TRAUMATIC AND ACQUIRED BRAIN INJURY IN NEW MEXICO

INCIDENCE, CAUSES, DIAGNOSIS, AND IMPACT

2004-2006 FATALITIES

2004-2007 HOSPITALIZATIONS

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Prepared by the
New Mexico Epidemiology and Response Division
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for the
New Mexico Brain Injury Advisory Council

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Executive Summary

The New Mexico Brain Injury Advisory Council contracted with the New Mexico Department of Health, Office of Injury Prevention (NM OIP) to prepare a report on the incidence, causes, and impact of brain injury death and hospitalization among New Mexico (NM) residents. Data from NM resident death records for the period 2004-2006 and hospitalization records for NM residents in NM hospitals for the period 2004-2007 were used to document what is currently known about traumatic and acquired brain injury (TBI and ABI) in New Mexico, including the financial sources used to care for head injury in general hospitals and specialty facilities.

Summary of Findings

From 2004-2006 an average of 1,157 fatal traumatic and acquired brain injuries occurred each year among New Mexico (NM) residents. An average of 743 New Mexicans died from ABI-related conditions (predominately strokes) per year, and an average of 414 died from TBI-related conditions, with rates of 39.2 and 21.2 per 100,000 residents, respectively.

From 2004-2007, an average of 9020 brain injury-related discharges, from both general hospital and specialty facilities, occurred annually. The majority of discharges, 7,631 per year, were from ABI-related conditions and 1,389 average annual discharges were due to TBI-related conditions. Public resources provided the majority of payments for brain injury hospitalizations. Hospitalizations occurred at an annual rate of 383 per 100,000 population for ABI and 70 per 100,000 population for TBI.

Traumatic Brain Injury (TBI) deaths 2004-2006:

- Leading TBI causes of death for all ages were suicide by firearm (37%), motor vehicle crash (22%), falls (17%), and homicide (12%).
- Males were almost 3.5 times more likely to die of TBI-related injuries than females.
- Leading TBI-related death causes differed by age:
    - For youth under 15 years of age, motor vehicle crash was the cause in 54% of the TBI-related deaths, followed by homicide as the cause in 23% of the deaths for this age group.
    - At ages 15-24 years, suicide by firearm and motor vehicle crash were the leading causes of TBI-related death (39% each).
    - Suicide by firearm ranked first at ages 25-64 years, followed by motor vehicle crash.
    - Falls became the leading cause as the population aged (46% at ages 65 years and older).
- Leading TBI-related death cause differed by race/ethnicity
    - The leading cause of TBI-related death among non-Hispanic Whites was suicide by firearm (49.6%); among Hispanics, the leading causes were suicide by firearm (29.6%) and motor vehicle crash (29.0%); among American Indians, the leading cause was motor vehicle crash (35.7%); and among Blacks, homicide (35.0%) was the leading cause.

Acquired Brain Injury (ABI) deaths:

- 84% of ABI-related deaths were due to cerebrovascular events such as strokes
- Brain tumors were the second leading cause (11%) of ABI-related death.

TBI hospitalizations in both general hospital and specialty facilities:

- Brain hemorrhages and skull fractures accounted for almost 50% of the average 1,389 annual hospitalizations (26% and 21%, respectively).
- About 1,200 annual discharges were from general hospitals; 200 from specialty facilities such as skilled nursing, rehabilitation, or psychiatric facilities.
- The average length of stay was 10 days in general hospitals and 23 days in specialty facilities.
- Public (non-private) sources paid the majority of costs:
    - Medicare paid for 28% of general hospital stays; 30% of specialty facility stays.
    - Medicaid paid for 18% of general hospital stays; 28% of specialty facility stays.
    - Indian Health Service (IHS), CHAMPUS, and VA paid for 5% of general hospital stays; 1% of specialty facility stays.
    - Private insurance paid 28% of stays in each type of facility.

ABI hospitalizations in both general hospital and specialty facilities:

- Cerebrovascular events were the main diagnosis in 81% of hospitalizations.
- About 8,000 annual discharges were from general hospitals; 1,000 from specialty facilities such as skilled nursing, rehabilitation, or psychiatric facilities.
- Average length of stay was 6 days in general hospitals and 23 days in specialty facilities.
- Public (non-private) sources provided the majority of payments:
    - Medicare paid for 63% of general hospital stays; 55% of specialty facility stays.
    - Medicaid paid for 8% of general hospital stays; 10% of specialty facility stays.
    - IHS, CHAMPUS, and VA paid for 1.5% of general hospital stays; 0.5 % of specialty facility stays.
    - Private insurance paid 18% of general hospital stays; 26% of specialty facility stays.

Purpose of Report

The New Mexico Brain Injury Advisory Council contracted with the New Mexico Office of Injury Prevention (NM OIP) to prepare a report on the incidence, causes, and impact of brain injury death and hospitalization in New Mexico. This report has been prepared to document what is currently known about traumatic and acquired brain injury (TBI and ABI) from New Mexico data systems.

Surveillance systems are needed to determine the magnitude of injury morbidity and mortality, the leading causes of injury, and the population groups and behaviors associated with the greatest risk of injury.[1] Surveillance data also are fundamental to determining program and prevention priorities. Limitations in state TBI data systems nationwide have resulted in extensive review and recommendations by experts since 2002 on the best approaches to documenting the magnitude of TBI-related injuries. Similar efforts are being made for ABI-related injury, specifically, stroke events.[2]

A national program for TBI registries was established after recognition of individual state needs to ensure adequate services for people with TBI by effectively informing primary prevention activities, policy development and planning.[3] The National Centers for Disease Control and Prevention (CDC) working group on TBI registries supported the idea that, "where possible, TBI data systems should also provide information about the outcomes and service needs of people with TBI and link those individuals to needed services, such as personal assistant services, transportation, or help finding employment." Registries collect relatively detailed information and may identify patients for long-term follow-up. CDC has not been able to establish a national program but several states have developed registries with differing goals and approaches. Case-registry systems for ABI are less well documented than those for TBI although some hospital-based registries include surveillance as a goal.[2] This report makes an assessment of the basic surveillance data currently available to describe the deaths and hospitalizations resulting from TBI- and ABI-related events and to support assessment of data needs for a NM case registry system.

Overview

Surveillance systems and case registries for brain injury have focused primarily on traumatic causes. Other brain conditions, referred to as acquired brain (or head) injury (ABI), primarily resulting from medical conditions, may result in a similar impact on patient functioning and outcomes. This report includes death and hospitalization data on TBI and ABI to support assessment of NM estimates of brain dysfunction with manifestations similar to those resulting from head injury, regardless of cause.

In 2007, CDC published the first multi-state assessment of TBI magnitude to include NM.[1] It compared 2004 annual fatality and hospitalization rates for 34 states. NM was included only in the fatality comparison as hospitalization data were unavailable. When compared to other states with 2004 data, NM had the 2nd highest TBI fatality rate (24.9 deaths per 100,000 persons) while individual state rates ranged from 7.1/100,000 to 25.2/100,000 and the national TBI rate was 17.9/100,000. NM male rates were also the 2nd highest among the 34 reporting states at 39.2/100,000 compared to the US range of 10.9 to 40.9 per 100,000 males. Males were about three times more likely to die of TBI than females in both NM and the US. In all of the reporting states, the highest TBI fatality rates were among people 65 years and older, with a range of 24.2 to 61.9 per 100,000 persons. NM's rate was 46.6/100,000, ranking 10th. The relatively high NM rates establish the need to prioritize program and prevention efforts to understand the causes and reduce the impact of TBI on New Mexico's population.

National and state efforts by the CDC and State and Territorial Injury Directors Association (STIPDA) have provided expertise and guidance for analyzing TBI. Their extensive recommendations for development and preparation of state TBI data estimates of magnitude, causes, diagnosis and impact guided preparation of this report.[4,5]

Methodology

Data: This report includes descriptive data for traumatic brain injury (TBI) deaths and hospitalizations and acquired brain injury (ABI) deaths and hospitalizations among NM residents. Data are presented using three types of statistics: counts, percentages, and rates. Rates are presented as either age-specific or age-adjusted per 100,000 population. Also included in this report are data on payment source for TBI and ABI hospitalizations.

Data Sources: Mortality data are based on the latest available multiple cause of death records for NM residents from the NM Bureau of Vital Records and Health Statistics (BVRHS) and prepared by the Office of Injury Prevention. Death certificates are originally completed for cause(s) of death by authorized certifiers such as medical examiners or attending physicians. More than one cause may be shown on the certificate. BVRHS categorizes death certificates according to coding criteria specified in the International Classification of Diseases, Revision 10 (ICD-10).[6] Guidelines are followed to specify which of multiple causes are considered to be the underlying cause, such as motor vehicle crashes, falls, suicide or homicide.

The 2007 Consensus Recommendations for Injury Surveillance in State Health Departments recommend that mortality surveillance data for TBI and other injuries be based on "multiple cause of death" files.[6] Recommendations state that although the underlying cause of death is the injury circumstance most commonly used in analysis of cause of death, multiple cause data include important information about types of injury diagnoses when the diagnoses are reported on the death certificate.

Thus, a fatal injury event described by ICD coding from multiple cause files is a two-dimensional cross-classification identifying the mechanism of the injury ('cause' and, in some instances, 'intent') and the body region that was injured (nature of injury or diagnosis). The latter information allows identification of TBI as a manner of death by searching all multiple-cause-of-death fields on the certificate. Use of multiple-cause-of-death files is specifically recommended for TBI-related deaths, as compared to other types of deaths, since deaths resulting from multiple body system trauma may involve more body regions than just the head, such as in motor vehicle crashes, where complex injuries ultimately contribute to a death. ABI death causes are based on the underlying cause.

Hospitalization information is for NM residents only, and is based on aggregated data for NM non-federal hospitals from the NM Health Information System maintained by the NM Health Policy Commission (HPC).[a] Records are included for 50 NM non-federal hospitals (36 general hospitals and 14 specialty facilities). Diagnostic categories are summarized from hospitalization counts of TBI and ABI conditions for individual patients with no individual or hospital level information shown. Hospitalization records across the US and NM do not uniformly note or report the cause of traumatic injuries, leading to incomplete reporting of the injury event leading to a hospitalization. External cause of injury (e-coding) is available for only 63% of hospitalization records in NM, and no information is available for which hospitals reported the causes. Due to potential bias, only the nature of nonfatal injuries is shown in this report.

STIPDA recommendations for state TBI surveillance includes use of ED visit records. At the time of this report, NM does not have ED data as a resource, [4] but has made data reportable to the NMDOH and is working with hospitals to initiate reporting. External cause includes falls, motor vehicle crashes, etc. The nature of injury diagnosis includes hip fracture, TBI, etc. The number of residents seen for head injury in emergency departments (ED) and outpatient services is, therefore, unknown. However, ED visits may be estimated at almost 100,000 each year.[5]

Analytic Approach: For injury deaths, the external cause rather than the injury diagnosis is always selected as the underlying cause of death. External cause of death includes falls, motor vehicle crashes, etc. The nature of injury diagnosis includes hip fracture, TBI, etc. A single injury diagnosis code is a two-dimensional cross classification identifying the cause/mechanism and manner/intent of the injury. The nature of injury/body region is obtained from the multiple cause of death file.

ICD-10 mortality classifications used in this report are based on the CDC instructions for preparation of state injury indicators. The ICD-9-CM (clinical modification) hospitalization classifications used in this report are based on the CDC instructions for preparation of state injury indicators with a couple of modifications.[7] Specific ICD codes for each classification are shown in Appendix A. Classifications include the following causes of death and nature of hospitalizations:

> *Cause of Death:* All nine cause of death fields of the multiple cause of death file were searched for TBI. STIPDA recommendations for TBI and other traumatic injury-related events are to exclude adverse effects and complications of medical and surgical care. The most frequent causes are highlighted in the sections specific to either TBI or ABI deaths along with the total numbers and rates. The nature of injury for TBIs include: 1) open wound of head; 2) fracture of skull and facial bones; 3) intracranial injury; 4) crushing injury of head; 5) other and unspecified injuries of head; and 6)

[a] The New Mexico Health Policy Commission provided the data used for analysis in this report. The accuracy of the original data is the responsibility of the NM Epidemiology and Response Division, Office of Injury Prevention, and the Health Policy Commission assumes no responsibility for any use made of or conclusions drawn from the data.

sequelae of injuries of head. Types of ABIs include: 1) cerebrovascular disease, 2) brain tumors, 3) anoxic brain damage, and 4) brain infections.

Nature of Hospitalizations: Both TBI and ABI cases were identified by searching all diagnostic fields of the hospital discharge record.[8] Specific ICD diagnostic classification codes are shown in Appendix A.

The following categories are used to categorize the nature of TBI-related hospitalizations: 1) skull fracture; 2) concussion; 3) cerebral laceration and contusion; 4) subarachnoid, subdural, and extradural hemorrhages following injury; 5) other and unspecified intracranial hemorrhage following injury; and 6) intracranial injury of other unspecified nature; and 7) head injury of unspecified nature. The specific ICD-9 codes by nature of each diagnosis are described further in Appendix A.

Duplication may exist for individuals hospitalized for conditions since the records are based on each hospital event and are not linked by a patient ID. An individual may also be transferred among hospitals or specialty facilities for the same injury event. The patient could be counted more than once since records are not de-duplicated by hospital or specialty facility.

Numbers and rates of deaths and hospitalizations are shown for the total NM resident population, NM Health Region, county, and a county's degree of urbanicity as defined by the US Census Bureau. [8] Due to differences in age distributions among the counties and NM Health Regions, age-adjusted rates also are calculated to allow better understanding of cause comparisons. Age-adjustment accounts for rate differences among jurisdictions that may be due to differences in the age distribution of the population. Unadjusted (crude) and age-adjusted rates may differ very little for the total state and in the larger jurisdictions but could differ more in county or rural areas. Aging populations in the latter areas would account for much of the difference. Number of deaths and hospitalizations by county are shown with crude and age-adjusted rates in Appendix B.

NM resident population estimates are produced by the University of New Mexico (UNM) Bureau of Business and Economic Research (BBER). [9] The resident population (both civilian and Armed Forces) living in the area as of July 1 of each year is calculated from a 'demographic components of change model' incorporating information on natural change (births and deaths) and net migration (net domestic migration and net movement from abroad) having occurred in the area since the 2000 census. Changes in annual rates are not shown in this report due to effects from modifications in the 2007 population estimation procedures by BBER. Total rates for the four-year period are considered reliable and are shown.

Urbanicity characteristics: For this report counties were assigned to "metro", "micro" or "non-core" (rural) categories based on the U.S. Office of Management and Budget (OMB) criteria. The (OMB) defines metropolitan statistical areas or "metro" areas as core counties with one of more urbanized areas of 50,000 or more population, and outlying counties that are economically tied to the core counties measured by commuting to work. The micropolitan statistical area or "micro" area contains a non-metro county with an urban cluster of at least 10,000 persons or more but less than 50,000. Non-core counties are neither micro nor metro and have been traditionally designated as "rural". A more detailed definition of the statistical requirements for county classifications by 'urbanicity' is included in Appendix A.

People residing in the micro and non-core counties have reduced access to health care services compared to people living in metro areas. Residents of the non-core counties may have to travel great

distances on rural roads to reach health care facilities which increases the time from being injured to receiving medical help. TBI and ABI death and hospitalization rates were compared by this urban/rural classification scheme.

Traumatic Brain Injury (TBI) Deaths, 2004-2006

Leading causes of TBI-related deaths:
TBI accounted for 1,241 deaths among NM residents for the three-year period 2004-2006. On average, 414 people died each year at an annual rate of 21.2 per 100,000 NM residents. Over the three year period TBI-related deaths from suicide by firearm resulted in the death of an average of 8 per 100,000 persons per year.

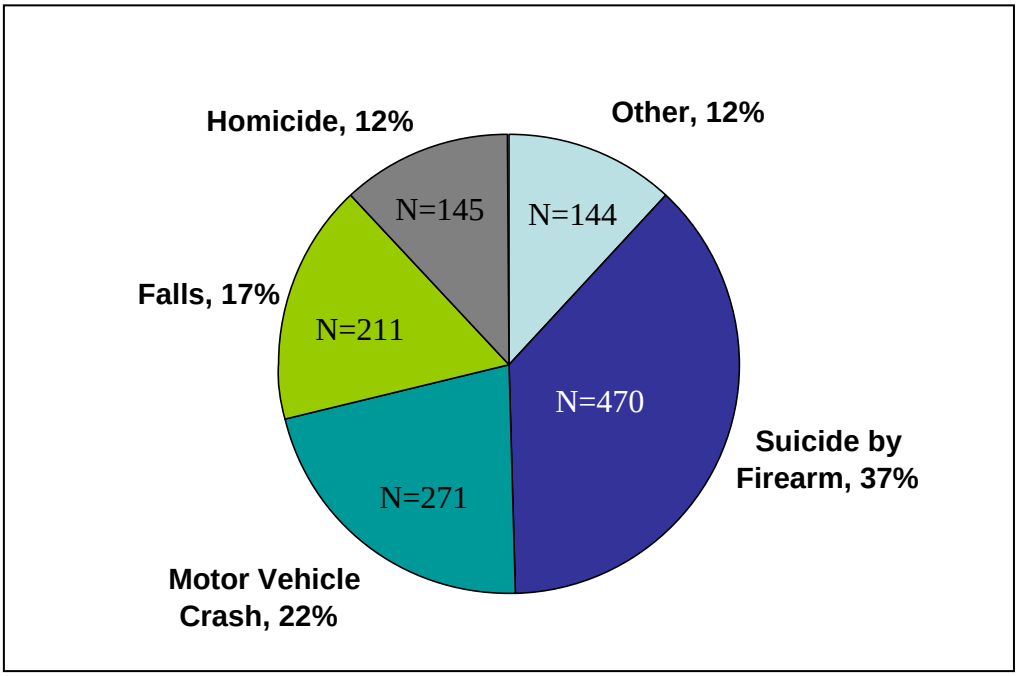
Leading Causes of TBI-related Deaths, NM, 2004-2006

All Ages	2004-2006	Rate*
Suicide by Firearm	470	7.9
Motor Vehicle Crash	271	4.6
Falls	211	3.7
Homicide	145	2.5
Other	144	2.5
Total	**1241**	**21.2**

*Age adjusted per 100,000 population

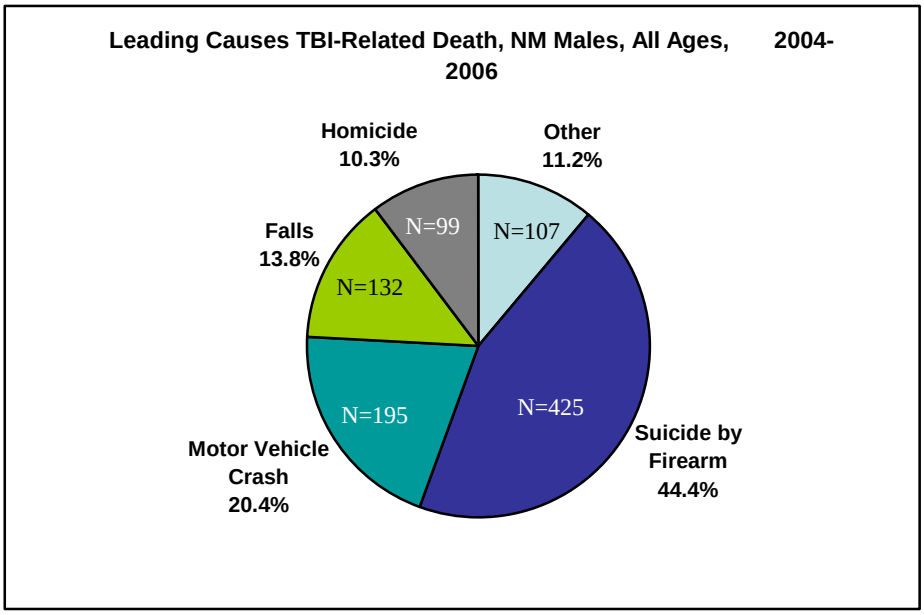
Leading causes of TBI-related deaths:
Of the total 1,241 TBI-related deaths, the leading cause was suicide by firearm (470 deaths, 37%), followed by motor vehicle crash (271 deaths, 22%), falls (211 deaths, 17%) and homicide (145 deaths, 12%). The brain may be the primary body region involved in an injury that resulted in death for some causes, such as suicide by firearm, or could be one of multiple bodily injuries in deaths occurring from motor vehicle crash incidents.

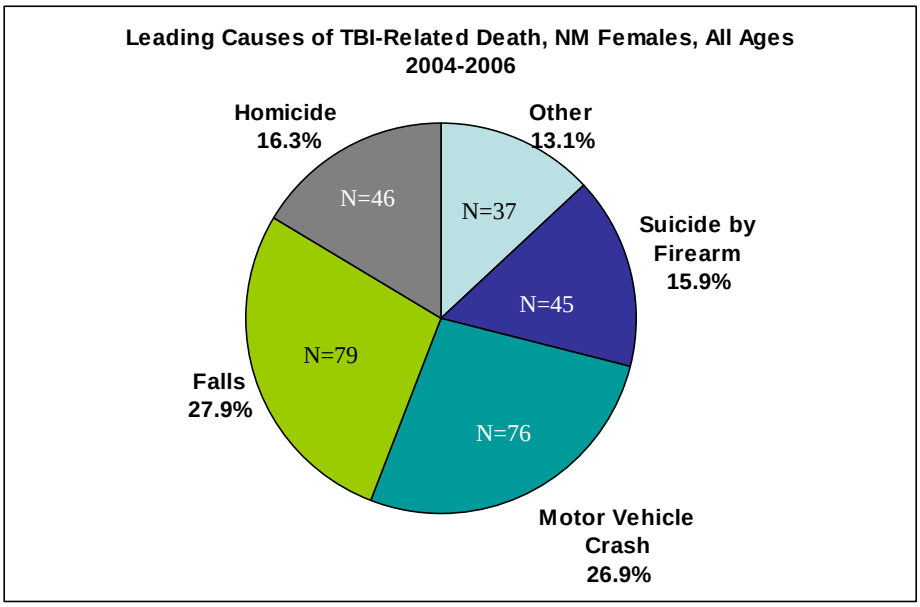
Leading Causes TBI-Related Death, NM, All Ages, 2004-2006



Gender Differences among TBI-related deaths:

- Males were almost 3.5 times more likely to die of TBI than were females (958 males compared to 283 females).
- The leading cause among males was suicide by firearm (425 deaths, 45% of male deaths).
- Females were more likely than men to die of falls (28%) and motor vehicle crashes (27%), representing more than half of all their deaths.

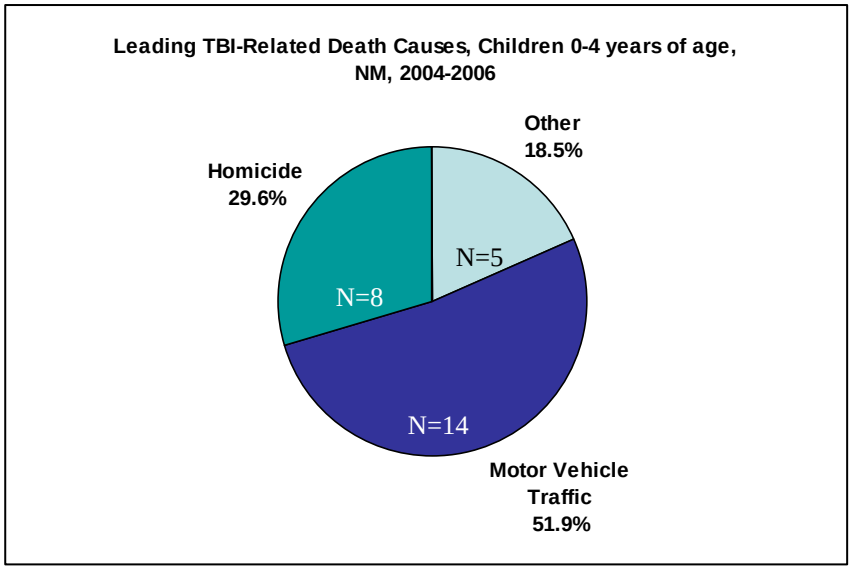




Leading underlying causes for TBI-related deaths by age:

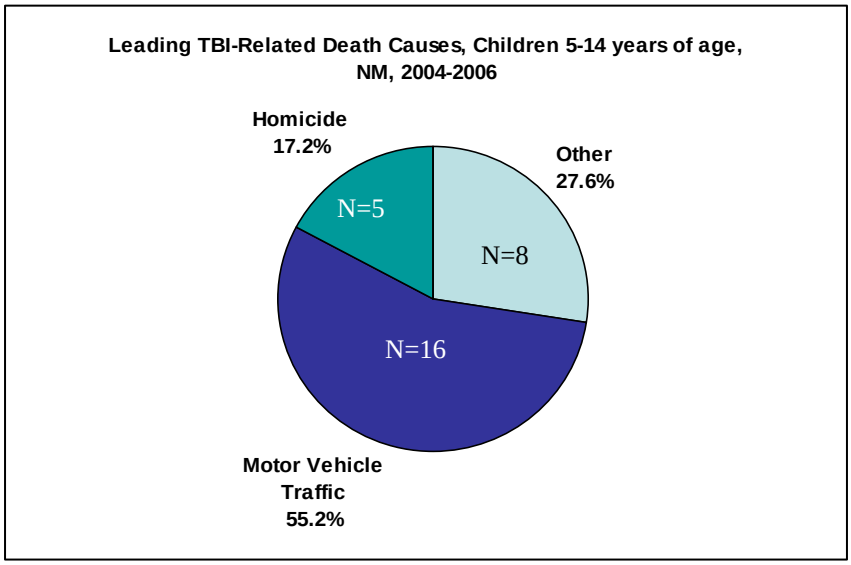
Age 0-4 years:

- Motor vehicle crash was the leading cause of TBI-related death for children ages 0-4 years, representing slightly more than half of the total 27 deaths for this age group.
- Homicide was the second leading cause, representing almost 30% of TBI-related deaths for children 0-4 years.
- There were 9 infant deaths among children <1 year of age, representing 1/3 of the 27 total deaths for the 0-4 year age group. Five of these deaths were homicides, and 4 were due to motor vehicle crashes.



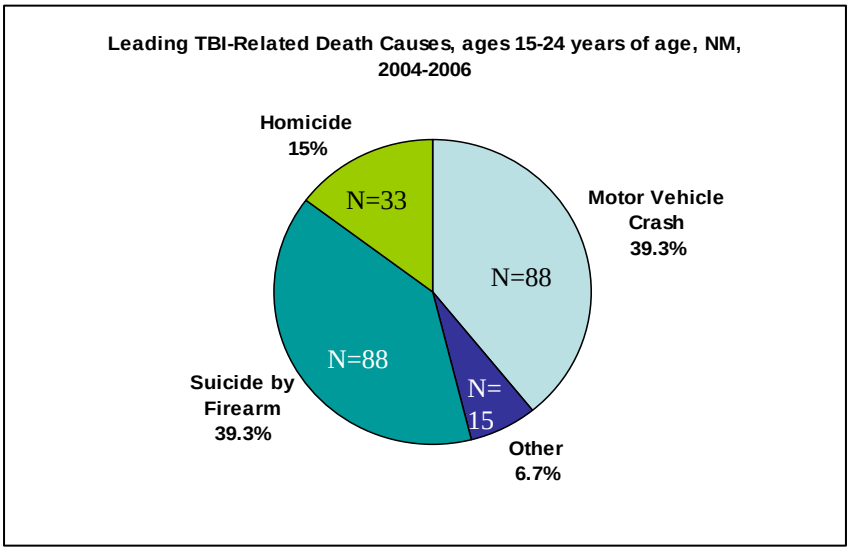
Age 5-14 years:

- Motor vehicle crash was the leading cause of death, representing 55% of the 29 total TBI-related deaths for the 5-14 year age group.
- Homicide was the second leading cause, representing 17% of the TBI-related deaths for this age group.



Ages 15-24 years:

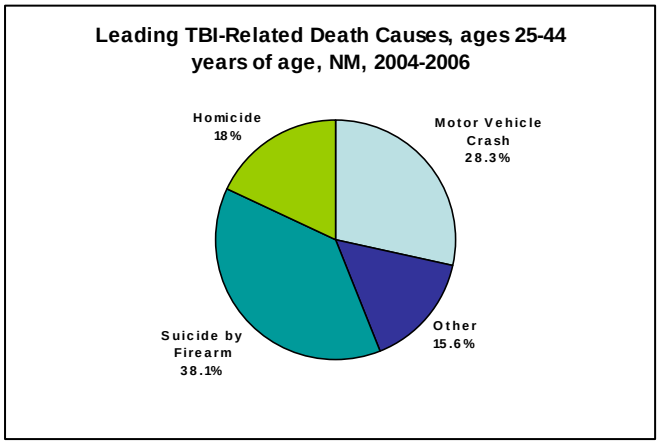
- Suicide by firearms and motor vehicle crashes were the leading causes of TBI-related death for 15-24 year olds with 88 deaths each, from 2004-2006.

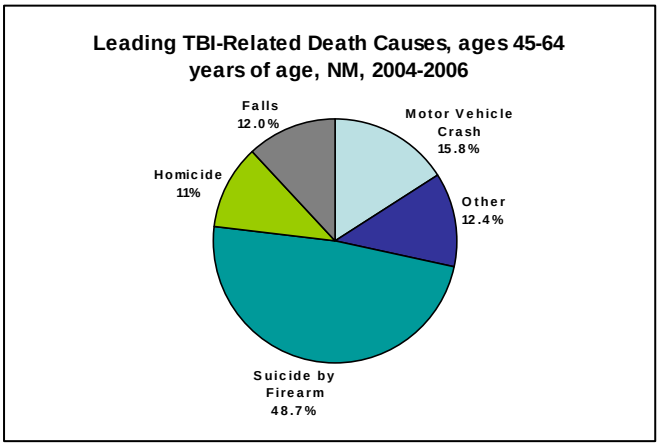


Ages 25-64 years:

As youth and young adults move into full adulthood, rankings of TBI-related deaths changed.

- Suicide by firearm was the leading cause, resulting in 38.1% of deaths at ages 25-44 years and 48.7% at ages 45-64 years.
- Motor vehicle crash became the 2nd ranking cause across ages 25-64 years.
- Falls became a leading cause of death at ages 45-64 years (12%), followed by homicide (11%)
- Proportions from motor vehicle crash decreased from 39% at ages 15-24 years to 28.3% at ages 25-44 years and 15.8% at ages 45-64 years.
- Proportions from homicides increased from 15% for persons aged 15-24 years to 18% for persons aged 25-44 years, and decreased to 11% for persons aged 45-64 years.

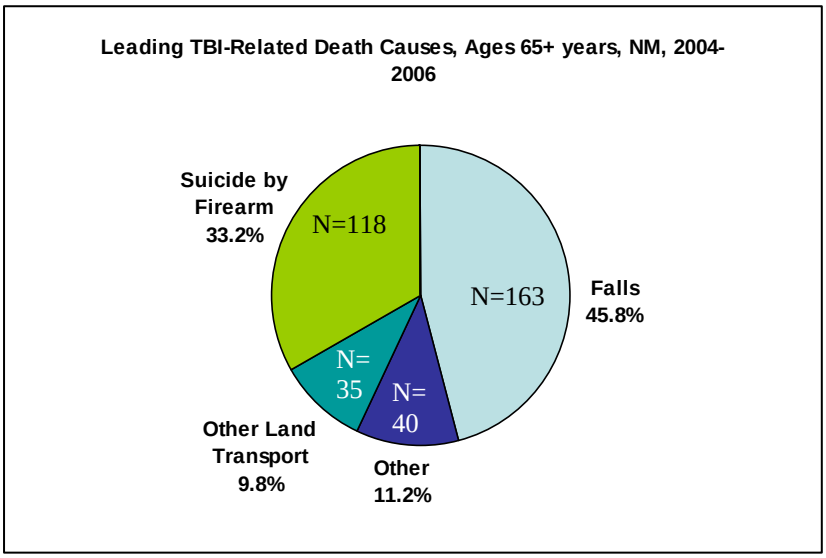




Ages 65 years and older:

Falls became the leading cause as the population aged.

- Falls represented 46% of all deaths (163 of 356 total).
- Suicide by firearm was the 2nd ranking cause at 33% of all deaths (118 deaths).



Race/ethnicity differences among TBI-related deaths:

- TBI-related death rates were highest among American Indian/Alaska Natives (23.1/100,000 population)
- Blacks had the lowest TBI-related death rate (13.9/100,000) during the period 2004-2006.
- During the three year period, 7 TBI-related deaths occurred among Asian/Pacific Islanders.

TBI-related deaths by race/ethnicity, NM, 2004-2006

Race/ethnicity	Number	Rate*
White, Non-Hispanic	631	21.5
Hispanic	442	19.0
American Indian/Alaska Native	140	23.1
Black	20	13.9

*Age-adjusted per 100,000 population

- The leading cause of TBI-related death for White non-Hispanics and Hispanics was suicide by firearm.
- Motor vehicle crash was the leading cause of TBI-related death among American Indian/ Alaska Natives.

Leading Causes of TBI death by Race/ethnicity,2004-2006

White, Non-Hispanic

Cause	Number	Percent
Suicide by firearm	313	49.6
Falls	124	19.7
Motor vehicle crash	90	14.3
Homicide	46	7.3
Other	58	9.2
Total	631	100.0

Hispanic

Cause	Number	Percent
Suicide by Firearm	131	29.6
Motor vehicle crash	128	29.0
Homicide	70	15.8
Falls	61	13.8
Other	52	11.8
Total	442	100.0

American Indian/Alaska Native

Cause	Number	Percent
Motor vehicle crash	50	35.7
Falls	23	16.4
Homicide	22	15.7
Suicide by firearm	17	12.1
Other	28	20.0
Total	140	100.0

TBI-related deaths by NM health region, county, and urbanicity characteristics:

Health Region: The NM Department of Health divides the state into five regions (northwest, northeast, southeast, southwest, and the one largest central county, Bernalillo). Regional designation provides for more efficient service administration by knowledgeable regional staff members. The counties in each region are shown in Appendix A.

- The Bernalillo county region had the most TBI-related deaths (N=401). The fewest TBI-related deaths occurred in the southeast region (N=147).
- The northeast region had the highest rate of death (26.4/100,000 population)

TBI-related Death by Region, 2004-2006

Region	Number	Rate
Bernalillo	401	21.9
Northwest	254	21.9
Northeast	239	26.4
Southwest	200	16.6
Southeast	147	19.4

*Age adjusted per 100,000 population

Urbanicity:

- The non-core area death rate was highest at 25.8/100,000 population, compared to 20.6/100,000 population in the urban areas.

TBI-related Death by Urbanicity, 2004-2006

Area	Number	Rate*
Metro	766	20.6
Micro	395	22.3
Non-core	80	25.8

*Age adjusted per 100,000 population

- More than 1/3 of populations in urbanized areas are under 25 years of age for whom risks from motor vehicle crash and homicide are higher.
- Non-core areas were more likely to have an older population with the percentage over 65 years of age increasing from 11.3% in the metro area and 12.8% of the micro area to 18.8% of the non-core areas.

Traumatic Brain Injury Hospitalizations, NM, 2004-2007

New Mexico residents were hospitalized 5,557 times for TBI-related conditions from 2004-2007 - including both general and specialty hospitals.

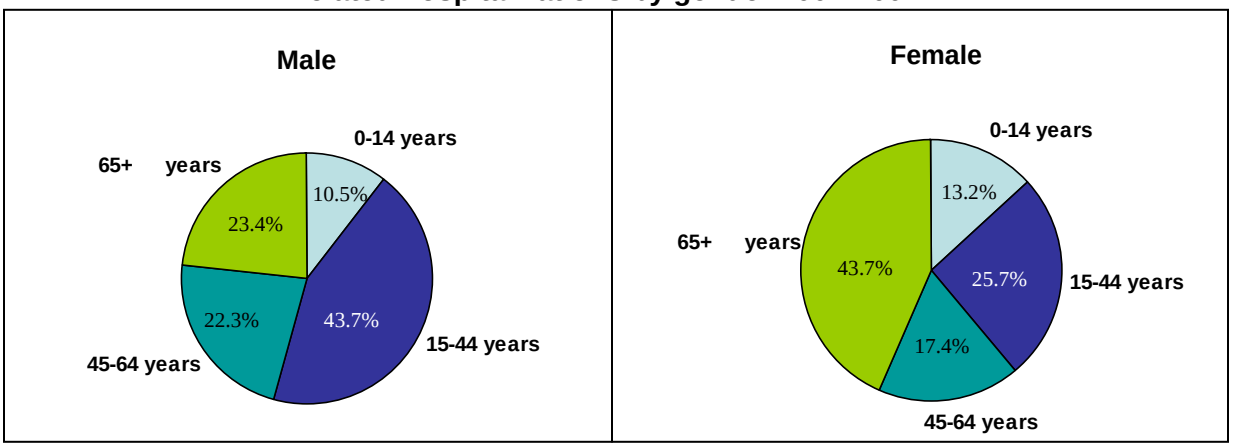
- Youth and young adults at ages 15-24 years had the highest proportion (16.3%) of TBI-related hospitalizations.
- One in five hospitalizations occurred among the older age group 75+ years of age.
- The proportion of TBI-related hospitalizations for children ages 0-4 years (5.9%) was comparable to the next ten year age group, ages 5-14 years (5.6%), however the rate of hospitalizations for the younger age group was much higher (60.9/100,000 to 28.3/100,000 respectively).
- Overall, males were almost twice as likely to be hospitalized as were females with higher male rates in each age group.
- From ages 15-44 years males were at least three times more likely to be hospitalized than females.
- Female hospitalizations were comparable to or exceeded males at ages 75+ years.

NM TBI-related hospitalizations by age and gender 2004-2007

Age Group	Total TBI Hospitalizations			Females		Males	
	Number	Rate/ 100,000	% of Total	Number	Rate/ 100,000	Number	Rate/ 100,000
0 - 4	328	60.9	5.9	144	54.3	184	67.2
5 - 14	311	28.3	5.6	109	20.1	202	36.2
15 -24	905	73.6	16.3	218	36.4	687	109.0
25 - 34	583	60.1	10.5	124	25.7	459	94.2
35 - 44	597	54.0	10.7	149	26.7	448	81.8
45 - 54	645	54.8	11.6	162	26.8	483	67.5
55 - 64	502	58.5	9.0	169	38.0	333	80.7
65 - 74	520	96.0	9.4	209	72.4	311	123.0
75 - 85	677	197.3	12.2	332	167.5	345	238.2
85 +	489	483.5	8.8	291	454.2	198	534.2
Total	**5,557**	**69.8**	**100.0**	**1,907**	**47.1**	**3650**	**93.2**

- 44% of male hospitalizations occurred at ages 15-44 years.
- 44% of female hospitalizations occurred at ages 65+ years.

TBI-related hospitalizations by gender 2004-2007



TBI-related hospitalizations by nature of injury:

TBI-related hospitalizations were identified by searching all diagnostic codes in a medical record. Of the 5,557 hospitalizations in both general hospitals and specialty facilities, TBI was listed as the primary diagnosis in 75% of the cases (n=4,167). About 1/3 (n=1,786) were not classified by nature of the TBI. Percents based on total TBI hospitalizations and those with specified classifications should be viewed with some caution due to the lack of classification of the nature of the brain injury.

- Subarachnoid, subdural and extradural hemorrhages (bleeding within the brain or between the brain and skull)[10] following injury represent the largest proportion (22.5%) of hospitalizations (n=1,250).
- The second largest known contributor to TBI-related hospitalization was skull fracture (21.3%), followed by cerebral lacerations and contusions (8%) and concussions (7%).
- Other and unspecified intracranial hemorrhages together with intracranial injuries of unspecified nature accounted for a combined 6% total of the hospitalizations (n= 332).
- Shaken baby was the basis for hospitalization for 21 infants (<1% of TBIs for all ages).

NM Hospitalizations by Nature of TBI	**2004-2007**	
	Number	**%**
Subarachnoid, subdural and extradural hemorrhages	1,250	22.5
Skull Fracture	1,183	21.3
Cerebral Laceration & Contusion	432	7.8
Concussion	396	7.1
Other and unspecified Intracranial Hemorrhage	202	3.6
Head Injury - Unspecified	157	2.8
Intracranial Injury of other unspecified nature	130	2.3
Shaken Baby*	21	<0.1
TBI Nature Subtotal	*3,771*	
Not Classified by Nature	1786	32.1
Total	**5,557**	**99.6**

**Shaken baby could also be classified according to the cause rather the nature of injury, so it may be undercounted.*

TBI-related hospitalizations by region:

The highest rates occurred in the southwest region and lowest in the Bernalillo region.

- The Bernalillo county region had about half the number of hospitalizations (n=1,889) as the southeast region (n=3,574).
- The southwest region had the highest rate of hospitalization (300.1/100,000), more than 3 times higher than the Bernalillo region (76.3/100,000) and the northwest region (96.9/100,000).
- The southeast region rate at 221.5/100,000 was more than twice that of the Bernalillo (76.3/100,000) and northwest (96.9/100,100) regions.

NM TBI-related Hospitalizations by Region 2004-2007

Region	Number	Rate*
Bernalillo	1,889	76.3
Northwest	1,517	96.9
Northeast	2,345	202.8
Southwest	3,059	300.1
Southeast	3,574	221.5
Totals	12, 384	

*Age adjusted per 100,000 population

TBI-related hospitalizations by urbanicity:

- Metro rates per 100,000 residents were somewhat higher than the less urban areas.
- Adjusting for age distribution within regions increased the rates per 100,000 residents slightly in the metro and micro areas but decreased the rates in the non-core areas.

NM TBI-related Hospitalizations by Urbanicity, 2004-2007

Area	Number	Rate*
Metro	3,774	75.0
Micro	1,489	63.7
Non-core	294	65.7
Total	5557	

*Age adjusted per 100,000 population

TBI-related discharge status from general hospitals and specialty facilities combined

- More than half (58.2%) of patients had a routine discharge to home.
- Approximately 25% transferred to another institution.
- 7.5% of TBI patients died during the hospitalization or were transferred to hospice home care.
- Another 6.4% were transferred to home health care

NM TBI-related Discharge Status from General Hospitals and Specialty Facilities Combined, 2004-2007

TBI Discharge Status	Total	Percent
Routine discharge	3,232	58.2
Transfer to another institution*	1,363	24.5
Expired or discharged to hospice care**	417	7.5
Transfer to home health care	355	6.4
Left against medical advice	77	1.4
Unknown discharge status	114	2.0
Total	**5,557**	**100.0**

Length of Stay for TBI-related Hospitalizations:

About 12,550 hospital days annually (50,221 in 2004-2007) were due to TBI-related events with an average length of stay of about 9 days.

- Almost 8,200 days annually (32,753 in 2004-2007) were spent in general hospitals; about 4,350 days annually in specialty facilities.
- General hospital stays averaged 10 days; specialty facility stays averaged 23 days.
- The average length of stay for all hospitalizations (cardiovascular disease, cancer, etc.) is 5 days.

Length of Stay TBI-related Hospitalizations, NM, 2004-2007

TBI Hospitalizations	Length of Stay by Hospital or Facility		
	All hospitalizations*	General hospitals	Specialty facilities
Hospitalizations	5,777	4,755	762
Total number of days	50,221	32,753	17,427
Average length of stay (days)	9.0	9.9	22.9

* An additional 40 hospitalizations, not identified by hospital/facility type, averaged a length of stay of 1.0 days, totaling 41 days in 2004-2007.

***TBI-related payment sources*:**
Payment for TBI-related hospitalizations in both general hospitals and specialty facilities were primarily from public (non-private) sources.

- Medicare accounted for 28% while Medicaid accounted for 20%.
- Private insurance accounted for 28%.
- Self pay accounted for 10%.
- Indian Health Service accounted 3% of cases; CHAMPUS (military) and VA sources paid for 1%.
- Medicaid was 1.5 times more likely to be the payer in specialty facilities than in general hospitals.
- Self pay covered 12% of cases in general hospitals but almost none in specialty facilities.

TBI-related Payment Sources by Hospital Type, NM, 2004-2007

TBI Hospitalization Payers	All Hospitalizations		General Hospitals		Specialty Facility	
	Total*	Percent	Total	Percent	Total	Percent
Champus Military, VA	53	1.0	51	1.1	2	0.3
Uncompensated Care	134	2.4	120	2.5	14	1.8
County Indigent Funds	64	1.2	64	1.3	0	0.0
IHS PHS	181	3.3	179	3.8	2	0.3
Medicaid	1,105	19.9	873	18.4	214	28.1
Medicare	1,547	27.8	1,316	27.7	229	30.0
Other Government Law	127	2.3	118	2.5	9	1.2
Private Insurance	1,537	27.7	1,316	27.7	215	28.2
Self Pay	577	10.4	567	11.9	2	0.3
Unknown*	180	3.1	70	1.5	53	7.0
Worker Compensation	96	1.7	74	1.6	21	2.8
Total*	**5,557**	**100.0**	**4,755**	**100.0**	**762**	**100.0**

* All hospitalizations include 40 cases for which payer is unknown among the hospital and facility types or for which complete payer source data were unavailable for all four years.

Acquired Brain Injury-related Deaths, NM, 2004-2006

ABI was identified as the underlying cause of death for 2,230 NM residents between 2004 and 2006. On average, 743 people died each year at an annual rate of 39.2 per 100,000 resident population. Over the three year period, cerebrovascular disease, the leading cause, resulted in the death of 33 of every 100,000 residents per year.

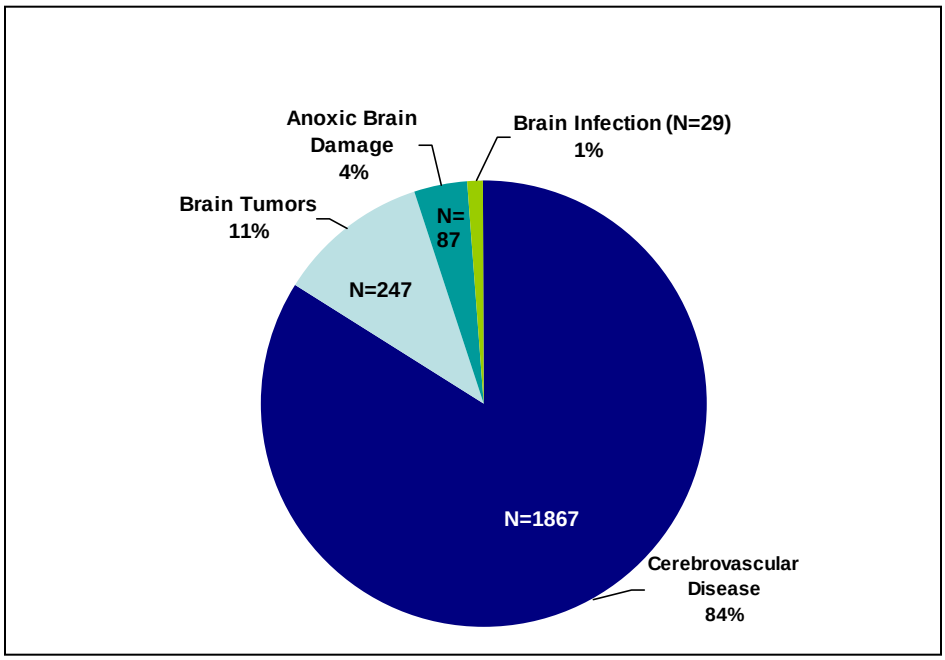
ABI-related Deaths by Cause, NM, 2004-2006

All Ages	2004-2006	Rate*
Cerebrovascular Disease	1,867	33.1
Brain Tumors	247	4.1
Anoxic Brain Damage	87	1.5
Brain Infection	29	0.5
Total ABI	**2,230**	**39.2**

*Age adjusted per 100,000 population

Cerebrovascular disease, primarily strokes, caused 84% of all ABI deaths, followed by brain tumors at 11%. Anoxic brain damage and other causes accounted for the remaining 5% of deaths.

Leading Causes of Acquired Brain Injury Hospitalization New Mexico 2004-2006 – All Ages



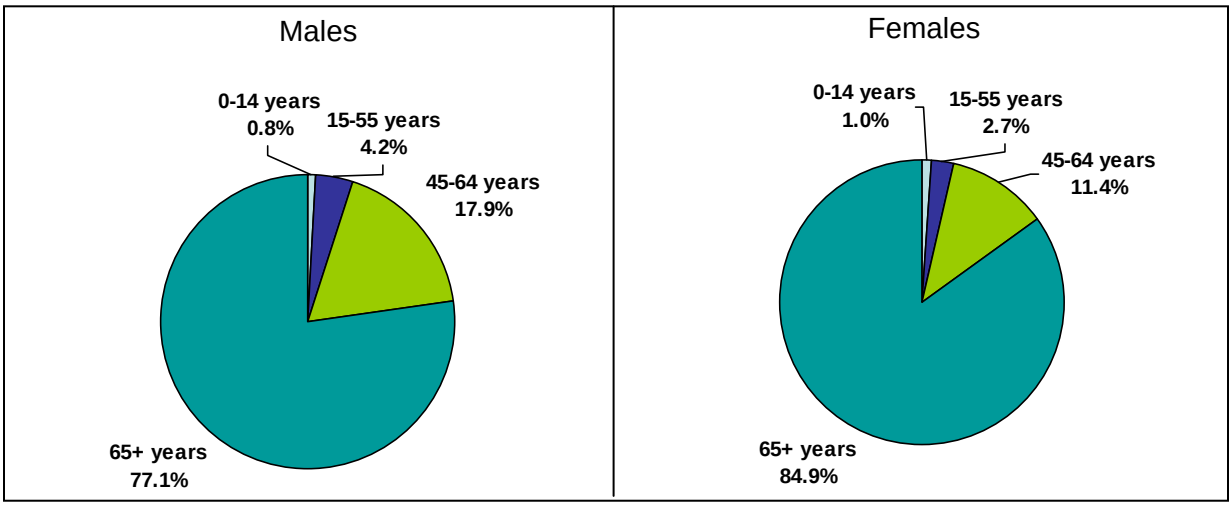
Gender differences among ABI-related deaths:

- Females were about 1.5 times more likely to die of ABI than males (1,316 females compared to 914 males).

NM ABI-related Deaths by Gender and Age, 2004-2007

Age Group	Males		Females	
	Number	Rate/ 100,000	Number	Rate/ 100,000
0-4	4	1.9	5	2.5
5-14	3	0.7	6	1.5
15-24	6	1.3	2	0.5
25-34	10	2.7	9	2.5
35-44	22	5.5	24	5.9
45-54	60	14.3	63	14.2
55-64	104	33.4	87	25.9
65-74	188	102.2	164	78.3
75-84	290	282.9	394	282.0
85+	227	736.8	562	1034.4
Total	**914**	**31.5**	**1,316**	**43.9**

ABI-related Deaths by Gender, NM, 2004-2007



- Most ABI-related deaths occurred among the population ages 65 years and older (77% of males; 85% of females).
- 18% of male ABI-related deaths occurred at ages 45-64 compared to 11% of female deaths.
- At the younger ages of 15-44 years, males proportions of deaths were slightly higher than for females at ages (4% of males and about 2% of females).

Race/ethnicity differences among ABI-related deaths, 2004-2006:

- Black New Mexicans had the highest ABI-related death rate
- American Indian/Alaska Native New Mexicans had the lowest ABI-related death rate
- During the three year period, 13 ABI-related deaths occurred among Asian/Pacific Islanders.

ABI-related deaths by race/ethnicity, 2004-2006

Race/ethnicity	Number	Rate*
White, Non-Hispanic	1,357	39.0
Hispanic	707	40.9
American Indian/Alaska Native	101	29.0
Black	48	51.2

*Age-adjusted per 100,000 population

ABI-related deaths by NM health region, county, and urbanicity characteristics:

Health Region:

- The Bernalillo county region had the most deaths (N=768) and the highest ABI-related death rate (43.7/100,000 population).
- The fewest ABI-related deaths occurred in the northeast region (N=264), which also had the lowest ABI-related death rate (29.0/100,000 population).

ABI-related Deaths by Health Region, NM, 2004-2006

Health Region	***Number***	***Rate****
Bernalillo	768	43.7
Southwest	486	39.4
Northwest	387	40.4
Southeast	325	39.7
Northeast	264	29.0

*Age adjusted per 100,000 population

Urbanicity:

- Number of ABI-related deaths decreased as the area characteristics changed from metro to micro to non-core due to population size, while death rates remained similar.

ABI-related Deaths by Urbanicity, NM, 2004-2006

***Area Urban* Characteristic**	***Number***	***Rate****
Metro	1,404	40.7
Micro	647	36.6
Non-core	179	38.1

*Age adjusted per 100,000 population

ABI-related Hospitalizations, NM, 2004-2007

NM residents were hospitalized from ABI about 7,600 times annually (30,522 times in 2004-2007) - including admissions to both general and specialty hospitals.

- Hospitalizations increase with age, particularly at 45 years of age and older.
- 64.3% of ABI hospitalizations were for ages 65 years and older; 79.8% for ages 55 years and older.
- Rates for young children are much higher for infants aged <1 year than for children ages 1-4 years (67.2/100,000 and 39.5/100,000 respectively).
- Females and males had similar numbers of hospitalizations at each age group until ages 75 years and older when females had more hospitalizations.

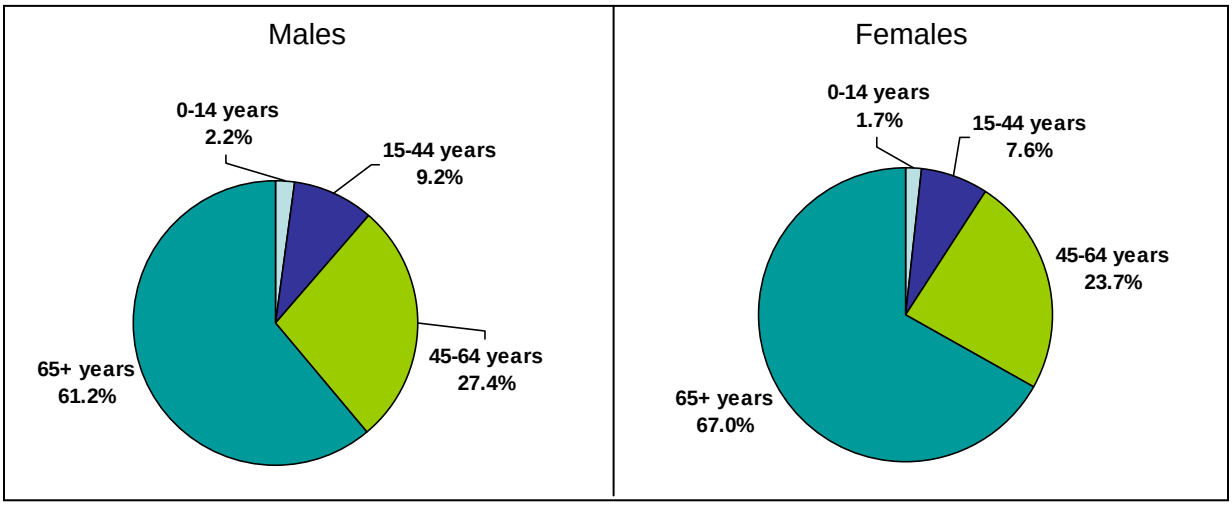
NM ABI-related Hospitalizations by Age and Gender 2004-2007

Age Group	Total ABI Hospitalizations			Females		Males	
	Number	Rate/ 100,000	% of Total	Number	Rate/ 100,000	Number	Rate/ 100,000
< 1	172	152.5	0.6	76	138.4	96	165.8
1 - 4	190	44.6	0.6	103	49.0	87	40.3
5 - 14	225	20.5	0.7	86	15.9	139	24.9
15 -24	434	35.3	1.4	165	27.6	269	42.7
25 - 34	701	72.3	2.3	353	73.2	348	71.4
35 - 44	1,414	129.9	4.6	699	125.2	715	130.6
45 - 54	2,947	250.3	9.7	1,452	239.9	1,495	209.0
55 - 64	4,820	561.9	15.8	2,327	522.7	2,493	604.2
65 - 74	6,833	1261.6	22.4	3,323	1150.7	3,508	1387.6
75 - 85	8,409	2450.9	27.6	4,658	2349.4	3,749	2588.5
85 +	4,377	4328.0	14.3	2,714	4236.1	1,661	4481.6
Total	**30,522**	**383.3**	**100.0**	**15,956**		**14,560**	

Note: Gender unknown for 6 cases

- 67% of female ABI hospitalizations occur at ages 65 and older compared to 61.3% of males.

Percent ABI-related Hospitalizations by Gender 2004-2007



ABI-related hospitalizations by Health region:

- The highest rates of hospitalized residents occurred in the southeast region (1,188.2/100,000 residents) and was approximately three times greater than the rates in the Bernalillo (396.1/100,000) and northwest (398.9/100,000) regions.
- The highest number of hospitalizations occurred in the southwest region (15,081).
- The lowest number of ABI-related hospitalizations occurred in the northwest region (5,647).

ABI-related Hospitalizations by Health Region, 2004-2007

Region	Number	Rate*
Bernalillo	9,931	396.1
Northwest	5,647	398.9
Northeast	8,555	687.6
Southeast	12,582	1188.2
Southwest	15,081	903.7

*Age adjusted per 100,000 population

ABI-related hospitalizations by urbanicity:

Numbers of ABI-related hospitalizations in metro areas were more than twice as great as hospitalizations in micro areas and almost eleven times greater than hospitalizations in non-core areas.

- The metro and micro area hospitalization rates were comparable; non-core areas had the lowest rates.

ABI-related Hospitalizations by Urbanicity, NM, 2004-2007

Area	Number	Rate*
Metro	19,395	393.1
Micro	9,291	389.3
Non-core	1,836	319.7

*Age adjusted per 100,000 population

Diagnosis for ABI-related hospitalization:
Some patients received more than one ABI-related diagnosis, which resulted in a total of 31,075 diagnoses for 30,522 total ABI-related hospitalizations.

- Cerebrovascular events accounted for almost 80% of the ABI-related hospitalizations.
- Brain neoplasms accounted for approximately 10% of ABI-related hospitalizations.

ABI-related Hospitalization by Diagnosis, NM, 2004-2007

Diagnoses among all ABI Hospitalizations	Number of Diagnoses	%
Cerebrovascular	24,685	79.4
Neoplasm of Brain	3,228	10.4
Anoxic Brain Damage	1,805	5.8
Brain Infection	1,055	3.4
Postconcussion Syndrome	172	0.6
Other	130	0.4
Total Diagnoses	**31,075**	**100**

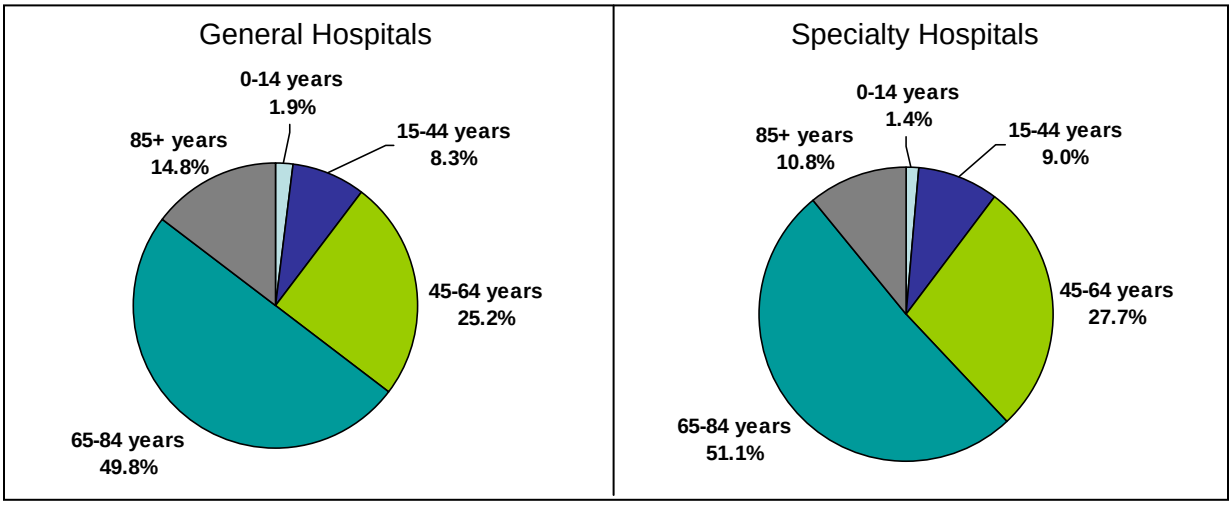
ABI-related hospitalizations by hospital type and age:
General hospitals included 8.5 times more ABI-related hospitalizations than did specialty facilities (342.1/100,000 residents and 40/100,000, respectively).

- Between ages 35 and 74 years, the hospitalization rates in each type of facility almost doubled with advances in each 10 year age group.
- At the oldest ages, 85+ years, the ABI-related hospitalization rate continued to almost double in general hospitals but the increase was about 35% in specialty facilities between ages 75-84 years and 85+ years.

ABI-related Hospitalizations by Hospital Type and Age, NM, 2004-2007

	General Hospitals		Specialty Facilities	
Age Group	Number	Rate/ 100,000	Number	Rate/ 100,000
0-4	341	63.3	20	3.7
5-14	198	18.0	26	2.4
15-24	382	31.1	49	4.0
25-34	625	64.5	75	7.7
35-44	1,244	112.5	169	15.3
45-54	2,580	219.2	364	30.9
55-64	4,285	499.5	528	61.6
65-74	6,047	1,116.5	770	142.2
75-84	7,519	2,191.5	876	255.3
85+	4,022	3,977.0	348	344.1
Total	**27,243**	**342.1**	**3,225**	**40.5**

Percent ABI-related Hospitalizations by Age Group 2004-2007



- 10% of both general hospital and specialty facility stays were for ages 0-44 years.
- 25% of general hospital stays and 28% of specialty facility stays were for cases between 45-64 years of age.
- About half of both general hospital and specialty facility stays were for cases 65-84 years of age.
- Cases at ages 85 or older represented 15% of general hospital stays and 11% of specialty facility stays.

ABI-related discharge status from general hospitals and specialty facilities combined:

- 47.3% of hospitalizations resulted in a routine discharge to home.
- 28.4% of ABI patients were transferred to another institution, representing some of the duplications among discharged cases across facilities.
- 11.7% of ABI patients were transferred to home health care.
- 9% of ABI patients died or were transferred to hospice care.

ABI Discharge Status	Total	Percent
Routine discharge	14,442	47.3
Transfer to another institution*	8,658	28.4
Transfer to home health care	3,585	11.7
Expired or discharged to hospice care**	2,631	8.6
Unknown discharge status***	1,206	4.0
Total	**30,522**	**100.0**

* Transfers to other institutions included: skilled nursing facilities (3,949 cases, 12.9%); short term general hospitals (1,769 cases, 5.8%); intermediate care facilities (944 cases, 3.1%); another institution, type not specified (1,974 cases, 6.5%).
** Discharge to hospice care accounted for 177 cases
*** Unknown discharge status includes 151 hospitalized cases who left against medical advice, represent 0.5% of total discharges.

Length of stay for ABI-related hospitalizations:

About 7,600 days annually were due to ABI-related events (30,522 in 2004-2007) with an average length of stay of about 7.5 days.

- About 6,600 days were spent annually in general hospitals (27,243 days 2004-2007); in specialty facilities, more than 800 days were spent annually (3,225 days 2004-2007).
- General hospital stays averaged almost 6 days; specialty facility stays averaged more than 22 days.

ABI-related Hospitalizations Length of Stay by Hospital Type, NM, 2004-2007

ABI Hospitalizations	Length of Stay by Hospital or Facility		
	All hospitalizations*	General hospitals	Specialty facilities
Hospitalizations	30,522	27,243	3,225
Total number of days	230,138	157,418	72,618
Average length of stay	7.5 days	5. 8 days	22.5 days

* An additional 54 hospitalizations, not identified by hospital/facility type, averaged a length of stay of 2.0 days totaling of 102 days in 2004-1007.

ABI–related payment sources:

Payment sources for most ABI-related hospitalizations in both types of hospitals or facilities were primarily from public (non-private) sources.

- Medicare accounted for 61.6% while Medicaid accounted for 8.4%.
- Private insurance accounted for 18.7%.
- Medicaid was about 1.3 times more likely to be the payer in specialty facilities than in general hospitals (10.5% and 8.2%, respectively).
- Medicare was slightly more likely to be the payer in general hospitals than in specialty facilities (63% and 55%, respectively).
- Self pay covered 4% of cases in general hospitals but only 1% in specialty facilities.

ABI-related Hospitalizations by Payment Source, NM, 2004-2007

ABI Hospitalization Payers	All Hospitalizations		General Hospitals		Specialty Facility	
	Total	**Percent**	**Total**	**Percent**	**Total**	**Percent**
Champus Military, VA	257	0.8	251	0.9	6	0.2
Uncompensated Care	372	1.2	360	1.3	12	0.4
County Indigent Funds	233	0.8	232	0.8	1	0.0
IHS PHS	177	0.6	168	0.6	9	0.3
Medicaid	2,562	8.4	2,224	8.2	338	10.5
Medicare	18,799	61.6	17,028	62.5	1,771	54.9
Other Government Law	316	1.0	292	1.1	24	0.7
Private Insurance	57,01	18.7	4,866	17.9	835	25.9
Self Pay	1,116	3.7	1,083	4.0	33	1.0
Unknown, NULL*	933	3.0	691	2.5	188	5.8
Worker Compensation	56	0.2	48	0.2	8	0.3
Total*	**30,522**	**100.0**	**27,243**	**100.0**	**3,225**	**100.0**

* All hospitalizations include 54 cases for which payer is unknown by hospital and facility type.

Data Limitations

Death data: Data are limited to information reported on death certificates. In general, death certificate data provide limited information about circumstances of injury incidents or contributing factors. Deaths associated with some injuries, especially suicide, may be underreported. Deaths resulting from complications of a head injury may not always be reported as due to the head injury. Deaths occurring after multiple hospitalizations due to complications may be attributed to the complicating factor.

Hospitalization data: A serious concern when using billing data (such as is used in statewide hospital discharge data) for injury surveillance is the issue of duplicate reporting.[4] In order to determine the incidence of injury (a critical measure for evaluating prevention efforts), it is important to count a person-injury event only once and to include only the first or initial visit.

- Duplicate reporting can occur when a patient has multiple records that either have exact duplicate information or describe different aspects of the same "person-injury event." For example, an injured person might be transferred between two or more hospitals, or be transferred to other in-hospital services (e.g., skilled nursing, long-term swing beds, rehabilitation) that bill separately within the same hospitalization. Additionally, persons may be re-hospitalized intermittently following the initial hospitalization for various procedures or complications. In instances such as these, more than one record for the same "person-injury event" could appear in the hospital discharge data set.
- Length of hospital stay, charges, and complications are important indicators of injury outcomes. Capturing complete information such as this from a person-injury event using billing data may also be a challenging task for state injury and violence prevention programs. Hospitals often transfer patients to different billing services (e.g., swing bed, skilled nursing, rehabilitation, etc) within the same acute care stay resulting in duplicate records.

The hospital discharge data does not include data from federal hospitals, such as the Veterans Administration Hospital and Indian Health Service hospitals. Since some American Indians are hospitalized at Indian Health Service hospitals rather than general hospitals in NM, there may be an undercount in injury hospitalization cases among this group. New Mexico residents who are hospitalized in out-of-state hospitals are not included in the hospital discharge data. This particularly impacts rates for counties along the state's border with Texas. These limitations result in the undercounting of injury cases.

E-coding is used to identify the cause of injuries, which is provided by hospitals on a voluntary basis. During the period 2004-2007 between 63% and 70% of the injury hospitalizations had a valid E-code. External cause of TBI-related events was not shown in this report due to inadequate coding (e-codes) in the hospitalization data.

Emergency Medical Service, Emergency department and outpatient data: Only injuries severe enough to lead to either hospitalization or death are reported. More complete surveillance is needed if the total burden of injury is to be understood.[4] Head injuries that lead to emergency department visits, physician office visits, or remain untreated are not available. Head injury events may be assessed multiple times in out-patient settings without hospitalization. For TBI events, repeated injuries may lead to long-term consequences not adequately assessed at the time of the injury. The need to include data from emergency medical system (EMS) information

systems and databases has been well established.[4] The NM Department of Health, Epidemiology and Response Division, Emergency Medical Services Bureau conducts the New Mexico Emergency Medical Services Tracking and Reporting System (NMEMSTARS) which includes patient care reports of the approximate 380,000 emergency medical service (EMS) runs encountered by EMS responders in the state. In future reports, the NM Department of Health Office of Injury Prevention will work to include TBI-related information from the NMEMSTARS system.

Since NM lacks the ability to document ED treatment for TBI-related injury events, estimation of the magnitude and causes of TBI in the population who received treatment only in EDs cannot be made. However, a continually-updated CDC national-level TBI data report allows a very rough estimation of the incidence of ED-treated TBI events based on the fatality and hospitalization data used in this NM report.[5] Ratios of deaths, hospitalizations and ED visits may be applied to NM resident population data. Nationally, in 2003, for every 3 TBI-related deaths, approximately 18 people were hospitalized, and 79 people sought ED treatment for a TBI-related injury. Using this ratio of annual deaths to hospitalizations in NM (an average of 414 deaths/year and 1,287 hospitalizations/year after exclusion of about 103 deaths /year during hospitalization), about 98,000 NM residents would have been expected to receive ED treatment each year.

Appendix A. Definitions, classification systems and data limitations

TBI fatalities were identified from the NM multiple cause of death files (MCOD) prepared by the NM DOH, BVHRS, as described in the overview section. Hospitalizations were identified from HPC data under direction of the NM DOH OIP. TBI fatalities and hospitalizations were identified by ICD codes and analyzed according to instructions for preparing state injury indicators by the CDC.[8] Nature and cause of death are obtained from official death certificate entries. ABI ICD codes were obtained from death files including only underlying cause of death.

Fatalities
TBI-related deaths were identified if they had any of the following ICD-10 codes in any field of the multiple cause of death file describing the **nature** of the TBI injury. Injuries at the neck level are not included in this TBI definition and not used in the US (ICD codes T01.0-T06.0). TBI injuries include the following:

TBI - Nature of Fatality	**ICD-10 Codes**
Crushing injury of head	S01.0–S01.9
Fracture of skull and facial bones	S02.0, S02.1, S02.3, S02.7–S02.9
Intracranial injury	S06.0–S06.9
Open wound of head	S07.0, S07.1, S07.8, S07.9
Other and unspecified injuries of head	S09.7–S09.9
Sequelae of injuries of head	T90.1, T90.2, T90.4, T90.5, T90.8, T90.9

In addition to the underlying cause of death, MCOD files may include up to 12 contributing causes based on. About 97% of TBI deaths, identified by nature in MCOD fields, had an injury as the underlying cause following:

TBI - Underlying Cause of death	**ICD-10 Codes**
Motor vehicle crash–related (unintentional)	V02–V04 (.1, .9); V09.2; V12–V14 (.3–.9); V19 (.4–.6); V20–V28 (.3–.9); V29 (.4–.9); V30–79 (.4–.9); V80 (.3–.5); V81.1; V82.1; V83–V86 (.0–.3); V87 (.0–.8); V89.2
Occupant	V30–79 (.4–.9); V83–V86 (.0–.3),
Motorcycle	V20–V28 (.3–.9); V29 (.4–.9)
Pedal cycle	V12–V14 (.3–.9); V19 (.4–.6)
Pedestrian	V02–V04 (.1, .9); V09.2
Other and unspecified - All other cause codes	V80 (.3–.5); V81.1, V82.1, V87 (.0–.8); V89.2
Falls (unintentional) (undetermined intent)	W00–W19; Y30
Homicide (includes firearm and other)	X85–Y09; Y87.1
Suicide Suicide by firearm	X60-X84 X72-X74
Struck by/against; (unintentional) (unintentional and undetermined)*	W20–W22; W50–W52 Y29
Other and unspecified	All other cause codes

ABI - Nature of Fatality	ICD-10 Codes
Malignant neoplasm of brain	C71 (.0-.9)
Malignant neoplasm of cranial nerves	C72.5
Malignant neoplasm of cerebral meninges	C70.0
Secondary malignant neoplasm of brain and spinal cord	C79.3
Secondary malignant neoplasm of other parts of nervous system	C79.4
Benign neoplasm of brain	D33.2
Benign neoplasm of cranial nerves	D33.3
Benign neoplasm of cerebral meninges	D32.0
Postconcussion syndrome	F07.2
Meningitis	G00, G03
Encephalitis, myelitis and encephalomyelitis	G04, G92
Late effects of intracranial abscess of pyrogenic infection	G09
Anoxic brain damage	G93.1
Subarachnoid hemorrhage	I60.9
Intracerebral hemorrhage	I61.9
Other and unspecified intracranial hemorrhage	I62 (.0 -.9)
Occlusion and stenosis of precerebral arteries	I63 (.0, .2), I65 (.0-.9)
Occlusion of cerebral arteries	I63 (.3-.5) I66 (.8-.9)
Transient cerebral ischemia	G45 (.0,.8,.9)
Acute, but ill-defined,cerebrovascular disease	I64
Other and ill-defined cerebrovascular disease	I67 (.1,.2,.4-.9), G45.4
Late effects of cerebrovascular disease	I69.8
Toxic effect of noxious substances eaten as food	T61.(.0-.9), T62 (.0-.9)
Effects of drowning and nonfatal submersion	T75.1
Effects of asphyxiation and strangulation	T71
Other specified adverse effects not elsewhere classified	T74.9, T78.8

Hospitalizations

Records showing the nature and causes of injury leading to admission rely on classification codes using a previous version of ICD categories created for clinical diagnoses (ICD-9-CM). ICD-10 classifications used for fatalities tend to be more specific than ICD-9. A direct one-to-one correspondence between ICD-10 causes of death and ICD-9-CM causes of hospitalization is not always possible. HPC data records showing ICD-9-CM diagnostic categories (N codes) were searched across nine diagnoses (primary through any additional mentions) to identify either traumatic or acquired brain injury as the diagnostic NATURE for each hospitalization. The following diagnostic categories were used:

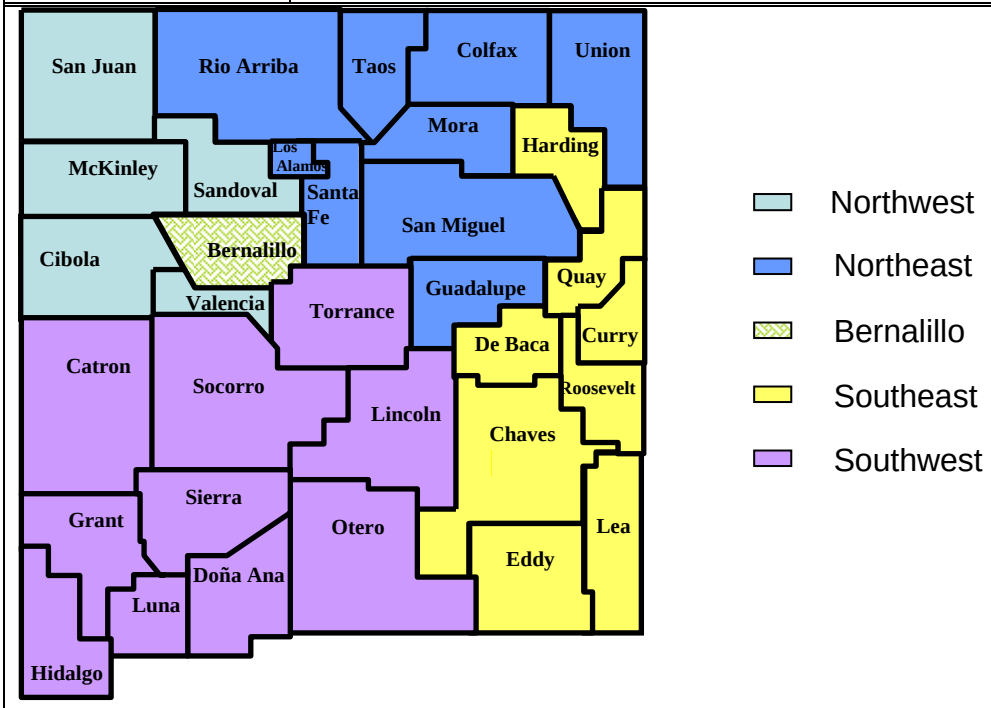
TBI - Diagnostic Category	**ICD-9-CM N-Code***
Skull fracture	800 – 801.99, 803 – 804.99
Concussion	850-850.9
Cerebral laceration and contusion	851-851.99
Subarachnoid, subdural, & extradural hemorrhage following injury	852-852.59
Other and unspecified intracranial hemorrhage following injury	853-853.19
Intracranial injury of other unspecified nature	854-854.19
Head injury unspecified, including Shaken Baby	959.01, 955.5

* Excludes birth injuries with a primary diagnosis of V30-V39

ABI - Diagnostic Category	**ICD-9-CM Code**
Neoplasm of brain	191 – 191.8, 192.0, 192.1, 198.3, 198.4, 225.0-225.2
Postconcussion syndrome	310.2
Meningitis, other brain infections	320-323.9, 326
Anoxic brain damage	348.1
Cerebrovascular disease	430-438.9
Effects of drowning and nonfatal submersion	994.1
Effects of asphyxiation and strangulation	994.7
Other specified adverse effects not elsewhere classified, including toxic effect of noxious substances eaten as food	995.8, 988.0-988.9

New Mexico Area Definitions

New Mexico Public Health Regions by county	
Region 1 (Northwest)	Cibola, McKinley, Sandoval, San Juan, Valencia
Region 2 (Northeast)	Colfax, Guadalupe, Los Alamos, Mora, Rio Arriba, San Miguel, Santa Fe, Taos, Union
Region 3 (Bernalillo)	Bernalillo
Region 4 (Southeast)	Chaves, Curry, De Baca, Eddy, Harding, Lea, Quay, Roosevelt
Region 5 (Southwest)	Catron, Doña Ana, Grant, Hidalgo, Lincoln, Luna, Otero, Sierra, Socorro, Torrance



Urbanicity designations

Population-based areas designated as metropolitan, micropolitan or non-core (rural) are determined according to US Census Bureau estimates of population with classifications designated according to the US Office of Management and Budget (OMB). See OMB Federal Register of August 22, 2000, for definitions[10] and OMB Bulletin No. 08-01 of November 2007[11] for updates to metropolitan and micropolitan statistical areas based on Census Bureau population estimates for 2005 and 2006. Metropolitan and micropolitan statistical areas (metro and micro areas) are geographic entities defined by OMB for Federal statistical agencies in collecting, tabulating, and publishing Federal statistics. The term "Core Based Statistical Area" (CBSA) is a collective term for both metro and micro areas. A metro area contains a core urban area of 50,000 or more population, and a micro area contains an urban core of at least 10,000 (but less than 50,000) population. Each metro or micro area consists of one or more counties and includes the counties containing the core urban area, as well as any adjacent counties that have a high degree of social and economic integration (as measured by commuting to work) with the urban core. The non-metro and non-micropolitan areas are referred to as non-core in this NM report.

Population category by county	
Metro	Bernalillo, Dona Ana, Farmington, Sandoval, Santa Fe, Torrance, Valencia
Micro	Chaves, Cibola, Curry, Eddy, Grant, Lea, Los Alamos, Luna, McKinley, Otero, Rio Arriba, Roosevelt, San Miguel, Taos
Non-core	Catron, Colfax, De Baca, Guadalupe, Harding, Hidalgo, Lincoln, Mora, Quay, Sierra, Socorro, Union

New Mexico population estimates used for rates:

NM population estimates are produced by the University of New Mexico (UNM) Bureau of Business and Economic Research (BBER).[10] Estimates are for resident population (both civilian and Armed Forces) living in the area as of July 1 of each year. Estimates are calculated from a demographic 'components of change' model that incorporates information on natural change (births and deaths) and net migration (net domestic migration and movement from abroad) that has occurred in the area since the 2000 census. BBER implemented a change in its process for estimating New Mexico population denominators, starting with its 2007 population estimates. This change involved updated, more accurate, migration data within its population estimation process. This change resulted in larger-than-average annual changes in population estimates for some age, sex, and race/ethnic groups, in some counties, in 2007 compared to previous years. Therefore, annual changes in TBI rates are not shown in this report.

State and county rates are calculated from the number of deaths or hospital discharges for each age or gender divided by the appropriate resident population BBER estimates. Age-adjusted rates are obtained by calculating age- (or gender-) specific rates, multiplying the rates by the proportion of each age group in the 2000 US Standard Population (age specific weight), and summing the results of each age group.

Appendix B. Descriptive Data Tables

New Mexico Traumatic Brain Injury Deaths
2004-2006 Total Numbers and Average Annual Rates*

New Mexico	*2004-06 Total Number**		*Annual Crude Rate*		*Age-Adjusted Annual Rate*
Total	**1241**		**21.0**		**21.1**
Counties					
Bernalillo	401		21.8		21.9
Catron	2		18.1		22.1
Chaves	53		28.4		27.1
Cibola	14		16.4		17.2
Colfax	15		34.7		34.0
Curry	24		17.4		17.3
De Baca	3		44.1		62.6
Dona Ana	77		13.4		14.3
Eddy	23		14.7		14.8
Grant	21		22.2		18.1
Guadalupe	3		20.9		20.3
Harding	1		42.2		19.6
Hidalgo	0		0.0		0.0
Lea	29		16.8		17.3
Lincoln	11		17.2		18.1
Los Alamos	11		18.6		19.4
Luna	17		21.1		23.3
McKinley	59		25.1		27.2
Mora	4		24.5		23.8
Otero	27		13.9		13.8
Quay	3		9.9		9.9
Rio Arriba	36		28.1		28.0
Roosevelt	11		19.6		19.8
Sandoval	52		16.2		16.5
San Juan	80		21.1		22.8
San Miguel	29		31.5		29.0
Santa Fe	96		22.3		22.6
Sierra	12		29.2		27.0
Socorro	22		39.6		42.5
Taos	41		42.8		42.6
Torrance	11		20.3		18.7
Union	4		31.0		33.1
Valencia	49		23.1		24.5

* Rates are averaged for the three year total. Rates based on small numbers should be viewed with caution. Death data are based on annual files for 2004-2006 from the NM Bureau of Vital Records and Health Statistics (BVRHS) as prepared by the Office of Injury Prevention.

New Mexico Traumatic Brain Injury Hospital Discharges
Includes both general and specialty hospitals
2004-2007 Average Annual Rates*

New Mexico	*2004-07 4 Year Total Number**	*Annual Crude Rate*	*Age-Adjusted Annual Rate*	Ages Under 65 Years		
				4 Year Total Number*	Annual *Crude Rate*	*Age-Adjusted Rate*
Total	**5,557**	**279.1**	**287.8**	**3,871**	**55.5**	
Counties						
Bernalillo	1,889	303.8	313.2	1315	60.3	
Catron	9	238.4	197.3	7	60.2	
Chaves	143	228.3	223.2	100	46.6	
Cibola	75	262.4	266.6	52	51.9	
Colfax	75	518.4	532.5	57	120.5	
Curry	54	116.2	117.7	36	21.9	
De Baca	< 5	176.2	165.8	< 5	48.3	
Dona Ana	232	118.6	130.1	113	16.3	
Eddy	82	156.8	155.5	49	27.3	
Grant	71	224.5	205.3	42	40.8	
Guadalupe	21	439.5	444.0	18	110.8	
Harding	<5	499.5	442.1	< 5	131.1	
Hidalgo	6	100.7	93.1	5	25.0	
Lea	89	154.6	161.6	61	30.1	
Lincoln	27	122.6	118.9	16	22.4	
Los Alamos	44	222.8	250.2	27	39.4	
Luna	61	224.3	191.5	27	30.4	
McKinley	300	381.2	450.5	227	78.2	
Mora	19	348.4	375.0	14	76.4	
Otero	81	124.6	132.6	39	17.2	
Quay	23	226.1	224.7	16	49.5	
Rio Arriba	196	454.2	470.5	162	106.3	
Roosevelt	12	63.9	63.1	< 5	6.0	
Sandoval	297	267.4	283.6	197	49.8	
San Juan	611	481.7	510.3	475	104.0	
San Miguel	123	399.4	418.6	92	85.5	
Santa Fe	456	316.2	345.7	330	64.9	
Sierra	32	233.5	173.4	12	30.4	
Socorro	65	349.6	368.2	47	71.2	
Taos	158	493.9	527.0	122	111.2	
Torrance	55	305.0	348.9	37	57.0	
Union	9	206.1	231.4	6	42.3	
Valencia	234	323.9	347.7	160	61.9	

* Rates are averaged for the four year total. The New Mexico Health Policy Commission provided the hospitalization data for 2004-2007. Accuracy of the data analysis is the responsibility of the NM Epidemiology and Response Division, Office of Injury Prevention. The Health Policy Commission assumes no responsibility for any use made of or conclusions drawn from the data.

New Mexico Acquired Brain Injury Deaths
2004-2006 Total Numbers and Average Annual Rates*

New Mexico	*2004-06 Total Number**	*Annual Crude Rate*	*Age-Adjusted Rate*
Total	**2,230**	**37.8**	**39.2**
Counties			
Bernalillo	768	41.7	43.7
Catron	4	36.0	21.5
Chaves	92	49.3	42.3
Cibola	21	24.6	25.7
Colfax	23	53.4	36.8
Curry	59	42.5	45.3
De Baca	3	44.3	20.0
Dona Ana	198	34.3	39.4
Eddy	66	42.2	37.0
Grant	64	67.7	46.5
Guadalupe	5	35.2	29.9
Harding	0	0.0	0.0
Hidalgo	23	128.5	99.1
Lea	70	40.9	44.0
Lincoln	24	36.5	30.9
Los Alamos	7	11.7	13.3
Luna	39	49.3	36.4
McKinley	53	22.6	38.1
Mora	4	24.5	19.8
Otero	61	31.8	34.6
Quay	19	62.7	39.5
Rio Arriba	37	28.7	29.9
Roosevelt	16	28.4	31.0
Sandoval	120	37.7	41.6
San Juan	104	27.5	38.6
San Miguel	31	33.6	33.3
Santa Fe	113	26.3	27.5
Sierra	39	95.2	42.3
Socorro	22	39.6	47.7
Taos	31	32.4	29.8
Torrance	12	21.9	26.5
Union	13	100.4	65.9
Valencia	89	41.5	49.4

* Rates are averaged for the three year total. Rates based on small numbers should be viewed with caution. Death data are based on annual files for 2004-2006 from the NM Bureau of Vital Records and Health Statistics (BVRHS) as prepared by the Office of Injury Prevention.

New Mexico Acquired Brain Injury Hospital Discharges
Includes both general hospitals and specialty facilities
2004-2007 average annual rates*

New Mexico	4 Year Total Number*	Annual Crude Rate	Age-Adjusted Annual Rate	Ages Under 65 Years		
				4 Year Total Number*	Annual Crude Rate	Age-Adjusted Rate
Total	**30,522**	**383.3**	**393.4**	**10903**	**156.3**	
Counties						
Bernalillo	9,931	399.3	403.5	3776	173.1	
Catron	62	410.6	315.8	19	163.4	
Chaves	1,216	485.3	440.6	335	156.2	
Cibola	350	306.2	318.8	166	165.7	
Colfax	325	561.6	435.6	93	196.5	
Curry	500	269.0	289.8	172	104.8	
De Baca	29	319.4	165.8	6	96.5	
Dona Ana	2,780	355.4	399.2	895	129.3	
Eddy	934	446.5	413.3	282	157.1	
Grant	664	524.8	401.5	197	191.3	
Guadalupe	89	465.6	451.3	28	172.4	
Harding	13	405.9	186.6	2	87.4	
Hidalgo	120	503.6	438.0	33	164.9	
Lea	637	276.5	296.2	198	97.8	
Lincoln	268	304.2	263.2	115	160.7	
Los Alamos	216	273.5	276.5	59	86.2	
Luna	795	730.9	573.9	179	201.5	
McKinley	825	262.0	373.0	399	137.4	
Mora	82	375.9	321.7	34	185.6	
Otero	869	334.1	338.2	285	126.0	
Quay	160	393.1	275.9	46	142.2	
Rio Arriba	720	417.2	447.8	274	179.8	
Roosevelt	253	336.6	369.2	71	107.2	
Sandoval	1,537	346.0	384.9	571	144.3	
San Juan	1,838	362.3	439.0	741	162.3	
San Miguel	663	538.2	537.1	262	243.4	
Santa Fe	1,995	345.9	365.1	683	134.4	
Sierra	315	574.7	344.6	80	202.7	
Socorro	309	415.5	465.2	102	154.5	
Taos	649	507.2	480.3	215	196.0	
Torrance	217	300.8	345.3	107	164.9	
Union	64	366.4	308.1	19	133.9	
Valencia	1,097	379.6	435.1	459	177.6	

* Rates are averaged for the four year total. Rates based on small numbers should be viewed with caution. The New Mexico Health Policy Commission provided the hospitalization data for 2004-2007. Accuracy of the data analysis is the responsibility of the NM Epidemiology and Response Division, Office of Injury Prevention. The Health Policy Commission assumes no responsibility for any use made of or conclusions drawn from the data.

TBI-related hospitalizations by hospital type:

Six times more general hospital stays occurred than did specialty facility stays (60/100,000 residents with 4,755 stays and 10/100,000 residents with 762 stays, respectively).

- Young children and youth ages 0-4 and 5-14 were about twelve times more likely to use general hospitals than specialty facilities.
- Youth ages 15-24 and adults ages 25-74 were five to six times more likely to use general hospitals than specialty facilities.
- Elderly patients were about nine times more likely to use general hospitals than specialty facilities.

NM TBI-related Hospitalizations by Age and Hospital Type 2004-2007

	General Hospitals			Specialty Facilities		
Age Groups	Number	Rate/ 100,000	Percent	Number	Rate/ 100,000	Percent
0-4	304	56.4	6.4	14	4.5	1.9
5-14	283	25.7	6.0	24	2.2	3.2
15-24	766	62.3	16.1	129	10.5	16.9
25-34	492	50.8	10.4	86	8.9	11.3
35-44	504	45.6	10.6	89	8.0	11.7
45-54	534	45.4	11.2	107	9.1	14.0
55-64	417	48.6	8.8	85	9.9	11.2
65-74	435	80.3	9.1	84	15.5	11.0
75-84	582	169.6	12.2	94	27.4	12.3
85+	438	433.1	9.2	50	49.4	6.6
Total	**4,755**	**59.7**	**100.0**	**762**	**9.6**	**100.0**

The distribution of hospitalizations by patient age differed within each type of facility

- 12.4% of general hospital cases were under age 15 compared to 5.1% of cases in specialty facilities.
- Percent of cases at ages 15-34 were about the same in general hospital and specialty facilities (26.5% and 28.2%)
- At ages 35-74, the percentage of cases in specialty facilities (47.9%) exceeded the percentage of cases in general hospitals (39.7%).

By age 75+, the percentage of cases in general hospitals were about the same as in specialty facilities (21.4% and 18.9%, respectively).

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