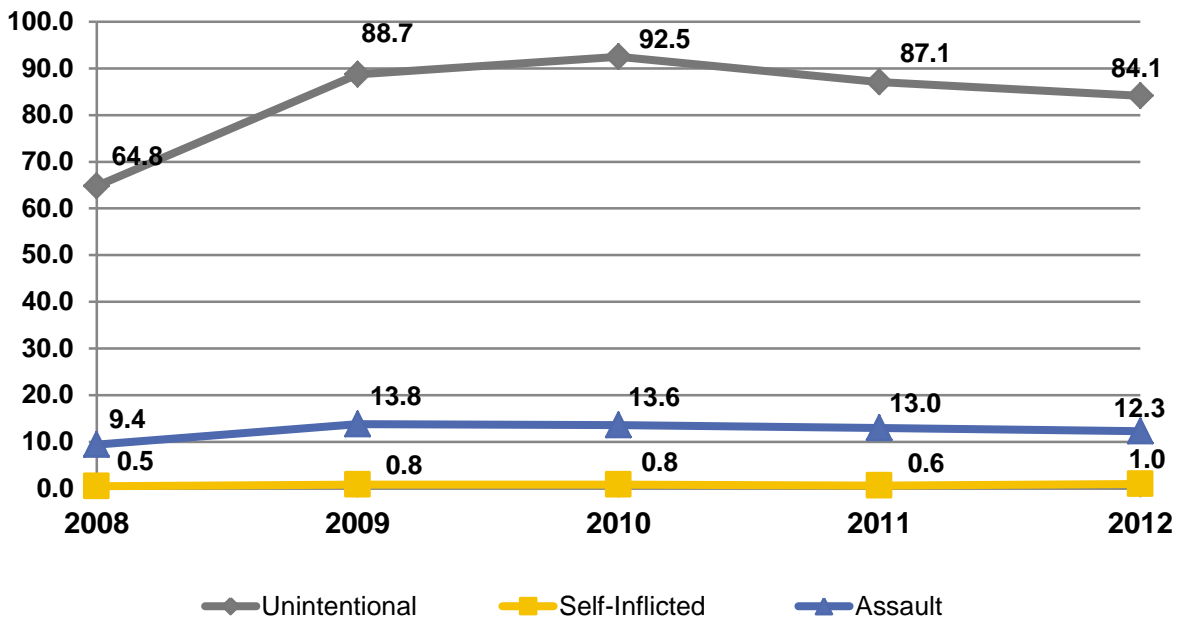
Between 2008 and 2012, the age-adjusted rate of TBI-related inpatient hospitalizations increased 25 percent, from 80.9 hospitalizations per 100,000 Arizona residents in 2008 to 101.4 hospitalizations per 100,000 residents in 2012. Despite that general upward trend, the 2012 rate was actually three percent lower than the 2011 rate, when it was 104.4 hospitalizations per 100,000 residents. Age-adjusted hospitalization rates among males were almost double the rates among females. Rates for males increased 17 percent from 2008 through 2012, and rates for females increased 45 percent. Figure 4 shows age-adjusted non-fatal TBI-related inpatient hospitalization rates by sex from 2008 through 2012. Please refer to the Data Notes Section of this report for additional information regarding increased inpatient hospitalization rates beginning in 2009.

**Figure 4. Age-Adjusted Non-Fatal TBI-Related Inpatient Hospitalization Rates by Sex, Arizona, 2008-2012**



While total age-adjusted TBI-related inpatient hospitalization rates increased from 2008 through 2012, changes in rates varied by manner and mechanism of injury. Figure 5 shows age-adjusted TBI hospitalization rates by manner of injury.

**Figure 5. Age-Adjusted Non-Fatal TBI-Related Inpatient Hospitalization Rates per 100,000 Residents by Manner of Injury, Arizona, 2008-2012**

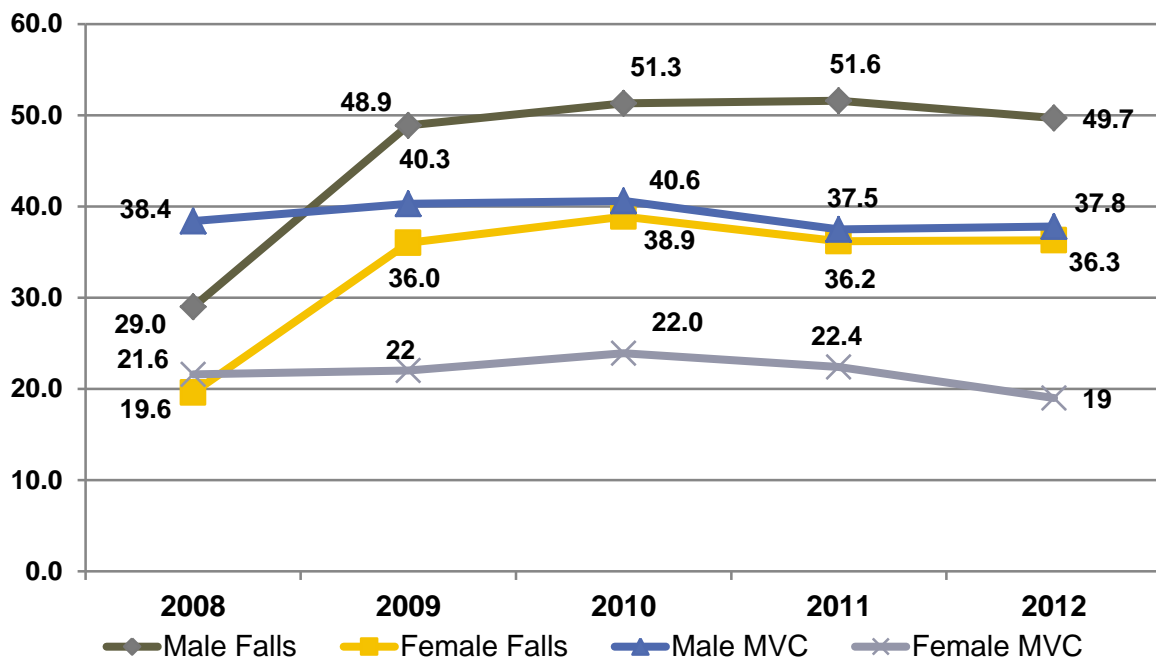


From 2008 through 2012, the rate of non-fatal inpatient hospitalizations due to fall-related traumatic brain injuries increased 77 percent, from 24.3 hospitalizations per 100,000 residents in 2008 to 43.0 hospitalizations per 100,000 residents in 2012. Males had a higher rate of fall-related TBI hospitalizations than females in each of the five years examined, and the disparity has grown over time.

While the rate of fall-related TBI hospitalizations increased since 2008, the rate of motor vehicle crash-related TBI hospitalizations decreased five percent in the past five years, from 30.0 crash-related hospitalizations in 2008 to 28.4 crash-related hospitalizations in 2012. 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. From 2009 onward, however, the rate of motor vehicle crash-related TBI hospitalizations was lower than the rate of fall-related cases. Figure 6 shows the trend of fall- and motor vehicle crash-related TBI hospitalizations by sex from 2008 through 2012.

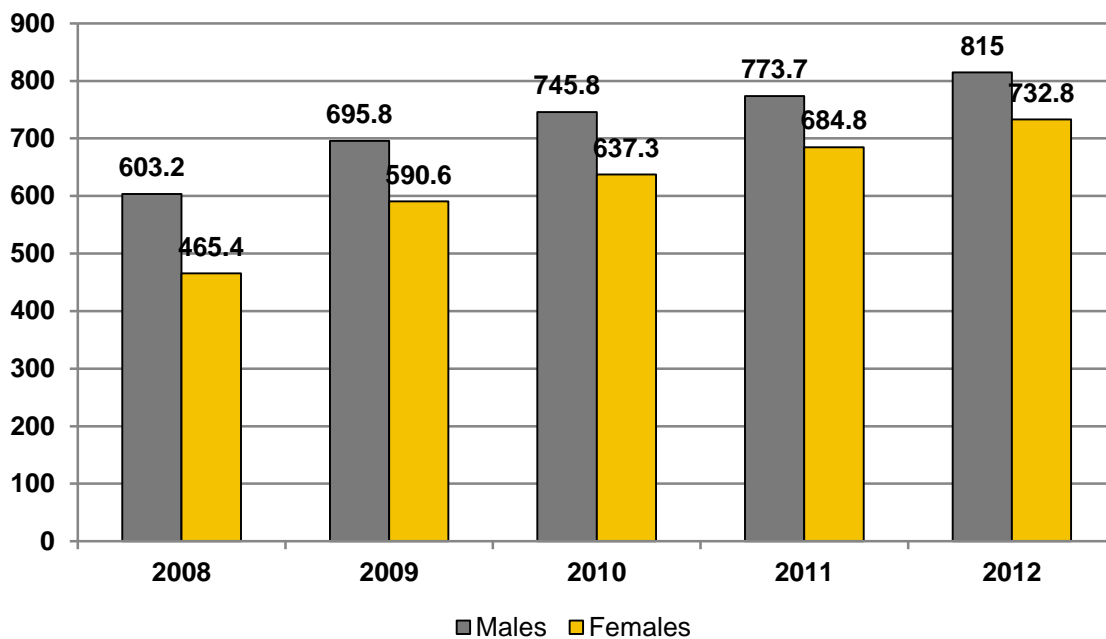
**Figure 6. Age-Adjusted Non-Fatal TBI Inpatient Hospitalization Rates per 100,000 Residents by Mechanism and Sex, Arizona, 2008-2012**



## ***Non-Fatal Emergency Department Visits***

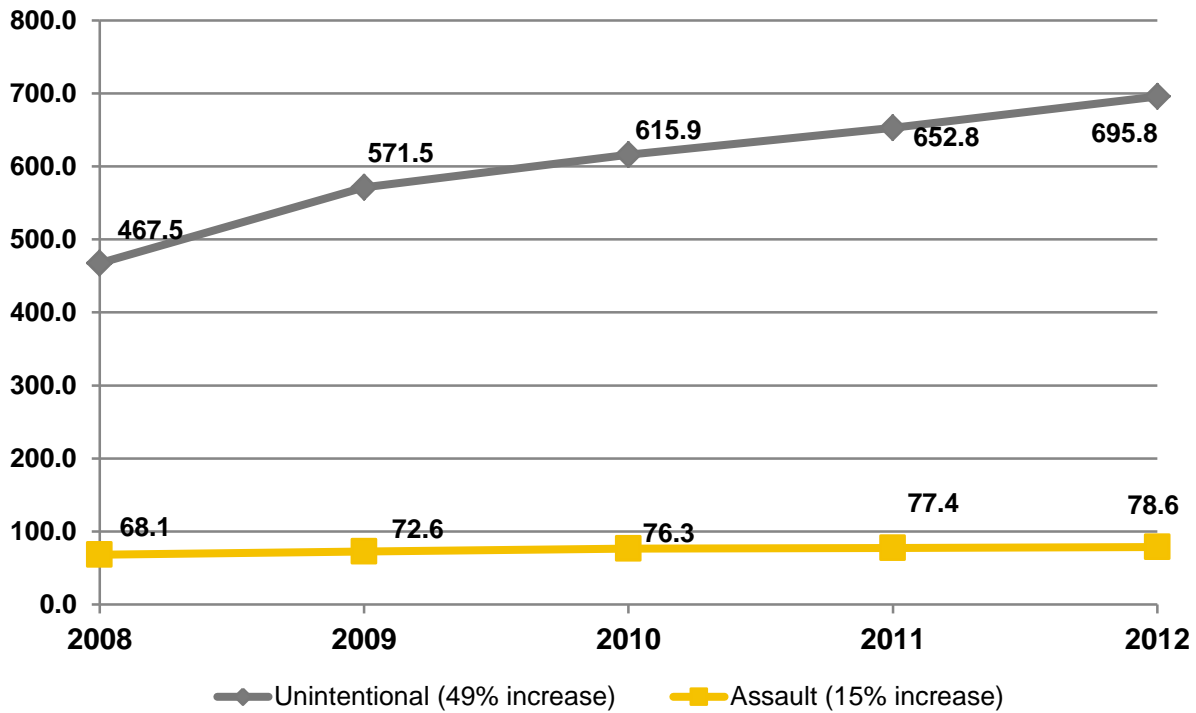
From 2008 through 2012, the age-adjusted rate of non-fatal TBI-related emergency department visits increased among both males and females. Among males, the rates increased 35 percent, from 603.2 visits per 100,000 Arizona residents in 2008 to 815.0 visits per 100,000 residents in 2012. Among females, rates increased 57 percent, from 465.4 visits per 100,000 in 2008 to 732.8 visits per 100,000 residents in 2012. Age-adjusted emergency department visit rates among males were higher than rates among females for the last five years. Figure 7 shows age-adjusted TBI-related emergency department visit rates by sex from 2008 to 2012. Please refer to the Data Notes Section of this report for additional information regarding increased emergency department visit rates beginning in 2009.

**Figure 7. Age-Adjusted Non-Fatal TBI-Related Emergency Department Visit Rates by Sex, Arizona, 2008-2012**

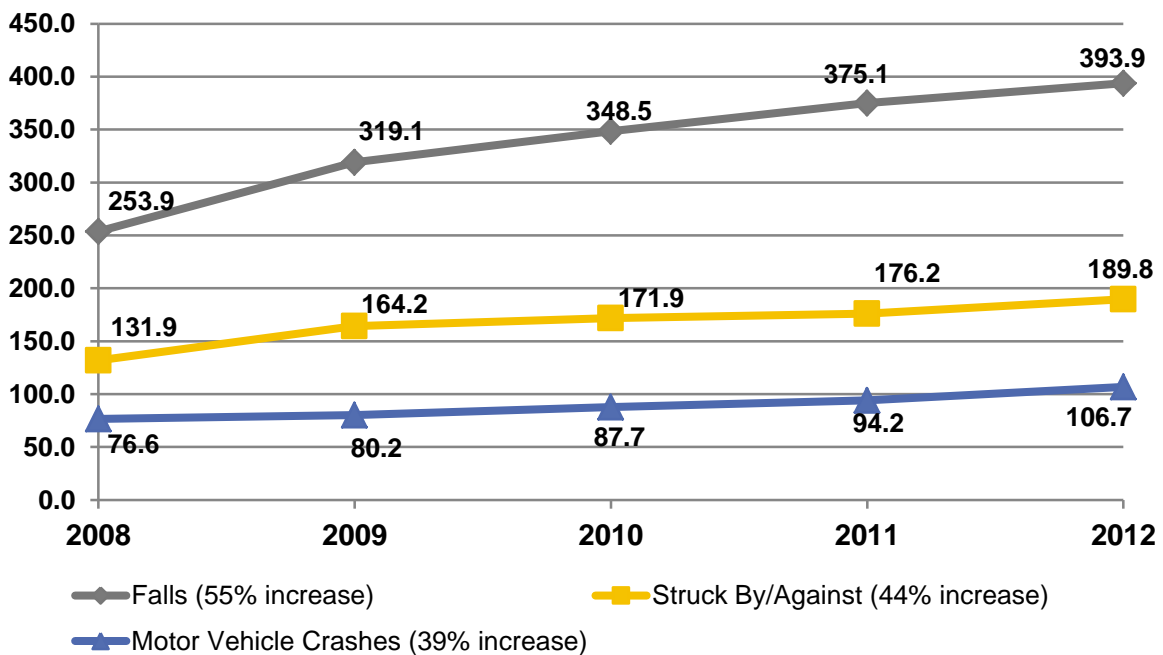


While total age-adjusted TBI-related emergency department visit rates increased from 2008 through 2012, changes in rates varied by manner and mechanism of injury. Unintentional injuries and injuries related to assaults increased at varying levels from 2008 through 2012. TBI-related hospitalizations due to self-harm are relatively low and are therefore not included in the figure. Figure 8 shows age-adjusted TBI emergency department visit rates by manner of injury, and Figure 9 shows age-adjusted rates for non-fatal TBI-related emergency department visits for selected causes of injury.

**Figure 8. Age-Adjusted Non-Fatal TBI-Related Emergency Department Visit Rates per 100,000 Residents by Manner of Injury, Arizona, 2008-2012**



**Figure 9. Age-Adjusted Non-Fatal TBI-Related Emergency Department Visit Rates per 100,000 Residents by Selected Cause of Injury, Arizona, 2008-2012**

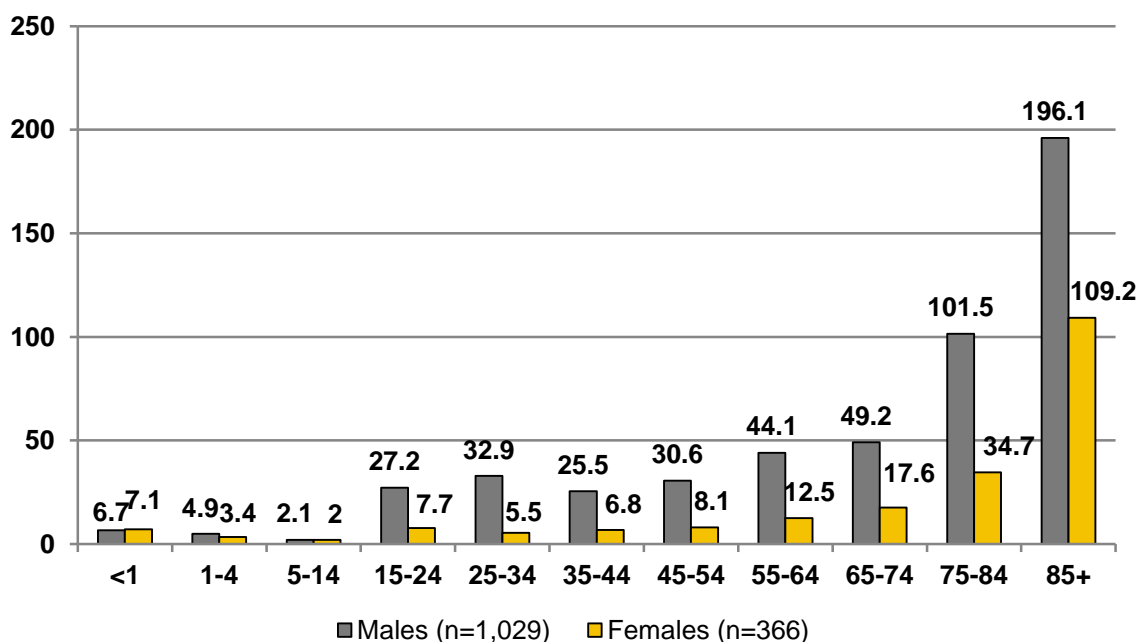


# DEATHS AMONG ARIZONA RESIDENTS DURING 2012

In 2012, 1,395 Arizona residents died as a result of TBI. The majority of deaths were among males (74 percent, n=1,029), while females accounted for 26 percent of TBI deaths (n=366). Males had higher rates of TBI-related mortality across all age groups, except among children under one year.

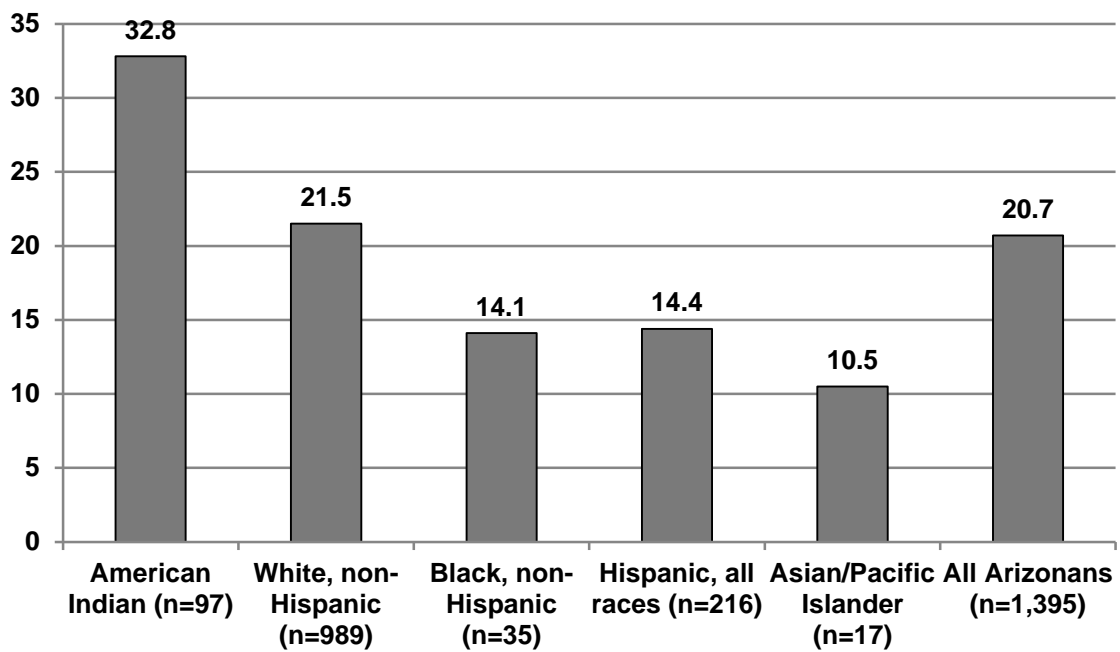
Males 85 years and older accounted for 78 deaths and had by far the highest rate of TBI deaths in 2012 (196.1 per 100,000 residents). Among adults 85 years and older, 75 percent of TBI deaths were due to unintentional falls (n=115). Figure 10 shows the 2012 TBI death rates by age group and sex for Arizona residents.

**Figure 10. Age-Specific TBI-Related Mortality Rates per 100,000 Residents by Sex, Arizona, 2012 (n=1,395)**



Age-adjusted TBI death rates were highest among American Indians (32.8 deaths per 100,000 residents) and Non-Hispanic Whites (21.5 deaths per 100,000 residents). Rates were lowest among Asian/Pacific Islanders, however the number of TBI-related death among this group were too low to calculate a reliable rate. Figure 11 shows the 2012 age-adjusted TBI death rates by race/ethnicity in Arizona.

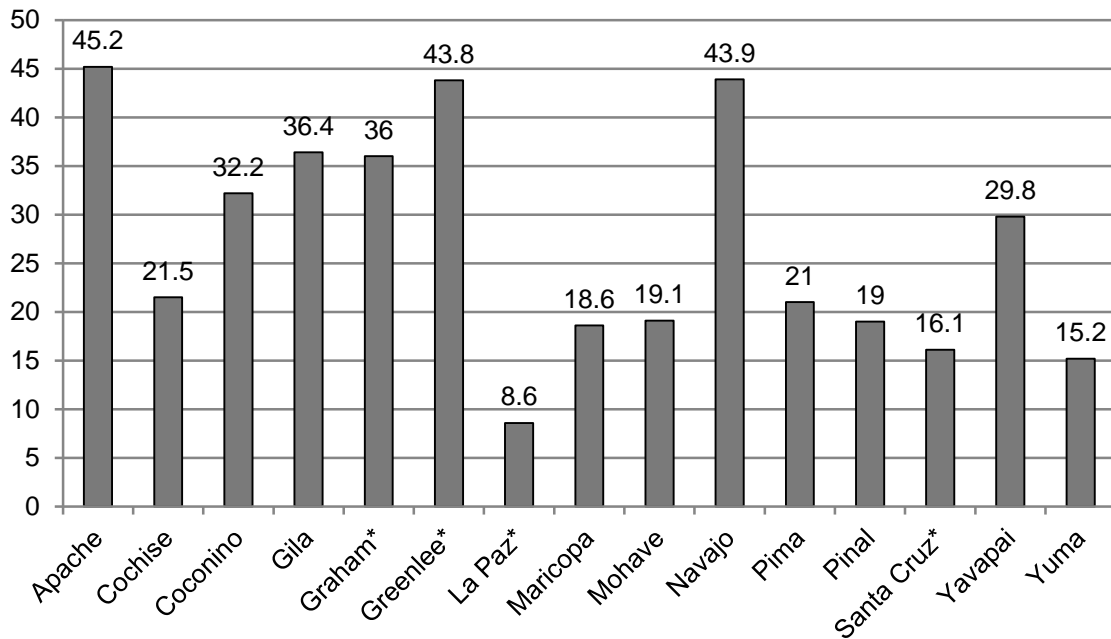
**Figure 11. Age-Adjusted TBI-Related Mortality Rates per 100,000 Residents by Race/Ethnicity, Arizona, 2012 (n=1,395)**



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

Apache county had the highest age-adjusted TBI mortality rate in 2012 (45.2 deaths per 100,000 residents). The second highest TBI mortality rate was in Navajo county with 43.9 deaths per 100,000 residents. Figure 12 shows the TBI mortality rate by county for 2012 in Arizona.

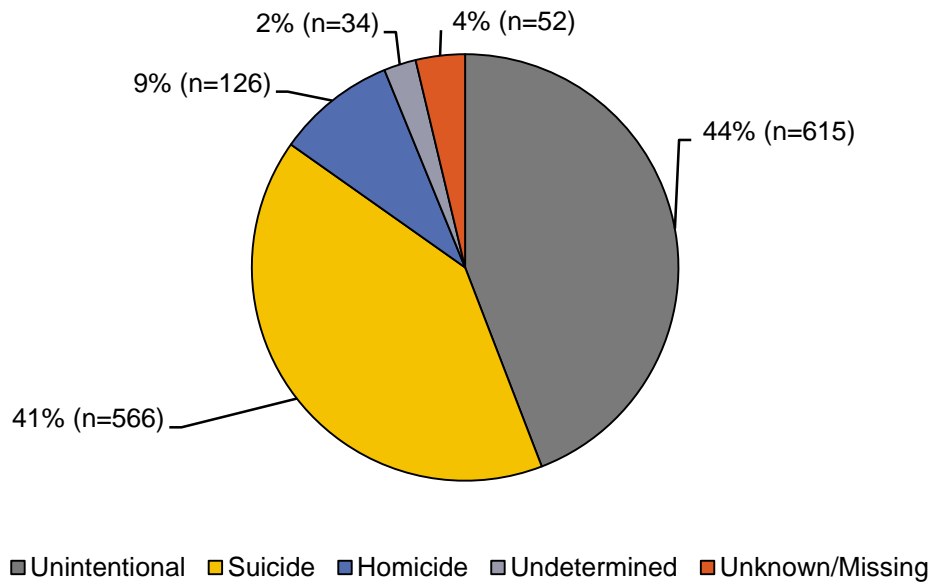
**Figure 12. Age-Adjusted TBI-Related Mortality Rates per 100,000 Residents by County, Arizona, 2012 (n=1,395)**



\*Rates are unstable due to low counts (n<20)

Forty-four percent of the TBI deaths in 2012 were due to unintentional injuries (n=615); 41 percent were due to suicides (n=566); and nine percent were due to homicides (n=126). Figure 13 shows TBI deaths by manner of injury during 2012 in Arizona.

**Figure 13. TBI-related Deaths by Manner, Arizona, 2012 (n=1,395)**



The most common causes of deaths were firearms (47 percent, n=662), falls (25 percent, n=348), and motor vehicle traffic crashes (14 percent, n=194). Causes of TBI deaths during 2012 in Arizona are shown in Table 1. Descriptions of these causes are given in Appendix A.

Cause	Number	Percentage
Firearm	662	47%
Fall	348	25%
Motor vehicle traffic	194	14%
Other/unspecified/unknown	140	10%
Other land transport	12	1%
Other pedestrian	7	1%
<b>Total</b>	<b>1395</b>	<b>100%</b>

The causes and manners of TBI-related mortality varied greatly by race/ethnicity. Suicides, due primarily to firearms, were highest among White, non-Hispanic Arizonans, while unintentional injuries, specifically due to motor vehicle crashes, were the leading cause and manner of TBI-related death among American Indian residents. Figures 14 and 15 show the percentages of TBI-related deaths for each race/ethnicity by cause and manner of death.

Figure 14. TBI-related Deaths by Manner and Race/Ethnicity, Arizona, 2012 (n=1,395)

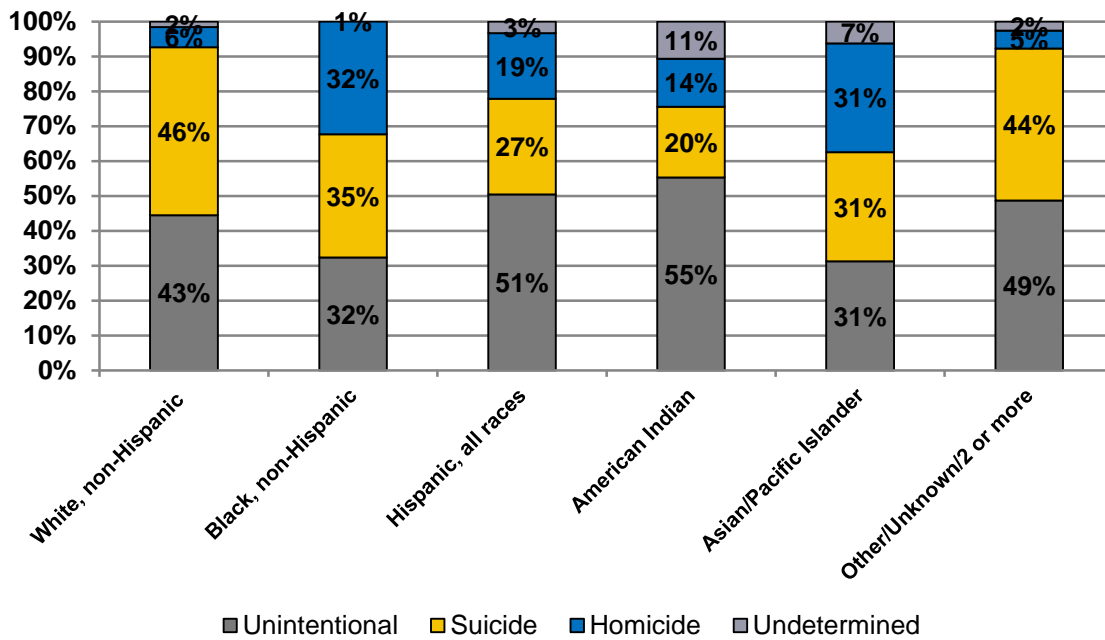
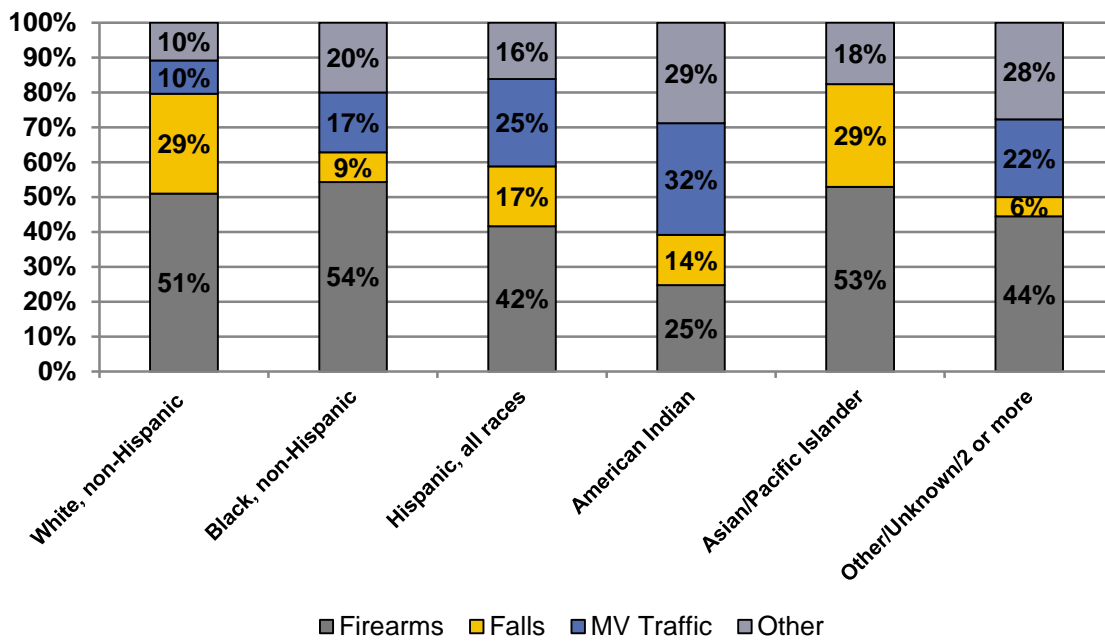


Figure 15. TBI-related Deaths by Mechanism and Race/Ethnicity, Arizona, 2012 (n=1,395)



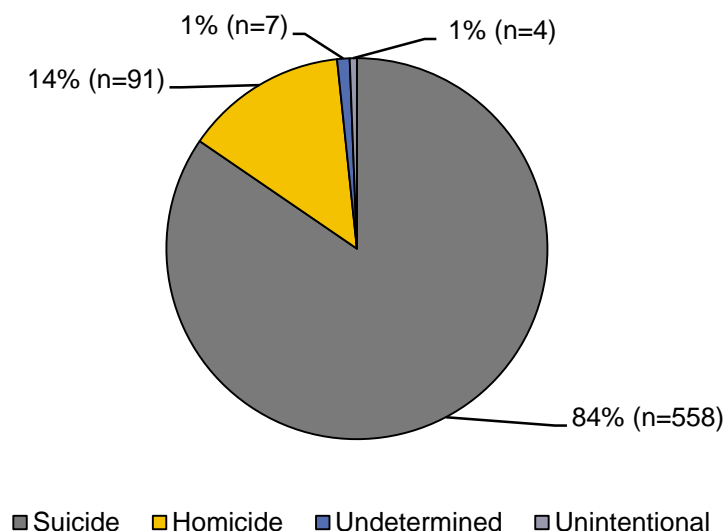
### Firearm-Related TBI Mortality

Among the 662 Arizona residents who died as a result of a firearm-related TBI, the majority were male (85 percent, n=560) and 15 percent were female (n=102).

The highest age-adjusted rate of firearm-related TBI deaths was among White Non-Hispanics (11.8 per 100,000 residents, n=504). The second highest rate was among African Americans (7.0 per 100,000 residents, n=19) but is not considered a stable rate (n<20). Hispanic Arizonans had the second highest count of firearm-related TBI (n=90) however the rate for this group was low, 4.9 per 100,000 residents.

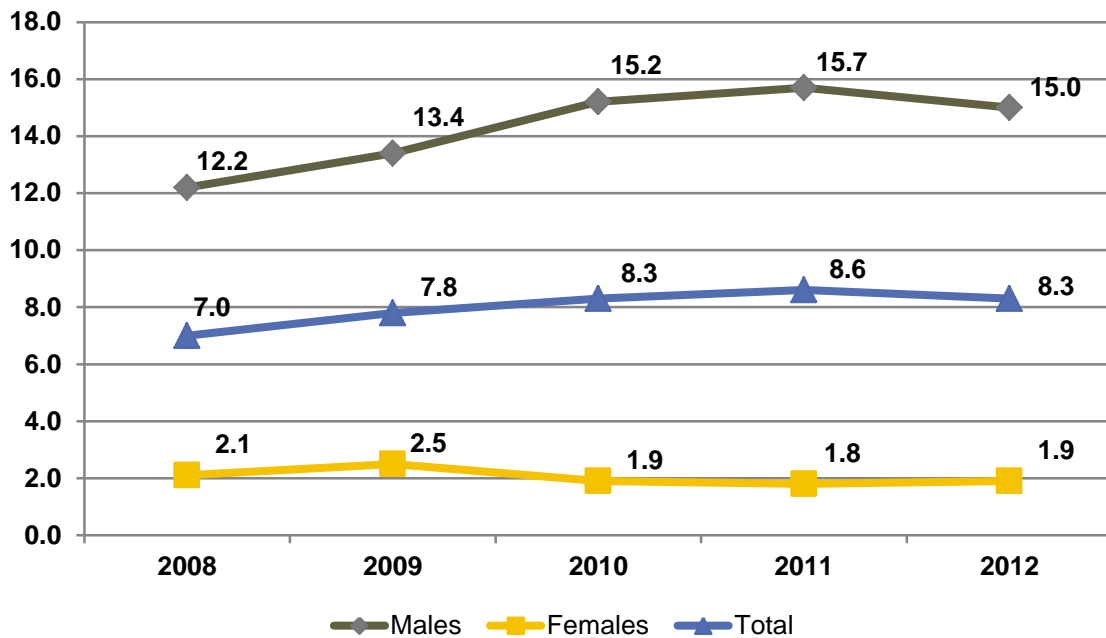
The majority of firearm-related TBI deaths were suicides (84 percent, n=558). Sixteen percent of the deaths were due to homicides (n=91); one percent were due to undetermined intent (n=7) and less than one percent were unintentional injuries (n=4). Figure 16 shows TBI deaths due to firearms by manner of injury.

**Figure 16. Firearm-related TBI Deaths by Manner, Arizona, 2012 (n=662)**



Among the 558 TBI deaths resulting from firearm-related suicides, 88 percent were among males (n=493) and 12 percent were among females (n=65). The age-adjusted rate of TBI deaths resulting from firearm-related suicides was 8.3 deaths per 100,000 residents. The highest age-specific rates were among adult males, particularly among those 85 years and older (40.2 per 100,000). Age-adjusted rates were substantially higher among males than among females over each of the years from 2008-2012. Figure 17 shows the age-adjusted rate of TBI deaths resulting from firearm-related suicides by sex and year from 2008 through 2012.

**Figure 17. Age-Adjusted TBI Mortality Rate due to Firearm Suicides by Sex and Year, Arizona, 2008-2012**

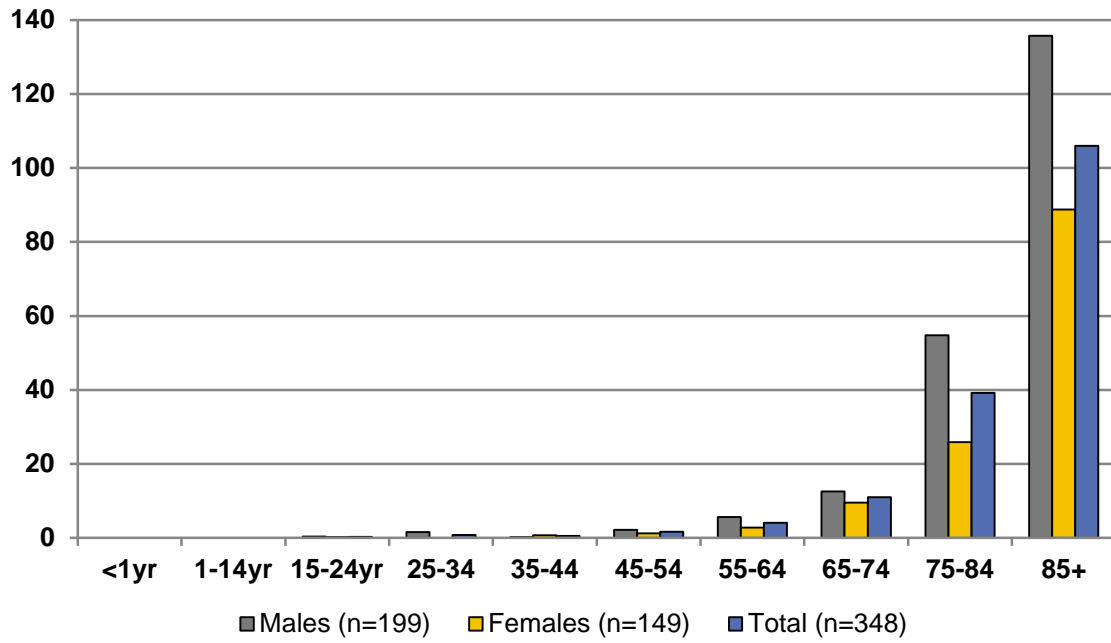


The highest age-adjusted rate of firearm-related TBI suicides was among White Non-Hispanics (10.5 per 100,000 residents, n=451). This high race-specific mortality rate coupled with the large population propelled the age-adjusted mortality rate for all Arizonans. The age-adjusted rate among American Indians was 7.2 deaths per 100,000 residents and the rate for Hispanic Arizonans was 3.3 deaths per 100,000 residents. For all other races, the total number of firearm-related suicides was too low to calculate a stable rate (n<20).

#### *Fall-Related TBI Mortality*

Among the 348 TBI deaths due to falls, 57 percent were among males (n=199) and 43 percent were among females (n=149). All but two 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=3). Sixteen percent of the deaths were among adults ages 25 through 64 years (n=56); and 83 percent were among adults 65 years and older (n=289). The age-adjusted rate of all fall-related TBI deaths in Arizona for 2012 was 4.9 deaths per 100,000 residents, however the highest age-specific mortality rate was among adults 85 years and older (106 per 100,000 residents) followed by adults 75 through 84 years of age (39.2 per 100,000 residents).

**Figure 18. Fall-Related TBI Mortality Rates per 100,000 Residents  
by Age and Sex, Arizona, 2012 (n=348)**

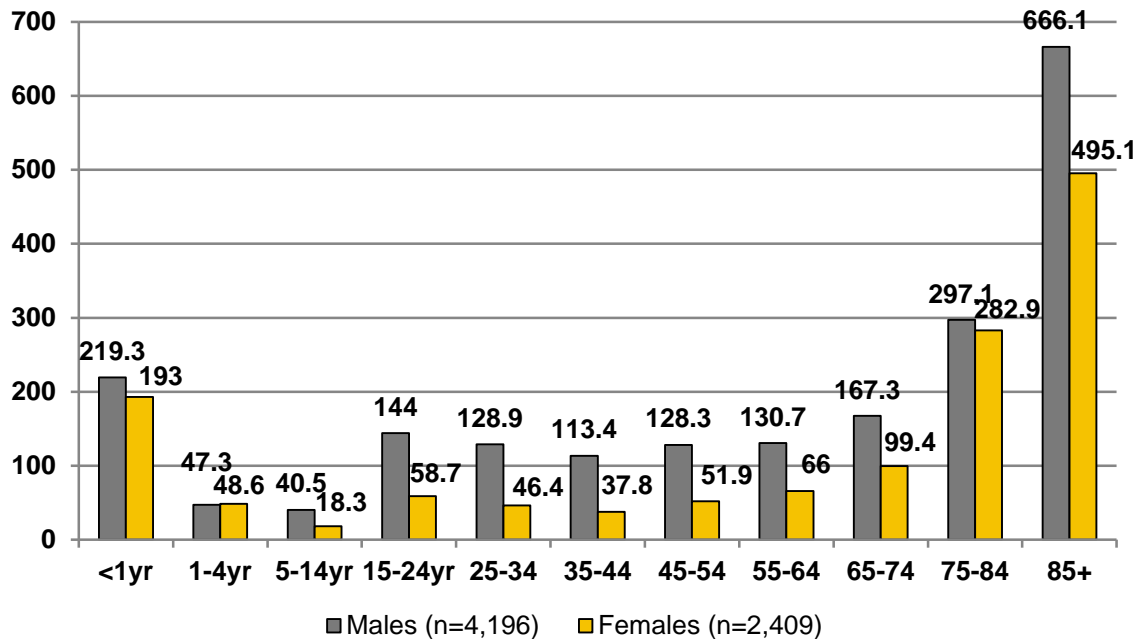


# Non-Fatal Inpatient Hospitalizations among Arizona Residents During 2012

In 2012, 6,606 Arizona residents were hospitalized due to non-fatal TBI. Males comprised 64 percent of total TBI hospitalizations (n=4,196) and females accounted for 36 percent (n=2,409). There was also one individual of unknown sex.

Adults 85 years and older had the highest rates of TBI inpatient hospitalizations in 2012. Males 85 years and older had a rate of 666.1 hospitalizations per 100,000 residents (n=265), an increase of seven percent from 2011. The rate for females 85 years and older was 495.1 hospitalizations per 100,000 residents (n=340), a 17 percent decrease from the 2011 rate. For adults 85 years and older, 89 percent of hospitalizations were due to unintentional falls (n=538). Figure 19 shows the 2012 TBI inpatient hospitalization rates by age group and sex for Arizona residents.

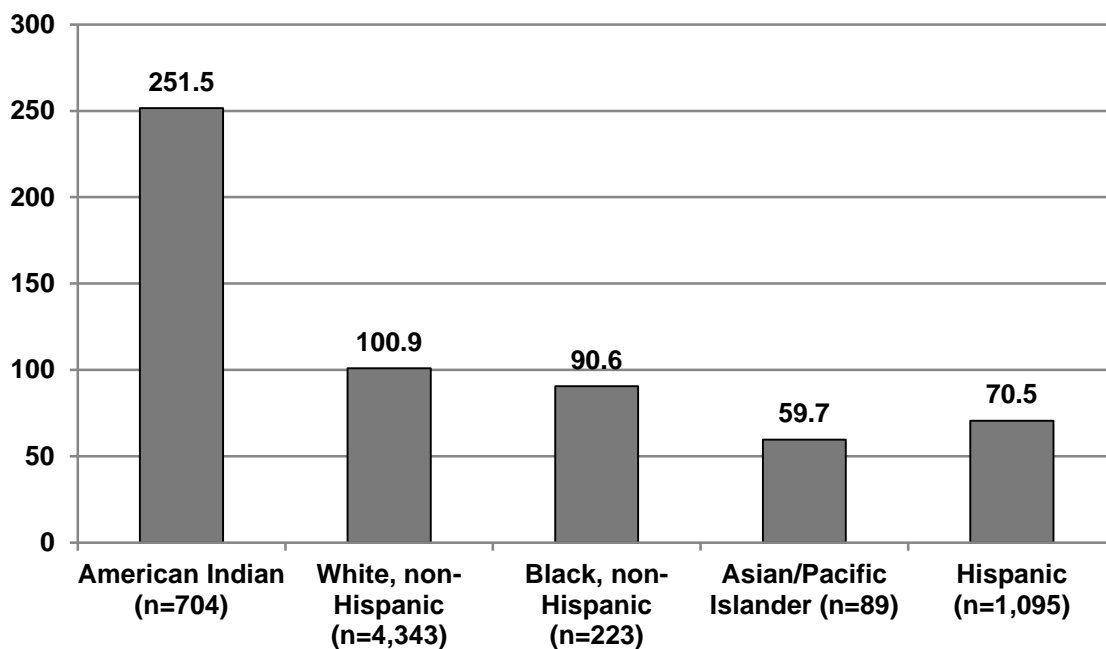
**Figure 19. TBI-Related Non-Fatal Inpatient Hospitalization Rates per 100,000 Residents By Age Group and Sex, Arizona, 2012**



Does not include 1 individual of unknown sex

Age-adjusted TBI inpatient hospitalization rates were highest among American Indians (251.5 hospitalizations per 100,000 residents), this represents a 28 percent increase from 2011, when the rate for this group was 196.2 hospitalizations per 100,000 residents. Non-Hispanic Whites had the second highest hospitalization rate (100.9 hospitalizations per 100,000 residents), representing a seven percent decrease since 2011, when the rate was 108.9 hospitalizations per 100,000 residents. Figure 20 shows the 2012 age-adjusted TBI inpatient hospitalization rates by race/ethnicity in Arizona.

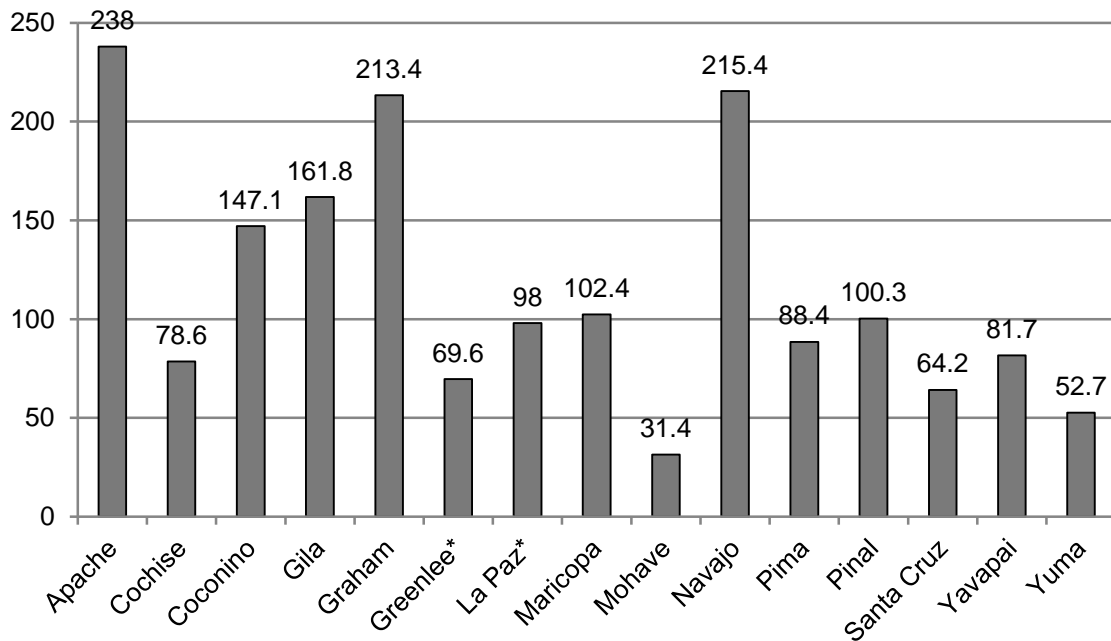
**Figure 20. Age-Adjusted TBI-Related Non-Fatal Inpatient Hospitalization Rates per 100,000 Residents, by Race/Ethnicity, Arizona, 2012 (n=6,606)**



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

Apache County had the highest non-fatal TBI-related inpatient hospitalization rate in 2012 with 238.0 hospitalizations per 100,000 residents and Navajo County had the second highest rate (215.4 per 100,000 residents). Both counties also had the highest mortality rates due to traumatic brain injuries. Figure 21 shows the age-adjusted non-fatal TBI-related inpatient hospitalizations by county for Arizona in 2012.

**Figure 21. TBI-related Non-Fatal Inpatient Hospitalizations by County, Arizona, 2012 (n=6,606)**



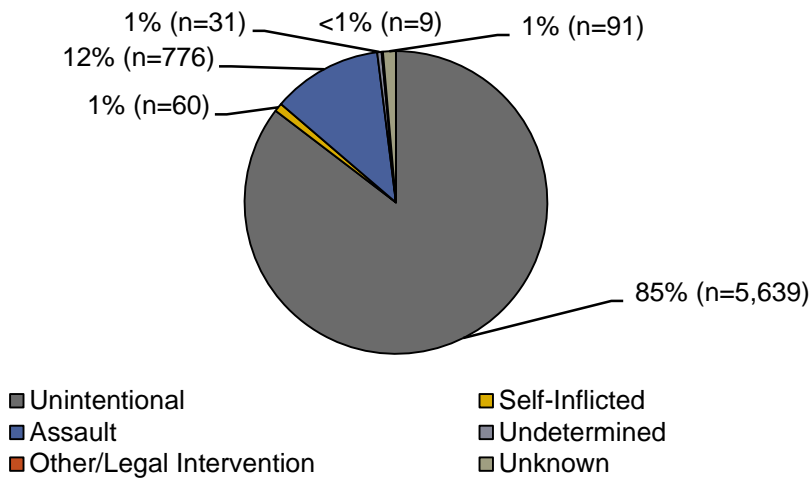
\*Rates are unstable due to low counts (n<20)

For TBI inpatient hospitalizations, the average length of stay was five days (median=3 days), and hospital stays due to TBI ranged from less than one full day to 139 days. In total, Arizonans spent 35,449 days hospitalized for TBI in 2012.

TBI inpatient hospitalization charges in 2012 totaled more than \$508.9 million, with 39 percent paid by the Arizona Health Care Cost Containment System (AHCCCS)/Medicaid and Medicare (n=2,853 cases, over \$199.3 million). This total does not include costs related to physician care, rehabilitation, lost wages, or long-term costs of disability.

Unintentional injuries accounted for 85 percent of TBI hospitalizations (n=5,639). There were 60 hospitalizations due to self-inflicted TBI (less than one percent) and 776 due to assaults (12 percent). Figure 22 shows the TBI inpatient hospitalizations by manner of injury for Arizona in 2012.

**Figure 22. TBI-related Non-Fatal Inpatient Hospitalizations by Manner, Arizona, 2012 (n=6,606)**



Fall-related injuries were the most common cause of TBI hospitalizations (45 percent, n=2,942), followed by motor vehicle traffic injuries (28 percent, n=1,843). Table 2 shows causes of TBI inpatient hospitalizations in Arizona during 2012. Descriptions of these causes are given in Appendix A.

Cause	Number	Percentage
Fall	2,942	45%
Motor vehicle traffic	1,843	28%
Struck by/against	691	10%
Other/unspecified	460	6%
Transport	323	5%
Other pedal cycle	170	3%
Firearm	58	1%
Cut/pierce	33	<1%
<b>Total</b>	<b>6,606</b>	<b>100%</b>

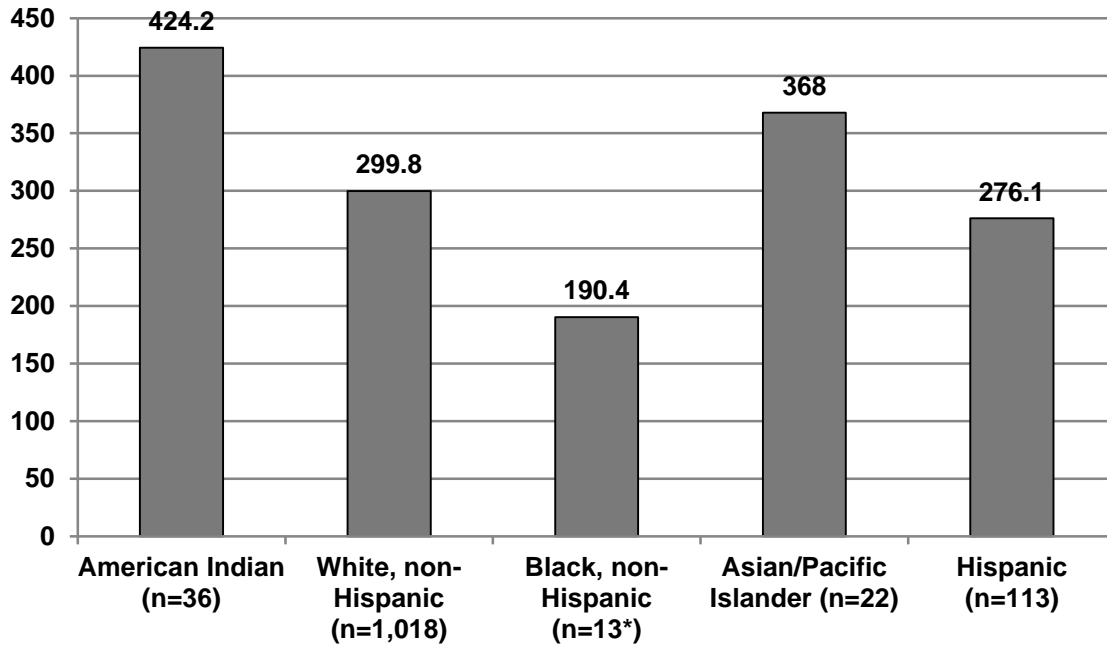
*Non-Fatal Fall-Related TBI Inpatient Hospitalizations*

There were 2,942 inpatient hospitalizations due to fall-related TBI. Fifty-four percent were among males (n=1,576) and 46 percent were among females (n=1,366). Falls were unintentional more than 99 percent of the time (n=2,934), with only 8 cases in which another manner was identified.

American Indians had the highest age-adjusted rate of fall-related TBI hospitalizations with 77.6 hospitalizations per 100,000 residents (n=182). The second highest rate was among Non-Hispanic Whites (44.1 hospitalizations per 100,000 residents; n=2,189). The age-adjusted rate for non-fatal fall-related inpatient hospitalizations among all Arizonans was 42.0 hospitalizations per 100,000 residents.

Despite the relationship between age-adjusted rates by race/ethnicity, the differences in age specific rates for adults 75 years of age and older paint a different picture of fall-related TBI. Among adults 75 years of age and older, the rate of fall-related TBI hospitalization is highest among American Indians. Figure 23 shows the age-specific hospitalization rates for fall-related TBI among Arizonan seniors 75 years of age and older, by race/ethnicity.

**Figure 23. Elder Fall-Related Non-Fatal TBI Inpatient Hospitalization Rates per 100,000 Residents 75 years of age and older, by Race/Ethnicity, Arizona, 2012**



Does not include 56 cases in which race/ethnicity information is unknown.  
 \*Count <20 so rate is unstable.

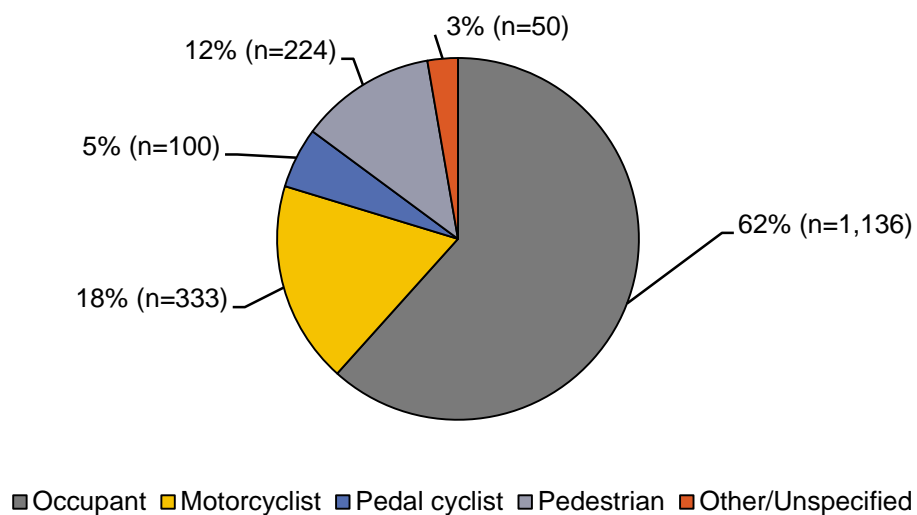
#### *Non-Fatal Motor Vehicle Traffic Crash-Related TBI Inpatient Hospitalizations*

Of the 1,843 TBI hospitalizations due to motor vehicle traffic crashes, 67 percent were among males (n=1,227) and 33 percent were among females (n=615). Nine of the crashes were not unintentional. The highest hospitalization rates for motor vehicle-related TBI were among teens and young adults 15 through 24 years of age (51.8 hospitalizations per 100,000 residents), for both males (66.8 hospitalizations per 100,000 residents) and females (35.6 hospitalizations per 100,000 residents).

American Indians had the highest rate of TBI hospitalizations for motor vehicle traffic crashes (62.8 hospitalizations per 100,000 residents; n=190), representing a 23 percent increase since 2011. With 30.4 hospitalizations per 100,000 residents, Non-Hispanic Whites had the second highest rate (n=1,149). The age-adjusted rate for non-fatal motor vehicle traffic-related inpatient hospitalizations among all Arizonans was 28.4 hospitalizations per 100,000 residents, a five percent decrease since 2011.

The majority of TBI inpatient hospitalizations due to motor vehicle traffic collisions were among occupants of motor vehicles (62 percent, n=1,136). Eighteen percent were motorcyclists (n=333); 12 percent were pedestrians (n=224); and five percent were pedal cyclists (n=100). This distribution is consistent with data from previous years. Figure 24 shows TBI inpatient hospitalizations due to motor vehicle traffic crashes by injured person.

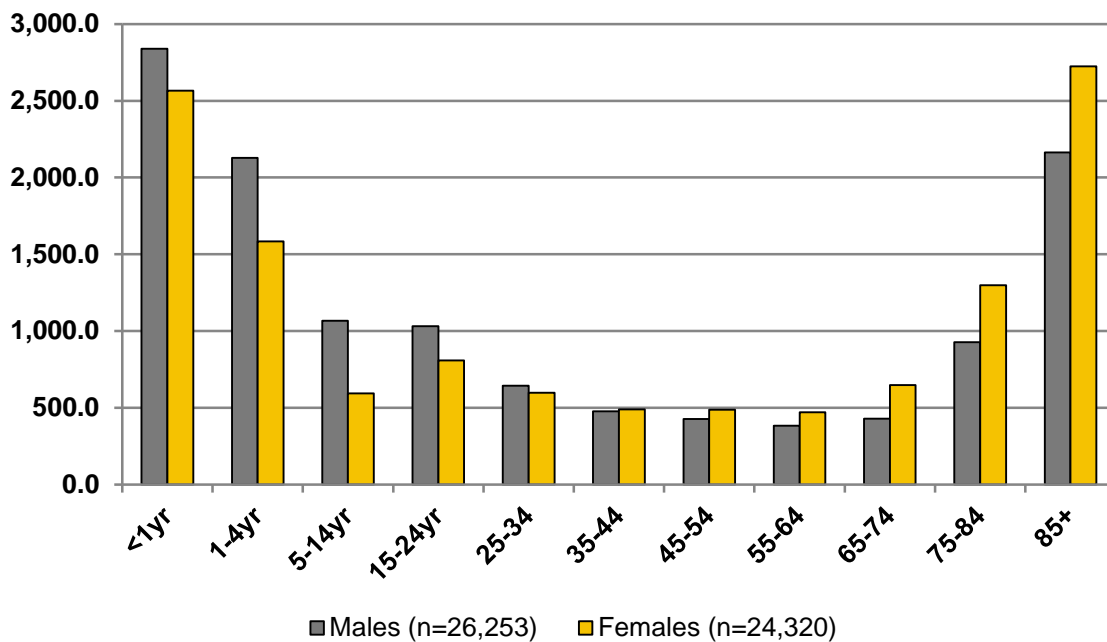
**Figure 24. Non-Fatal Motor Vehicle Crash-Related TBI Inpatient Hospitalizations by Injured Person, Arizona, 2012 (n=1,843)**



# Non-Fatal Emergency Department Visits among Arizona Residents During 2012

In 2012, there were 50,574 TBI emergency department visits among Arizona residents. Males accounted for more than half of TBI emergency department visits (52 percent, n=26,253), while females accounted for 48 percent of visits (n=24,320). There was one case among an individual of unknown sex. TBI emergency department visit rates were highest among children younger than one year of age. There were 1,090 emergency department visits among females younger than one year of age (a rate of 2565.5 visits per 100,000 residents), and 1,269 visits among males younger than one year of age (a rate of 2,839.2 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=2043). Figure 25 shows the 2012 TBI emergency department visit rates per 100,000 Arizona residents.

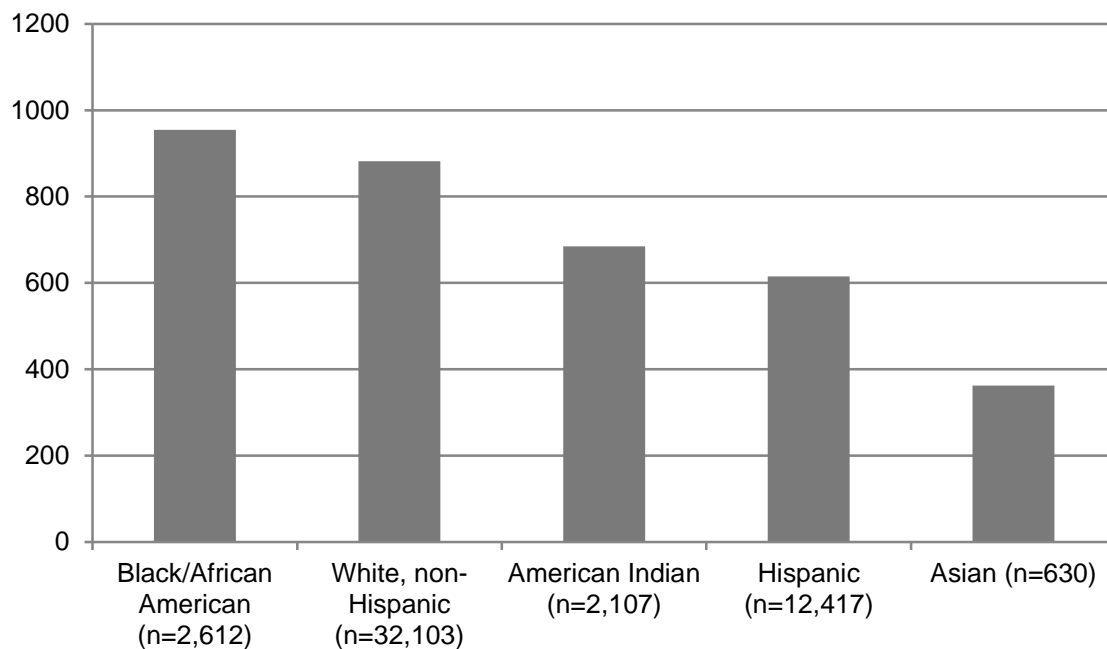
**Figure 25. Age-Specific TBI Emergency Department Visit Rates per 100,000 Residents, by Sex, Arizona, 2012 (n=50,574)**



Does not include one individual of unknown sex.

Age-adjusted TBI emergency department visits were highest among African Americans (954.6 hospitalizations per 100,000 residents). Non-Hispanic Whites had the second highest emergency department visit rate with 881.9 visits per 100,000 residents. The age-adjusted rate for non-fatal TBI-related emergency department visits among all Arizonans was 778.1 hospitalizations per 100,000 residents. Figure 26 shows the age-adjusted emergency department rates by race/ethnicity.

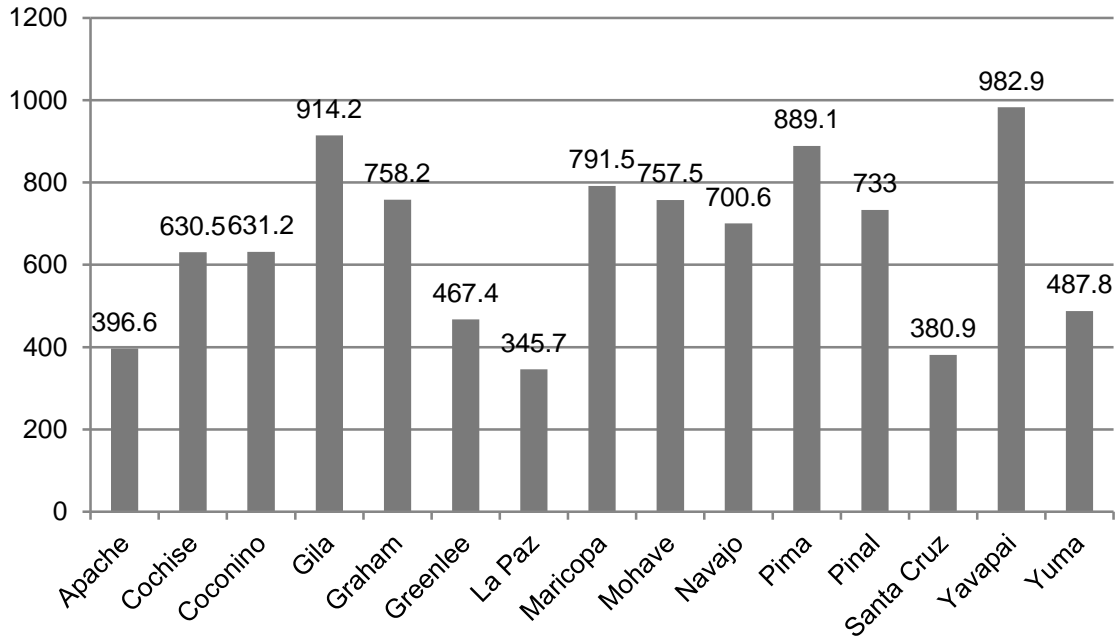
**Figure 26. Age-Adjusted TBI-Related Non-Fatal Emergency Department Rates per 100,000 Residents, by Race/Ethnicity, Arizona, 2012 (n=50,574)**



Does not include 705 cases in which race/ethnicity information is unknown.

Unlike the mortality and inpatient hospitalization rates Yavapai County had the highest non-fatal TBI-related emergency department visits in 2012 (982.9 visits per 100,000 residents). Gila County had the second highest rate with 914.2 visits per 100,000 residents. Figure 27 shows the age-adjusted TBI-related non-fatal emergency department visits by county.

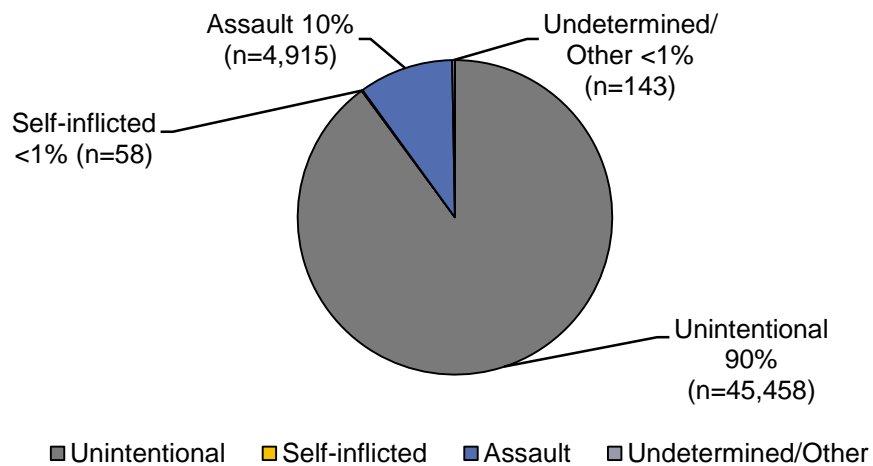
**Figure 27. Age-Adjusted TBI-Related Non-Fatal Emergency Department Rates per 100,000 Residents, by County, Arizona, 2012 (n=50,574)**



TBI emergency department charges in 2012 totaled more than \$240.6 million, with 45 percent paid by the Arizona Health Care Cost Containment System (AHCCCS)/Medicaid and Medicare (n=22,067, over \$108.4 million). This total does not include costs related to physician care, rehabilitation, lost wages, or long-term costs of disability.

The majority of TBI emergency department visits were due to unintentional injuries (90 percent, n=45,458), and 10 percent were assaults (n=4,915). Figure 28 shows TBI emergency department visits by intent during 2012 in Arizona.

**Figure 28. TBI Emergency Department Visits by Manner of Injury, Arizona 2012 (n=50,574)**



The leading causes of TBI emergency department visits were falls (52 percent, n=26,090), struck by/against injuries (24 percent, n=12,071), and motor vehicle traffic crashes (14 percent, n=6,841). Table 3 shows TBI emergency department visits by cause for Arizona in 2012. Descriptions of these causes are given in Appendix A.

<b>Cause</b>	<b>Number</b>	<b>Percentage</b>
Fall	26,090	52%
Struck by/against	12,071	24%
Motor vehicle traffic	6,841	14%
Other/unspecified	2,709	5%
Other pedal cycle	1,185	2%
Transport	1,134	2%
<b>Total</b>	<b>50,574</b>	<b>100%</b>

### *Non-Fatal Fall-Related Emergency Department Visits*

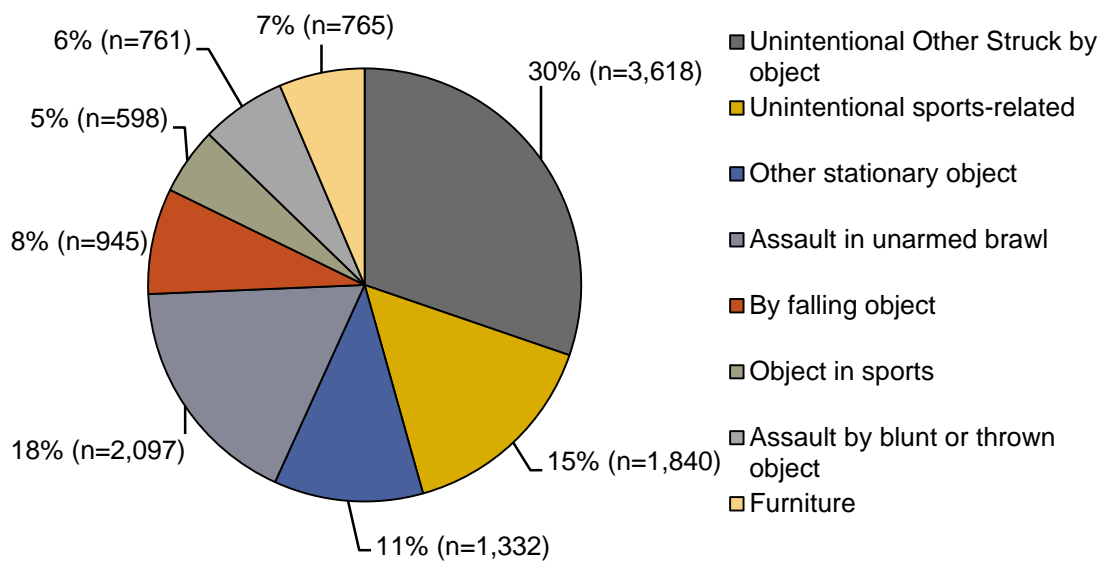
There were 26,090 emergency department visits due to fall-related TBI. Forty-six percent were among males (n=12,083) and 54 percent were among females (n=14,006). Over 99 percent of these falls were unintentional (n=26,076). As with all TBI emergency department visits, those due to falls are most common among the oldest and youngest members of the population. Among children under one year of age, the rate of fall-related TBI is 2,343.3 visits per 100,000 residents; among adults 85 and older, the rate is 2,400.0 visits per 100,000 residents.

### *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 12,071 TBI emergency department visits due to struck by/against injuries, 62 percent were among males (n=7,488) and 38 percent were among females (n=4,583). Seventy-six percent of these injuries were unintentional (n=9,131), and 24 percent were assaults (n=2,858). Sixty percent of TBI emergency department visits from struck by/against injuries were among individuals one and 24 years of age (n=7,284).

The emergency department discharge database did not include specific information regarding contributing event for 30 percent of the struck by/against injuries (n=3,618). The most frequently specified contributing events were assaults in unarmed fights (18 percent of specified events, n=2,097) and unintentional blows while playing sports (15 percent of specified events, n=1,840). Figure 29 shows TBI emergency department visits due to struck by/against injuries by specified contributing event.

**Figure 29. TBI Emergency Department Visits due to Struck by/Against by Specified Contributing Event, Arizona, 2012 (n=10,624)**



## Data Notes

All rates were calculated using the 2012 Arizona Vital Statistics population estimates, available on the internet from the AZ Vital Statistics website. 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 2012. Inpatient hospitalization and emergency department visit data were compiled from the 2012 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 2012 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 pedestrian	Includes injured pedestrians struck by pedal cycles, non-motorized vehicles, or other pedestrians.
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
Unknown cause	Cause not listed.