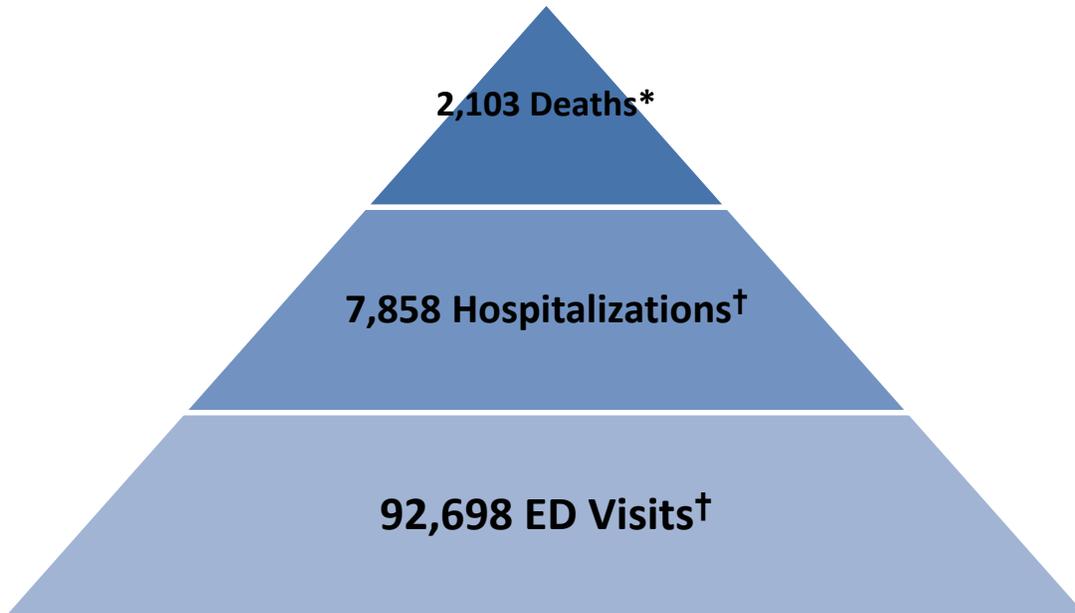


SECTION 5: TRAUMATIC BRAIN INJURIES (TBIs)



CHAPTER HIGHLIGHTS:

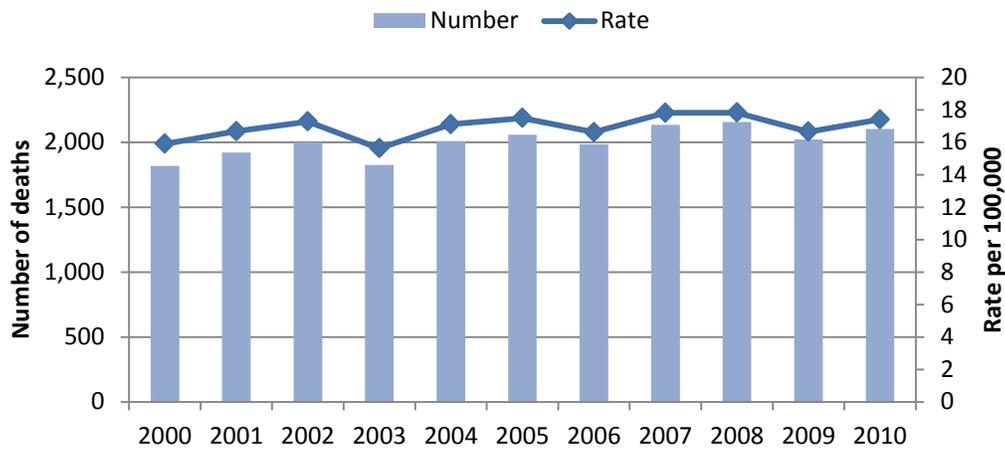
Patterns:

- Males were more likely to experience fatal and non-fatal TBI than females.
- Highest rates of fatal and non-fatal TBIs were found among ages 85 or older.
- Falls were the most common causes of fatal and non-fatal TBIs.

Trends:

- Rates of fatal TBIs did not change over time.
- TBI related hospitalizations increased from 2002-2007 then decreased from 2007-2010.
- ED visit rates increased 78 percent in 2002-2010.
- Largest increases in fatal and non-fatal TBI rates were found among adults ages 85 or older.
- Fatal and non-fatal fall related TBI rates have increased while motor vehicle traffic crash related TBI rates have decreased.

Figure 14.1. Number and age adjusted death rate for traumatic brain injuries by year, Ohio, 2000-2010



Source: Ohio Department of Health, Vital Statistics

DEATHS:

Approximately 2,100 Ohioans died from a traumatic brain injury (TBI) in 2010. The death rate was 17.4 per 100,000 (Figure 14.1). Rates were 3 times higher among males (27.4 per 100,000) than females (8.7 per 100,000). Among both males and females, the highest rates of deaths occurred among adults ages 75 or older (Figure 14.2). The highest rates of TBI deaths occurred among blacks (19.4 per 100,000) followed by whites (17.0 per 100,000), other races (12.1 per 100,000) and Hispanics (11.6 per 100,000). See Table 14.1 for TBI risk profile. The most common mechanisms associated with TBI deaths were falls (28 percent), suicides (27 percent), motor vehicle traffic crashes (21 percent), and homicides (10 percent).

Table 14.1 Traumatic Brain Injury Death Risk Profile		
	2010 At Risk Groups	Annual Trend since 2000
Overall		Inconsistent trend
Sex	Males	Inconsistent trend
Age	75 or older	85 or older (largest increase)
Race and ethnicity	Blacks	Inconsistent trends

TRENDS:

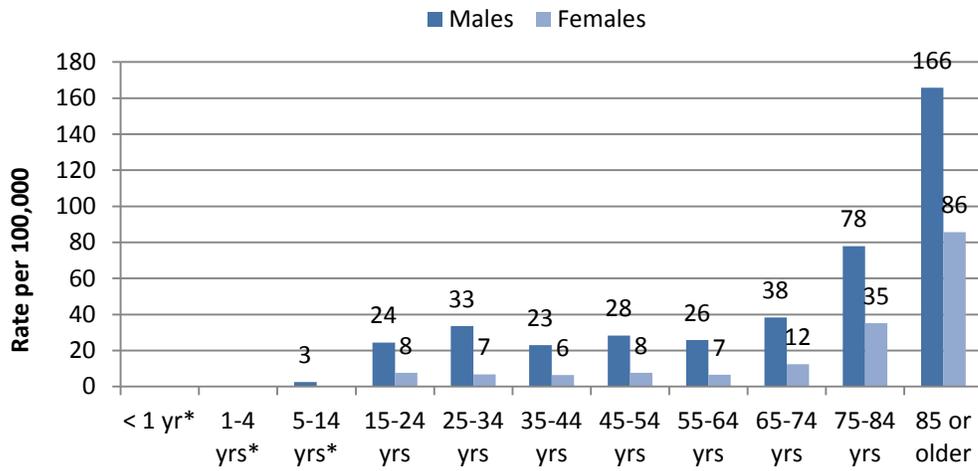
TBI death rates did not follow a consistent linear trend over the study period. Inconsistent trends were also found among males, females, all race and ethnic groups. Consistent trends were found among some age groups with the largest increases found among older adults. Rates increased on average by 5 deaths per 100,000 per year among adults ages 85 or older and 1 death per 100,000 per year among ages 75-84. The number of TBI deaths associated with falls (37 per year) and suicide (10 per year) increased while the number of deaths associated with motor vehicle traffic crashes decreased (-20 per year) (Figure 14.3). See Tables 52a-

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Ohio Violence and Injury Prevention Program, Ohio Department of Health

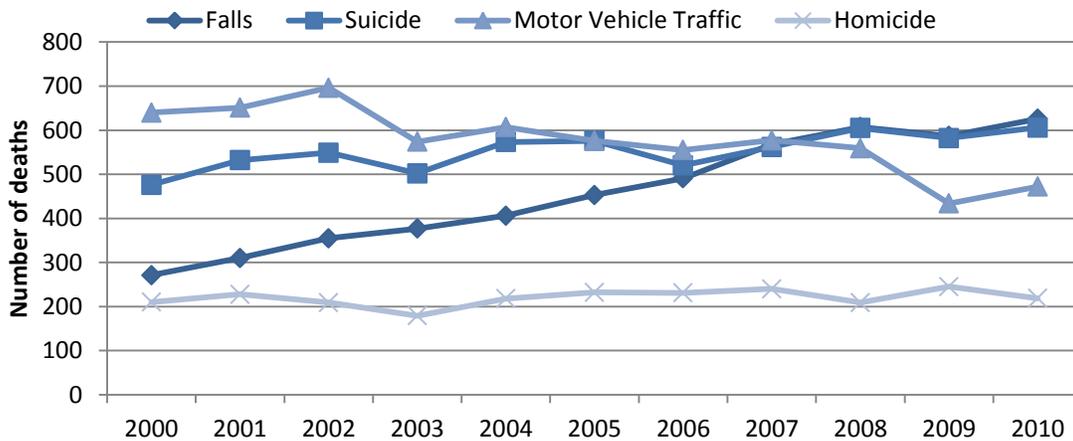
located at the end of this section for more detailed information on the number and rate of TBI deaths in Ohio.

Figure 14.2. Traumatic brain injury fatality rates by age and sex, Ohio, 2010



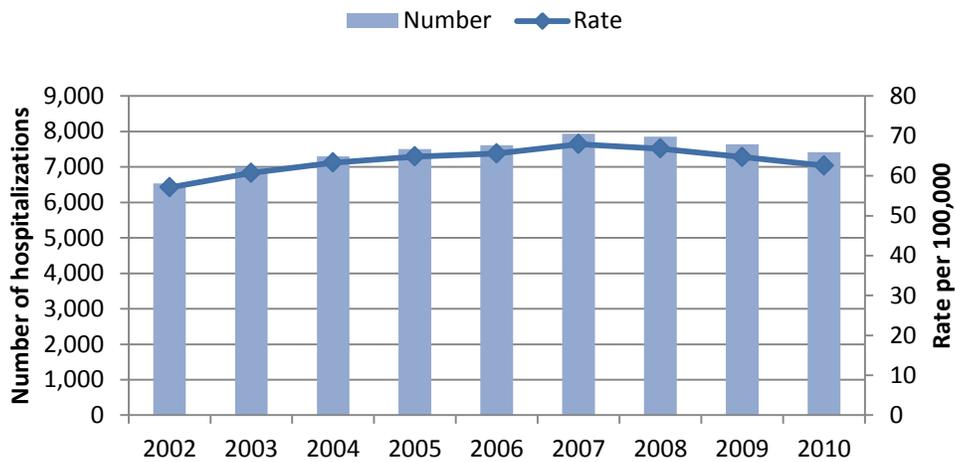
Source: Ohio Department of Health, Office of Vital Statistics
 *Data suppressed due to less than 20 deaths

Figure 14.3. Number of traumatic brain injury deaths by mechanism and year, Ohio, 2000-2010



Source: Ohio Department of Health, Office of Vital Statistics

Figure 14.4. Number and age adjusted rate for traumatic brain injury related hospitalizations by year, Ohio, 2002-2010



Source: Ohio Hospital Association

HOSPITALIZATIONS:

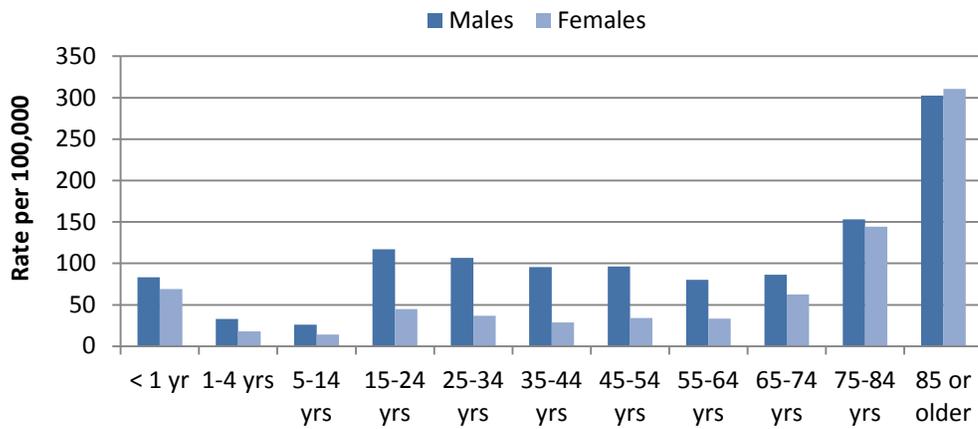
In 2010, approximately 7,900 hospitalizations were associated with traumatic brain injuries (TBI). The hospitalization rate was 62.5 per 100,000 (Figure 14.4). The rate was 2 times higher among males (90 per 100,000) than females (43 per 100,000). For both males and females, the highest hospitalization rates were found among ages 75 or older (Figure 14.5). See Table 14.2 for a TBI hospitalization risk profile. The most common mechanisms associated with TBI were falls (26 percent) and motor vehicle crashes (21 percent). In addition, 40 percent of hospitalizations did not have external cause of injury listed.

Table 14.2 TBI Hospitalization Risk Profile		
	2010 At Risk Groups	Annual Trend Since 2002
Overall		Increased then decreased
Sex	Males	Increased then decreased
Age	75 or older	85 or older (largest increase)

TRENDS:

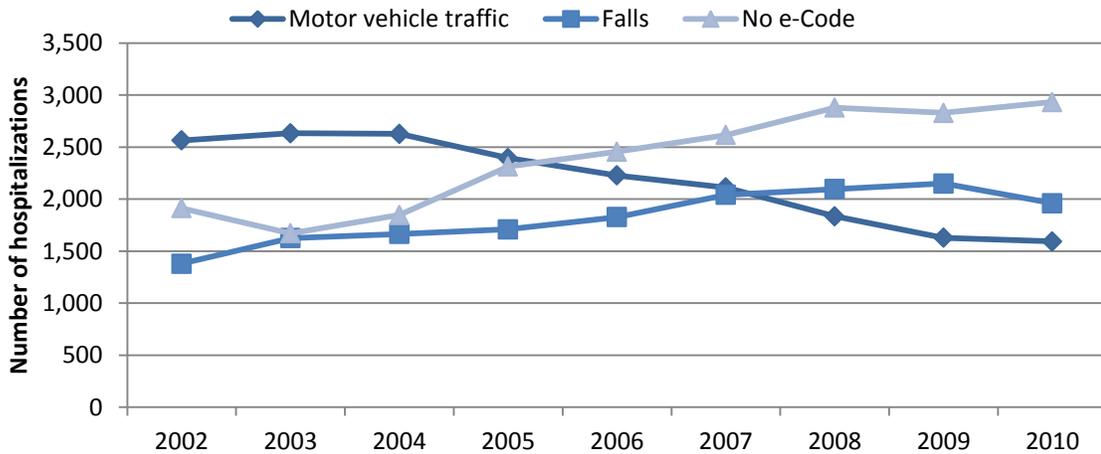
Hospitalization rates appeared to increase in 2002-2007 then decrease in 2007-2010. Rates among males followed the same pattern while rates among females increased in 2002-2008 then decreased in 2008-2010. Trend patterns varied by age group. A decrease in rates was found among ages 5-14 (1 per 100,000 per year) and ages 15-24 (2 per 100,000 per year) while an increase was found among ages 45 or older. The largest annual increase was found among adults ages 85 or older (14 per 100,000 per year). The mechanisms of TBI related hospitalizations shifted between 2002 and 2010. The number of hospitalizations associated with motor vehicle traffic crashes decreased by 146 per year while the number of hospitalizations associated with falls and without an external cause of injury code increased by 85 per year and 165 per year, respectively (Figure 14.6). See Tables 53a-c located at the end of this section for more detailed information about TBI related hospitalizations in Ohio.

Figure 14.5. Hospitalization rates for traumatic brain injuries by sex and age, Ohio, 2010



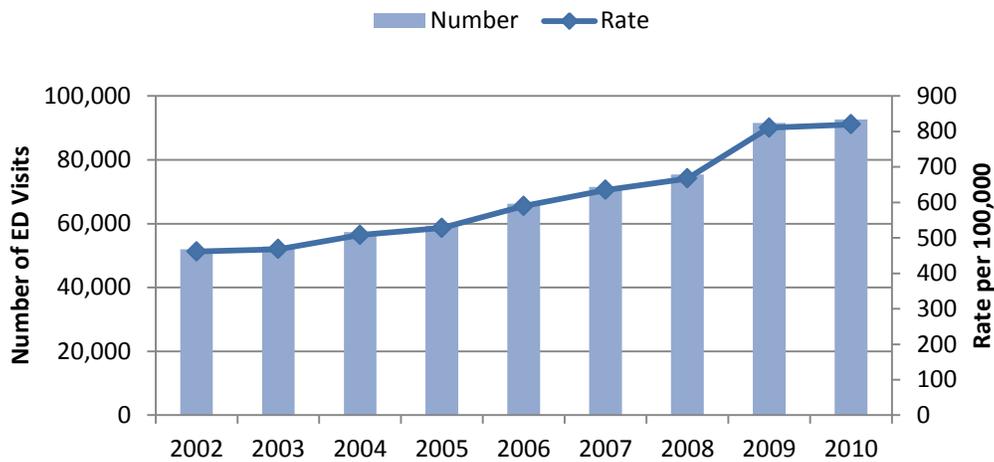
Source: Ohio Hospital Association

Figure 14.6. Number of hospitalizations resulting from traumatic brain injuries, by mechanism and year, Ohio, 2002-2010



Source: Ohio Hospital Association

Figure 14.7. Number and age adjusted rate for traumatic brain injury related ED visits by year, Ohio, 2002-2010



Source: Ohio Hospital Association

EMERGENCY DEPARTMENT VISITS:

Nearly 93,000 emergency department (ED) visits were associated with traumatic brain injuries (TBI) in 2010. The ED visit rate was 820 per 100,000 (Figure 14.7). Overall, males were more likely to experience a TBI related ED visit than females (886 versus 747 per 100,000). However, this pattern changed by age group. Among ages 54 or younger, ED visit rates were higher among males compared to females while rates were higher among females compared to males among ages 55 or older. For both males and females, TBI related ED visits followed a bimodal age distribution with the highest rates of ED visits found among infants less than 1 year of age and adults ages 85 or older (Figure 14.8). See Table 14.3 for TBI ED visit risk profile. The most common mechanisms associated with ED visits were falls (36 percent), being struck by or against (14 percent), and motor vehicle traffic crashes (11 percent). In addition, 23 percent of TBI related ED visits did not have an external cause of injury code.

Table 14.3 TBI ED Visit Risk Profile		
	2010 At Risk Groups	Annual Trend Since 2002
Overall		+78%
Sex	Males	Similar for males and females
Age	85 or older	85 or older (largest increase)

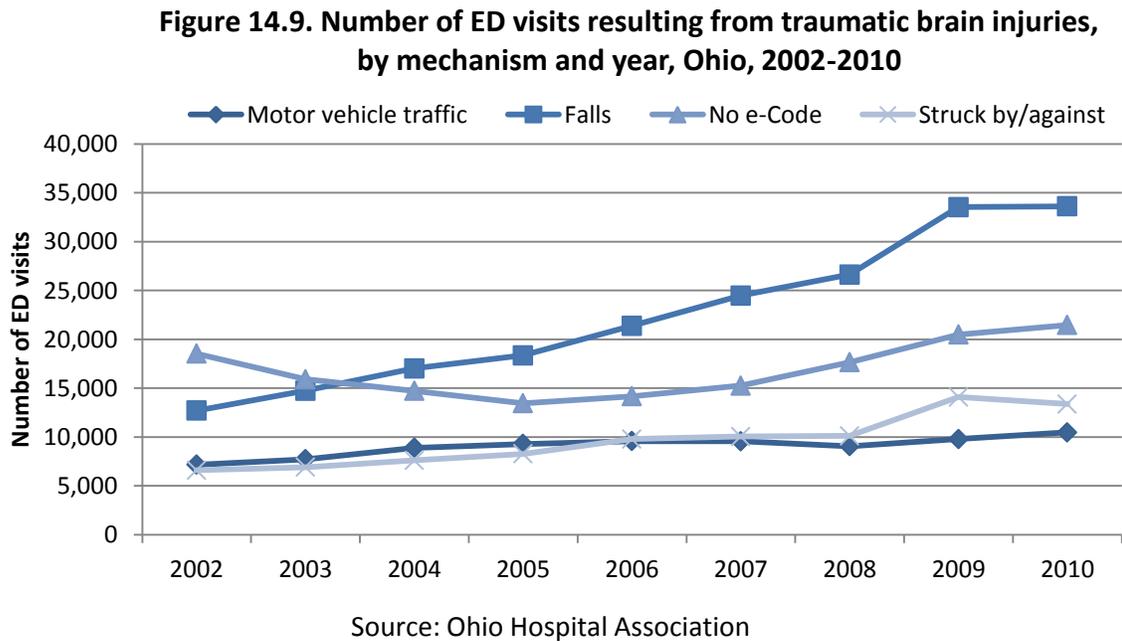
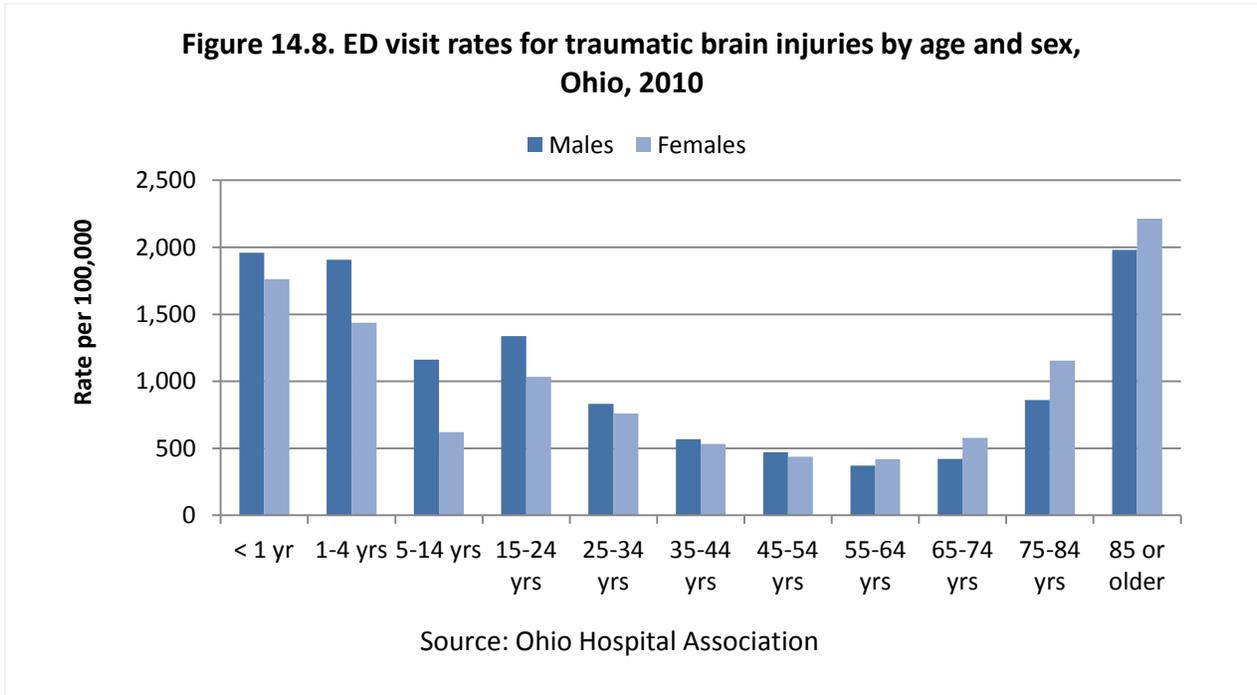
TRENDS:

Rates of TBI related ED visits increased 78 percent from 461 per 100,000 in 2002 to 820 per 100,000 in 2010. The average annual increase was 53 per 100,000 per year. The increase in rates was similar for both males and females. Rates increased among all age groups with the largest increase found among adults ages 85 or older (180 per 100,000 per year). The distribution of ED visits by mechanism shifted during the study period. Increases in the number of ED visits were found among falls (2,755 per year), being struck by or against (927 per year), sports or recreation activities (360 per year) and motor vehicle traffic crashes (334 per year) (Figure

Burden of Injury in Ohio, 2000-2010

Ohio Violence and Injury Prevention Program, Ohio Department of Health

14.9). The number of ED visits without an external cause code appeared to decrease in 2002-2005 then increase in 2005-2010. See Tables 54a-c located at the end of this section for more detailed information on the number and rate of TBI related ED visits.



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Table 52a. Number of deaths resulting from traumatic brain injuries, by year, Ohio, 2000-2010

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Overall	1,818	1,921	1,999	1,825	2,009	2,060	1,986	2,136	2,156	2,022
Sex										
Males	1,331	1,420	1,471	1,309	1,488	1,512	1,420	1,569	1,581	1,491
Females	487	501	528	516	521	548	566	567	575	531
Age										
< 1 yr	6.0	8.5	6.8	6.8	6.7	6.8	6.1	7.3	10.1	10.1
1-4 yrs	4.3	4.7	3.5	4.5	2.8	3.9	2.2	4.4	4.1	4.7
5-14 yrs	4.5	3.1	3.5	2.1	2.7	3.2	3.0	1.7	2.1	2.1
15-24 yrs	21.8	20.8	20.3	19.0	22.3	17.9	19.3	20.9	17.1	15.4
25-34 yrs	16.5	17.1	18.5	16.1	17.2	18.3	17.4	17.4	18.1	15.4
35-44 yrs	16.4	16.6	16.8	13.7	14.8	17.1	11.8	15.5	15.3	15.5
45-54 yrs	12.9	16.7	17.4	14.4	18.1	17.9	17.7	17.5	18.1	17.5
55-64 yrs	13.8	16.4	15.2	15.4	17.1	17.8	16.3	17.4	18.3	17.7
65-74 yrs	19.0	19.5	22.9	20.2	21.8	22.8	22.2	23.9	23.9	21.4
75-84 yrs	38.0	43.7	40.7	40.9	47.1	48.3	48.4	49.8	52.9	48.4
85 or older	70.9	65.7	91.5	95.2	74.3	86.9	102.5	113.4	119.4	110.6
Race and ethnicity										
White‡	270	253	250	234	270	206	215	244	188	180
Black‡	6	9	7	5	5	8	5	8	12	9
Hispanic	14	20	12	19	15	14	8	18	17	17
Other‡	63	36	41	24	33	42	36	20	24	22

‡Non-Hispanic

Source: Ohio Department of Health, Office of Vital Statistics

Burden of Injury in Ohio, 2000-2010

Ohio Violence and Injury Prevention Program, Ohio Department of Health

Table 52b. Death rates per 100,000 resulting from traumatic brain injuries, by year, Ohio, 2000-2010

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Trend (per yr)
Overall†	15.9	16.7	17.3	15.6	17.1	17.5	16.6	17.8	17.8	16.6	17.4	0.12 (NL)
Sex†												
Males	25.2	26.7	27.8	24.6	27.3	27.8	25.9	28.6	28.8	26.9	27.1	0.18 (NL)
Females	7.8	8.0	8.4	8.0	8.1	8.4	8.4	8.4	8.4	7.8	8.7	0.04 (NL)
Age												
< 1 yr	6.0	8.5	6.8	6.8	6.7	6.8	6.1	7.3	10.1	10.1	12.2	0.44
1-4 yrs	4.3	4.7	3.5	4.5	2.8	3.9	2.2	4.4	4.1	4.7	4.3	0.01 (NL)
5-14 yrs	4.5	3.1	3.5	2.1	2.7	3.2	3.0	1.7	2.1	2.1	1.4	-0.22
15-24 yrs	21.8	20.8	20.3	19.0	22.3	17.9	19.3	20.9	17.1	15.4	16.1	-0.54
25-34 yrs	16.5	17.1	18.5	16.1	17.2	18.3	17.4	17.4	18.1	15.4	20.0	0.12 (NL)
35-44 yrs	16.4	16.6	16.8	13.7	14.8	17.1	11.8	15.5	15.3	15.5	14.6	-0.16 (NL)
45-54 yrs	12.9	16.7	17.4	14.4	18.1	17.9	17.7	17.5	18.1	17.5	17.8	0.32 (NL)
55-64 yrs	13.8	16.4	15.2	15.4	17.1	17.8	16.3	17.4	18.3	17.7	15.9	0.25 (NL)
65-74 yrs	19.0	19.5	22.9	20.2	21.8	22.8	22.2	23.9	23.9	21.4	24.4	0.41
75-84 yrs	38.0	43.7	40.7	40.9	47.1	48.3	48.4	49.8	52.9	48.4	52.7	1.34
85 or older	70.9	65.7	91.5	95.2	74.3	86.9	102.5	113.4	119.4	110.6	110.8	4.80
Race and ethnicity†												
White‡	15.4	16.2	17.1	15.3	16.8	16.9	16.0	17.4	17.6	16.4	17.0	0.13 (NL)
Black‡	20.1	21.4	18.1	18.7	19.3	21.1	21.7	20.6	19.5	19.4	19.8	0.01 (NL)
Hispanic	16.9	13.8	18.0	19.7	13.1	16.2	12.7	16.3	17.9	9.7	11.6	-0.46 (NL)
Other‡	*	*	*	*	*	*	*	*	*	*	12.1	*

†Rates age-adjusted to 2000 U.S. standard population

*Suppressed due to less than 20 deaths

‡Non-Hispanic

NL: Interpret with caution because trend does not follow linear pattern

Source: Ohio Department of Health, Office of Vital Statistics

Burden of Injury in Ohio, 2000-2010

Ohio Violence and Injury Prevention Program, Ohio Department of Health

Table 52c. Number of deaths resulting from traumatic brain injuries, by mechanism and year, Ohio, 2000-2010

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	% in 2010	Trend (per yr)
MV traffic	640	651	696	574	607	576	555	577	559	434	472	21.3%	-20
Falls	271	310	355	377	406	453	491	568	607	587	626	28.3%	37
Pedestrian	83	78	62	73	66	76	74	83	73	70	68	3.1%	<-1 (NL)
Pedal cycle	17	13	15	7	14	11	12	11	10	12	8	0.4%	*
Homicide	210	228	209	179	218	232	231	240	209	245	219	9.9%	2
Suicide	476	532	549	502	573	576	520	562	605	582	606	27.4%	10

Source: Ohio Department of Health, Office of Vital Statistics

NL: Interpret with caution because trend does not follow linear pattern

*Suppressed due to less than 20 deaths

Table 53a. Number of hospitalizations resulting from traumatic brain injuries by year, Ohio, 2002-2010

	2002	2003	2004	2005	2006	2007	2008	2009	2010
Overall	7,200	7,439	7,669	7,897	8,095	8,422	8,293	8,097	7,858
Sex									
Males	4,702	4,804	4,956	5,158	5,305	5,545	5,325	5,171	5,039
Females	2,498	2,635	2,713	2,739	2,790	2,877	2,968	2,926	2,819
Age									
< 1 yr	126	147	126	144	125	133	143	130	106
1-4 yrs	202	168	191	193	170	165	166	184	149
5-14 yrs	524	531	501	441	477	427	419	372	308
15-24 yrs	1,581	1,528	1,533	1,599	1,637	1,536	1,360	1,376	1,292
25-34 yrs	984	997	1,054	1,023	1,071	1,152	1,046	1,018	1,010
35-44 yrs	1,045	1,096	1,130	1,117	1,118	1,093	1,058	1,021	917
45-54 yrs	845	902	953	1,009	1,056	1,210	1,194	1,138	1,128
55-64 yrs	504	561	576	646	705	714	788	753	812
65-74 yrs	437	471	471	520	494	582	584	606	625
75-84 yrs	558	608	678	703	714	791	869	810	801
85 or older	394	430	456	502	528	619	666	689	710

Source: Ohio Hospital Association

Burden of Injury in Ohio, 2000-2010

Ohio Violence and Injury Prevention Program, Ohio Department of Health

Table 53b. Hospitalization rates per 100,000 resulting from traumatic brain injuries by year, Ohio, 2002-2010

	2002	2003	2004	2005	2006	2007	2008	2009	2010	Trend (per yr)
Overall†	62.9	64.7	66.6	68.2	69.8	72.1	70.6	68.7	66.4	0.6 (NL)
Sex†										
Males	85.9	87.5	89.9	93.6	95.5	100.0	95.7	92.8	90.3	0.86 (NL)
Females	40.7	42.4	43.5	43.8	44.1	45.1	45.9	44.7	42.8	0.35 (NL)
Age										
< 1 yr	85.6	99.7	84.4	98.3	84.4	87.7	93.7	88.0	76.2	-1.08 (NL)
1-4 yrs	33.6	28.1	32.1	32.5	29.0	28.1	28.1	31.1	25.6	-0.59 (NL)
5-14 yrs	32.4	33.2	31.7	28.4	31.1	28.2	28.0	24.9	20.2	-1.36
15-24 yrs	99.9	95.8	96.1	100.4	103.5	97.6	86.5	87.9	81.4	-1.99
25-34 yrs	66.7	68.0	72.1	70.2	73.5	78.8	71.5	68.9	71.6	0.50 (NL)
35-44 yrs	59.9	64.2	67.4	67.8	68.9	68.6	68.0	67.2	62.0	0.32 (NL)
45-54 yrs	51.3	53.9	56.2	58.7	60.8	69.2	68.2	64.9	64.7	2.02
55-64 yrs	46.5	49.8	49.3	53.2	56.1	55.0	59.1	54.3	55.9	1.21
65-74 yrs	56.6	61.3	61.4	67.9	64.2	74.4	72.3	72.5	73.5	2.16
75-84 yrs	100.9	109.4	122.0	126.8	129.9	145.7	162.4	149.4	148.0	6.80
85 or older	208.6	219.4	227.5	242.5	245.8	278.2	291.3	303.0	308.1	13.53

†Rates are age adjusted to 2000 U.S. standard population

Source: Ohio Hospital Association

NL: Interpret with caution because trend does not follow linear pattern

Burden of Injury in Ohio, 2000-2010

Ohio Violence and Injury Prevention Program, Ohio Department of Health

Table 53c. Number of hospitalizations resulting from traumatic brain injuries by mechanism and year, Ohio, 2002-2010

	2002	2003	2004	2005	2006	2007	2008	2009	2010	% in 2010	Trend (per yr)
Motor vehicle traffic	2564	2,633	2,626	2,395	2,228	2,112	1,835	1,628	1,593	21%	-146
Motor vehicle non traffic	341	369	375	361	366	411	341	365	278	4%	-5 (NL)
Pedal cycle	128	148	161	162	168	190	184	172	141	2%	3 (NL)
Pedestrian	200	220	206	216	224	166	180	160	158	2%	-8
Falls	1379	1,626	1,665	1,709	1,827	2,042	2,097	2,150	1,960	26%	85
Assaults	573	657	696	662	734	763	722	723	627	8%	11 (NL)
Struck by/against	188	192	156	165	219	189	168	167	159	2%	-2 (NL)
Sports and recreation	99	109	90	77	102	92	92	89	84	1%	1 (NL)
Suicide	60	62	75	61	64	78	68	69	66	1%	-2 (NL)
No e-Code	1,913	1,672	1,847	2,313	2,456	2,616	2,879	2,829	2,933	40%	165

*Mechanisms not mutually exclusive

NL: Interpret with caution because trend does not follow linear pattern

Source: Ohio Hospital Association

Burden of Injury in Ohio, 2000-2010

Ohio Violence and Injury Prevention Program, Ohio Department of Health

Table 54a. Number of ED visits resulting from traumatic brain injuries by year, Ohio, 2002-2010

	2002	2003	2004	2005	2006	2007	2008	2009	2010
Overall	51,953	52,878	57,329	59,416	66,250	71,562	75,400	91,576	92,698
Sex									
Males	29,991	30,036	32,812	33,364	37,326	39,839	40,872	48,493	48,515
Females	21,962	22,842	24,517	26,052	28,924	31,723	34,528	43,083	44,183
Age									
< 1 yr	1,830	1,698	1,831	1,858	2,162	2,187	2,329	2,858	2,591
1-4 yrs	6,614	6,114	6,277	6,302	7,535	7,562	7,937	10,607	9,758
5-14 yrs	9,611	8,923	9,254	9,258	10,315	10,832	10,544	14,191	13,659
15-24 yrs	12,009	12,241	13,337	13,871	15,185	15,927	15,752	19,097	18,847
25-34 yrs	6,082	6,287	7,150	7,730	8,060	8,808	9,363	10,649	11,224
35-44 yrs	5,269	5,466	6,066	6,103	6,479	6,902	7,426	7,946	8,144
45-54 yrs	3,434	4,009	4,502	4,907	5,379	6,057	6,912	7,631	7,910
55-64 yrs	1,966	2,318	2,570	2,783	3,174	3,826	4,345	5,260	5,740
65-74 yrs	1,564	1,851	1,951	1,977	2,351	2,719	3,193	3,997	4,304
75-84 yrs	2,148	2,360	2,664	2,713	3,245	3,813	4,216	5,094	5,592
85 or older	1,426	1,611	1,727	1,914	2,365	2,929	3,383	4,246	4,929

Source: Ohio Hospital Association

Burden of Injury in Ohio, 2000-2010

Ohio Violence and Injury Prevention Program, Ohio Department of Health

Table 54b. ED visit rates per 100,000 resulting from traumatic brain injuries by year, Ohio, 2002-2010

	2002	2003	2004	2005	2006	2007	2008	2009	2010	Trend (per yr)
Overall†	461.2	468.3	508.3	527.6	589.6	634.9	667.3	810.4	819.8	52.6
Sex†										
Males	540.3	540.9	591.8	603.3	677.4	723.9	743.3	883.8	885.5	53.0
Females	378.8	391.4	420.6	447.7	496.1	540.5	585.6	729.3	746.7	51.8
Age										
< 1 yr	1,243.4	1,152.0	1,226.8	1,268.2	1,459.1	1,442.5	1,526.4	1,934.7	1,863.5	99.3
1-4 yrs	1,099.1	1,022.3	1,054.0	1,060.4	1,283.5	1,286.3	1,342.6	1,792.3	1,677.2	96.2
5-14 yrs	595.0	558.2	586.0	595.8	672.0	715.0	704.5	949.6	897.1	49.1
15-24 yrs	758.9	767.5	835.8	870.8	959.9	1,011.6	1,002.2	1,220.3	1,187.7	66.7
25-34 yrs	412.2	428.8	489.4	530.4	553.4	602.8	639.8	720.4	796.1	51.8
35-44 yrs	301.8	320.3	362.0	370.4	399.4	433.1	477.3	522.8	550.3	36.0
45-54 yrs	208.6	239.7	265.4	285.7	309.7	346.6	394.7	435.0	454.0	34.5
55-64 yrs	181.5	206.0	219.9	229.3	252.5	294.6	326.0	379.5	395.2	30.1
65-74 yrs	202.7	240.8	254.2	258.1	305.6	347.6	395.6	478.2	506.2	41.0
75-84 yrs	388.3	424.5	479.3	489.5	590.5	702.4	788.0	939.7	1,033.0	86.6
85 or older	754.9	822.1	861.5	924.8	1,100.9	1,316.3	1,479.6	1,867.0	2,139.1	179.9

†Rates are age adjusted to 2000 U.S. standard population

Source: Ohio Hospital Association

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Table 54c. Number of ED visits resulting from traumatic brain injuries by mechanism* and year, Ohio, 2002-2010

	2002	2003	2004	2005	2006	2007	2008	2009	2010	% in 2010	Trend (per yr)
Mechanism of TBI											
Motor vehicle traffic	7,169	7,714	8,899	9,277	9,575	9,567	9,059	9,788	10,467	11%	334
Motor vehicle non-traffic	1,829	1,980	2,335	2,367	2,438	2,672	2,475	2,987	2,786	3%	124
Pedal cycle	1,097	1,116	1,274	1,271	1,367	1,574	1,414	1,746	1,553	2%	72
Pedestrian	335	347	357	379	334	429	401	370	404	0%	8 (NL)
Falls	12,707	14,742	17,015	18,346	21,375	24,480	26,624	33,523	33,605	36%	2755
Assaults	3,862	4,356	5,363	6,036	7,083	7,475	7,455	8,230	8,427	9%	592
Struck by/against	6,602	6,911	7,603	8,279	9,789	10,048	10,105	14,086	13,369	14%	927
Sports and recreation	2,596	2,686	2,955	3,138	5,242	4,123	4,024	5,715	4,944	5%	360
No e-Code	18,535	15,918	14,724	13,448	14,168	15,262	17,650	20,482	21,470	23%	552 (NL)

*Mechanisms not mutually exclusive

NL: Interpret with caution because trend does not follow linear pattern

Source: Ohio Hospital Association

APPENDICES

APPENDIX 1: DATA SOURCES

This report uses data from behavioral risk factor surveys, hospital discharge records and death certificates to study patterns and trends in injuries among Ohio residents. The following is brief summary of each data source referenced in this report.

Cost of Injuries

The medical and work loss cost of injuries was estimated by the Centers for Disease Control and Prevention (CDC). Cost estimates for fatal and non-fatal injuries can be queried on the CDC's Web-based Injury Statistics Query and Reporting System Web (WISQARS).

http://www.cdc.gov/injury/wisqars/pdf/WISQARS_Cost_Methods-a.pdf

Death Records

Death records are maintained by ODH's Office of Vital Statistics. Death certificates provide limited information about circumstances of injury circumstances or contributing factors. Both injuries and their external causes were classified according to the 10th Revision of the International Classification of Diseases (ICD-10). See Appendix 3 for a complete list of external cause of injury codes by mechanism and intent.

<http://dwhouse.odh.ohio.gov/datawarehousev2.htm>

Hospital Discharge Records

Hospital discharge records are collected and maintained by the Ohio Hospital Association (OHA) from information provided by member hospitals. Both injuries and their external causes were classified according to the 9th Revision of the International Classification of Diseases, Clinical Modification (ICD-9-CM). For hospitalizations, a case was defined as an Ohio resident with an injury listed in the primary diagnosis field. For ED visits, a case was defined as an Ohio resident with an injury listed in the primary diagnosis field or a valid external cause of injury code any of the 15 diagnosis fields. Injury mechanisms for both hospitalizations and ED visits were based on the first listed external cause of injury. See Appendix 2 for a complete list external cause of injury codes by mechanism and intent.

<http://www.ohanet.org/>

Leading Causes of Death

The data source for WISQARS Fatal Injury Data is the National Vital Statistics System (NVSS) operated by the National Center for Health Statistics. WISQARS provides death counts and death rates for the United States and by state, county, age, race, Hispanic ethnicity, sex, and leading cause of death, injury intent, and injury mechanism categories. WISQARS can be used to query death data for the years 1999 - 2009, of which the underlying cause of death is specified using ICD-10 codes.

http://www.cdc.gov/injury/wisqars/leading_causes_death.html

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Ohio Behavioral Risk Factor Surveillance System (BRFSS)

The Ohio Behavioral Risk Factor Surveillance System (BRFSS) is a random digit dial telephone survey of non-institutionalized adults aged 18 years of older. The BRFSS has been conducted annually by the Ohio Department of Health since 1984. The survey collects information on the prevalence of health behaviors, health care usage, and disease diagnosis associated with the leading cause of disease, injury and death in the United States. Results from the survey are weighted to represent the age, sex, race, and ethnic composition of Ohio.

<http://www.odh.ohio.gov/healthstats/brfss/behrisk1.aspx>

Ohio Population Estimates

The National Center for Health Statistics releases bridged-race population estimates of the resident population of the United States for use in calculating vital rates. These estimates result from bridging the 31 race categories used in Census 2000 and Census 2010. The bridged-race population estimates are produced under a collaborative arrangement with the U. S. Census Bureau.

http://www.cdc.gov/nchs/nvss/bridged_race.htm

Ohio Pregnancy Risk Assessment Monitoring System (PRAMS)

The Pregnancy Risk Assessment Monitoring System (PRAMS) is a population-based survey designed to examine maternal behaviors and experiences before, during and after a woman's pregnancy, and during the early infancy of her child. The Centers for Disease Control and Prevention initiated PRAMS in 1987 in an effort to reduce infant mortality and the incidence of low birth weight. PRAMS were implemented in Ohio in 1999.

<http://www.odh.ohio.gov/healthstats/pramshs/prams1.aspx>

Ohio Traffic Crash Reports

The Ohio Department of Public Safety compiles statistical data on crashes that occur on Ohio's roads and highways. Crash data is available in the form of annual reports. Users can also develop customized queries of the data online.

http://ohiohighwaysafetyoffice.ohio.gov/otso_annual_crash_facts.stm

Ohio Youth Risk Behavior Survey (YRBS)

The Ohio Youth Risk Factor Survey (YRBS) is an anonymous paper and pencil survey of high school students enrolled in public and non-public schools. The YRBS has been conducted in Ohio since 1993 and is collaborative project between the Ohio Departments of Education and Health. The survey collects information on the prevalence of health behaviors, health care usage, and disease diagnosis associated with the leading cause of disease, injury and death in the United States. Results from the survey are weighted to represent the age, sex, race, and ethnic composition of Ohio.

http://www.odh.ohio.gov/odhprograms/chss/ad_hlth/youthrsk/youthrsk1.aspx

APPENDIX 2: ANALYTIC METHODS

This analysis was limited to descriptive statistics, which were generated through the use of Statistical Analysis System (SAS) Version 9.1, Cary, N.C. The data were analyzed using injury surveillance guidelines from the Centers for Disease Control and Prevention (CDC).

Deaths:

- Injury deaths were defined as a death with the underlying cause of death listed as an injury. Traumatic brain injury deaths were defined as deaths with an injury as underlying cause of death and a traumatic brain injury listed in one of the multiple cause of death fields. See Appendix 4 for a list of ICD-10 codes for injury mechanisms and Appendix 6 for a list of mechanism subcategories.
- Deaths included in this report were restricted to Ohio residents.
- Rates were calculated by dividing the number of injuries by the number of Ohio residents. Population estimates were based on estimates from the National Center for Health Statistics. Rates were age adjusted to the 2000 U.S. standard population.

Hospitalizations:

- Discharge dataset includes nonfederal, acute care, or inpatient facilities. The dataset does not include Veterans' Affairs and other federal hospitals, rehabilitation centers, or psychiatric hospitals.
- Injury hospitalizations were defined as an inpatient visit with an injury listed in the primary discharge diagnosis field. See Appendix 5 for a list of ICD-9-CM codes for injury mechanisms and Appendix 7 for a list of mechanism subcategories.
- Datasets include readmissions, transfers, and deaths occurring in the hospital.
- Hospitalizations included in this report were restricted to Ohio residents.
- The external cause of injury code used in the analysis was the first listed cause of the discharge diagnosis fields. If the codes E000-E030, E849, E967, E869.4, E870-E879, or E930-E949 were the first listed codes then the next valid external cause code was used.
- Rates were calculated by dividing the number of injuries by the number of Ohio residents. Population estimates were based on estimates from the National Center for Health Statistics. Rates were age adjusted to the 2000 U.S. standard population.

Emergency Department Visits:

- Discharge dataset includes nonfederal, acute care, or inpatient facilities. The dataset does not include Veterans' Affairs and other federal hospitals, rehabilitation centers, or psychiatric hospitals.
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- Injury ED visits were defined as an ED visit with an injury listed in the primary discharge diagnosis field or a valid external cause of injury code in any of the discharge diagnosis fields. See Appendix 5 for a complete list of ICD-9-CM codes.
- ED visits included in this report were restricted to Ohio residents.
- Persons who are treated at an ED and later admitted to a hospital are removed from the ED dataset, and therefore are not included in any analysis of ED data.
- The external cause of injury code used in the analysis was the first listed cause of the discharge diagnosis fields. If the codes E000-E030, E849, E967, E869.4, E870-E879, or E930-E949 were the first listed codes then the next valid external cause code was used.
- Rates were calculated by dividing the number of injuries by the number of Ohio residents. Population estimates were based on estimates from the National Center for Health Statistics. Rates were age adjusted to the 2000 U.S. standard population.

Trend Analysis for Deaths, Hospitalizations and Emergency Department Visits:

- Trend analysis for annual injury death, hospitalization, and ED visit rates was conducted in Microsoft Excel. Annual injury rates were plotted and a linear trend line was drawn to minimize the distance between the trend line and data point. The goodness of fit for the linear trend line was determined by the R-squared value. Linear trends were defined as a trend line with an R-squared value of 0.5 or higher. Non-linear trends were defined as a trend line with an R-squared value of less than 0.5. The slope and goodness of fit of the trend line were reported in the data tables. Non-linear trends were labeled with (NL) next to the slope.

Poverty Status and County Urbanity Classifications:

- County urbanity was derived from county of residence reported by Ohio Behavioral Risk Factor Surveillance System respondents. County urbanity classifications were based on a combination of proximity and connectedness to urban core economic development area and definitions of Appalachian counties established by the Appalachian Development Commission. See Appendix 11 for a map with county classifications.
- Poverty status was derived from household income and household composition reported by Ohio Behavioral Risk Factor Surveillance System respondents. Respondents were grouped into categories based on the 2010 Federal Poverty Guidelines. See Appendix 12 for household income and composition thresholds.

Cost of Injuries:

- Fatal Injury costs were calculated by multiplying the number of injury deaths in Ohio by the average cost associated the death for Ohio published on the CDC's
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WISQARS website. See Appendix 8 for average cost estimates by mechanism and intent.

- Non-fatal injury costs for hospitalizations were calculated by multiplying the number of hospitalizations by the average cost associated with hospitalizations for the United States published on the CDC's WISQARS website. See Appendix 9 for average cost estimates by mechanism and intent.
 - Non-fatal injury costs for ED visits were calculated by multiplying the number of ED visits by the average cost associated with ED visits for the United States published on the CDC's WISQARS website. See Appendix 10 for average cost estimates by mechanism and intent.
 - Total injury costs were calculated by adding the estimated costs for injury deaths, hospitalizations and ED visits.
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APPENDIX 3: LIMITATIONS OF INJURY SURVEILLANCE DATA

Death Certificate Data:

- The cause of death reported on the death certificate is based on the underlying cause of death determined by a physician or coroner. While physicians and coroners are well trained to investigate and determine causes of death, a standardized process for investigating and determining causes of death does not exist in Ohio. This lack of uniformity may lead to differences in how underlying causes of death are classified and pose limitations for comparing rates across local jurisdictions.

Hospital Discharge Data:

- In each year of the study period, approximately 30 percent of injuries treated in the as inpatients and emergency departments were not assigned an external cause code (E-code). This most likely resulted in an underestimate of total costs and incidence rates, because not all mechanism and intents for injuries could be identified and included in the analysis by mechanism.
- Of the non-fatally injured, only those who sought medical care were captured for this analysis.
- Discharges, not individuals, were the unit of measurement, thereby resulting in duplication when readmissions for the same initial event occurred. The inclusion of readmissions would lead to an overestimate of incidence rates.
- Race and ethnicity are largely incomplete in the hospital discharge data and were not included in the analysis.
- Ohio residents treated in out-of-state hospitals are not consistently included, thereby affecting rates, particularly of border counties.
- Severity of injury is assumed based on type of medical treatment received (i.e., inpatient treatment is for more severe injuries than ED visits).

Behavioral Risk Factor Data:

- Data from the Pregnancy Risk Assessment Monitoring System (PRAMS), Ohio Youth Risk Behavior Survey (YRBS) and Behavioral Risk Factor Surveillance System (BRFSS) are based on self-reported behaviors by respondents. The accuracy of self-reported data depends on the respondents' ability to recall and willing to report the information. Self-reported data can lead to overestimates or underestimates of the true prevalence in the population depending on the topic being asked.
 - Results from Ohio YRBS represent a random sample of students enrolled in high schools in Ohio. The results do not represent high school age youth who have dropped out of school.
 - Results from the Ohio BRFSS represent a random sample of non-institutionalized adults ages 18 or older in Ohio with a landline in their home. The BRFSS excludes institutionalized adults and adults living in cell phone only households.
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