

February 2018

Highlights

- Bicyclist injury rates increased by 21%, from 28.4 (2007) to 34.4 per 100,000 residents (2013).
- In rural areas, the percentage of total fatal bicyclist injuries (2.8%) was double the percentage of non-fatal injuries (1.4%).
- Most bicyclist injuries occurred in summer (36%) followed by fall (34%).
- The majority of bicyclist injuries occurred from 3 p.m. to 5:59 p.m., while the least amount of injuries occurred from 3 a.m. to 5:59 a.m.
- About 4% of total persons killed in traffic crashes were bicyclists.
- More than three-fourths of the bicyclists injured in traffic crashes were men (77%), and the bicyclist injury rate (51.6) for men is four times the rate for women (12.6 per 100,000).
- The highest rates of bicyclist fatalities involving motor vehicles were among 45 and older age groups (0.6 per 100,000).
- Bicyclists 15 to 24 years old who were drinking had the highest injury rate (114.6 per 100,000).
- San Joaquin and Sacramento were the top two counties for bicyclist fatalities.
- Inyo and Santa Cruz were the top two counties for non-fatal bicyclist injuries.

Introduction

Bicycling offers a convenient and relatively cheap mode of active transportation that combines travel and exercise, positively impacts the environment, and benefits health. Bicycling in larger U.S. cities has risen sharply – by about 71% from 2007 to 2013, compared to 50% for all areas overall.¹ However, bicyclists represent a growing percentage of total traffic fatalities and injuries since 2007. In 2007, bicyclist fatalities comprised 1.7% of all traffic deaths nationwide, but reached 2.3% in 2013.²

This report presents California 2007-2013 data on the overall frequency, severity, and characteristics of bicyclist injuries involving motor vehicles only*, using the California Highway Patrol's (CHP) Statewide Integrated Traffic Records System (SWITRS) data.³ The bicyclist injury information is presented as follows:

- Overview
- Characteristics by Location
- Time of Day and Day of the Week
- Age Groups
- Gender
- Alcohol Involvement
- Fatal Injuries by County
- Non-Fatal Injuries by County
- Summary

*Bicycle injuries not related to a motor vehicle crash are excluded (e.g., single bicycle, bicycle only, bicycle-pedestrian and off road bicycle injuries)

Overview

Injuries to bicyclists that involve motor vehicles are a growing traffic safety and public health concern in California. Table 1 presents numbers and age-adjusted rates for all motor vehicle traffic injuries and for all bicyclist injuries involving motor vehicles (fatal and non-fatal combined) for 2007 to 2013. There was an average of about 238,000 fatal and non-fatal traffic injuries annually from 2007-2013 in California for a seven-year total of nearly 1.7 million injuries. By 2013, bicyclist traffic injuries comprised nearly 5.9% (n=13,334) of the total traffic injuries, of which 99% were non-fatal. While bicycle injury rates increased by 21% from a low of 28.4 per 100,000 residents in 2007 (n=10,574) to 34.4 in 2013 (n=13,334), the overall traffic injury rate decreased from 732 per 100,000 to 583 per 100,000 during this period. These trends indicate bicyclist injuries are increasing both in absolute and relative terms compared to overall motor vehicle crashes.

Table 1: Total Fatal and Non-Fatal Traffic and Bicyclist Injuries, 2007-2013

Year	Number of Traffic Injuries	Number of Bicyclist Injuries	Percent of Total Injuries	Traffic Injury Rate*	Bicyclist Injury Rate*	95% CI**
2007	270,654	10,574	3.9	731.9	28.4	26.3 - 30.5
2008	245,274	11,743	4.8	657.0	31.2	29.1 - 33.3
2009	235,853	12,003	5.1	627.1	31.8	29.7 - 33.9
2010	232,093	12,624	5.4	612.0	33.1	31.1 - 35.2
2011	228,437	13,627	6.0	597.8	35.5	33.4 - 37.6
2012	229,539	13,940	6.1	595.8	36.1	34.0 - 38.2
2013	226,232	13,334	5.9	583.4	34.4	32.3 - 36.5
Total	1,668,082	87,845	5.3	629.1	33.0	30.9 - 35.1

*Age-adjusted rates per 100,000 using California Population data (California Department of Finance (CDoF)-California Department of Public Health ([CDPH-EPI Center](#)) and Year 2000 US Standard Population Weights

**Confidence interval with lower and upper limits for bicycle injury rates.

Source: California Highway Patrol-Statewide Integrated Traffic Records System (CHP-SWITRS) data sets 2007-2013

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Characteristics by Location

As shown in Table 2, the vast majority of bicyclist injuries during the 2007-2013 period occurred in urban areas (98.6%) compared to rural areas (1.4%).⁴ For fatal and non-fatal injuries combined, the rate of bicyclist injuries was lower in rural areas compared to urban areas (20.5 versus 33.9, respectively). Because most injuries are non-fatal, the non-fatal rates are very similar to the total rates in both urban areas (33.5 per 100,000) and rural locations (20.1 per 100,000). However when measuring fatal injuries, rural areas have a slightly higher rate than urban areas (0.4 versus 0.3).

Table 2: Bicyclist Injuries in Traffic Crashes by Location, 2007-2013

Location	Number of Total Injuries	Total Injury Rate *	Number of Non-Fatal Injuries	Non-Fatal Injury Rate*	Number of Fatal Injuries	Fatal Injury Rate*
Urban	86,630	33.9	85,738	33.5	892	0.3
Rural	1,215	20.5	1,189	20.1	26	0.4
Total	87,845	33.6	86,927	33.2	918	0.4

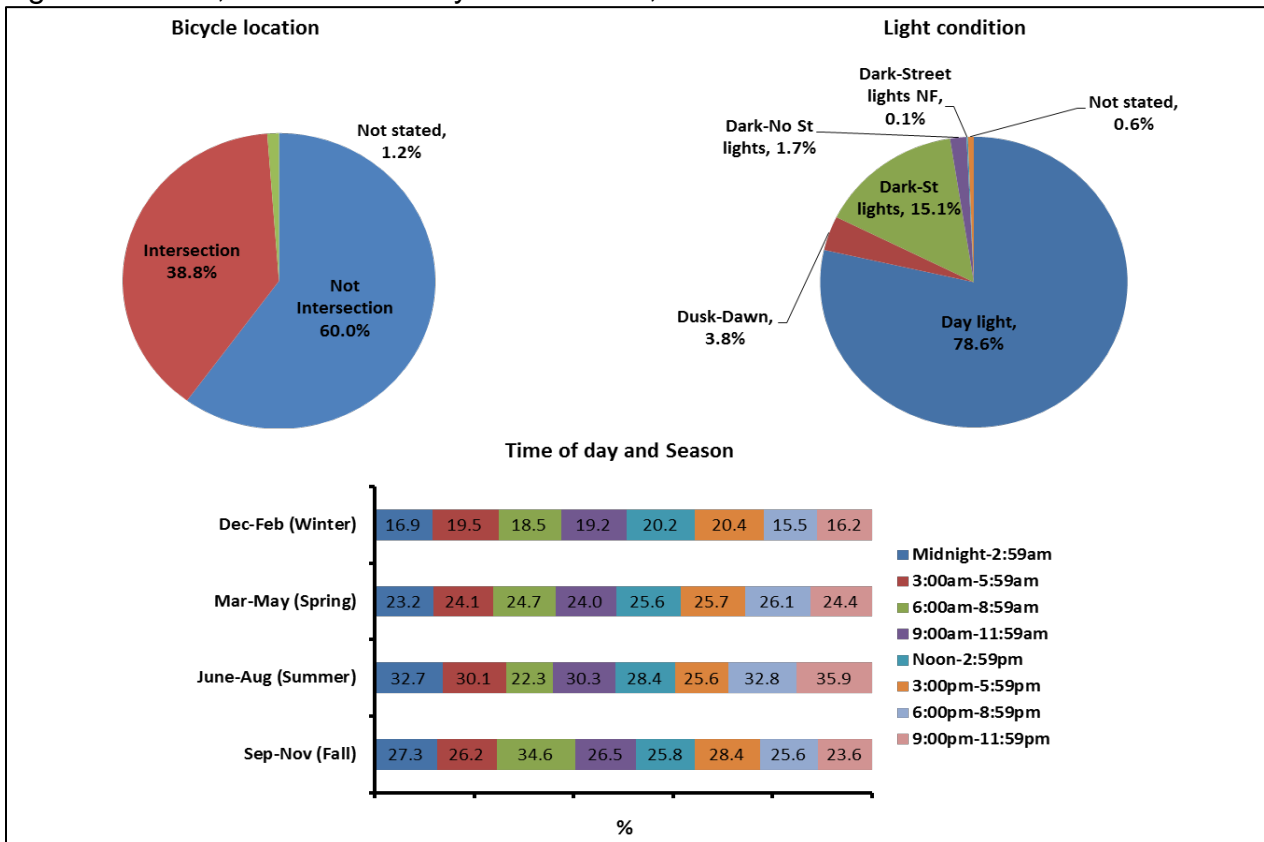
*Rate per 100,000 using California Population data (from the CDoF-[CDPH-EPI Center](#))

Source: CHP-SWITRS data sets 2007-2013

Prepared by: California Department of Public Health, Safe and Active Communities Branch, October 2017

Figure 1 displays the role of bicyclist crash location, lighting, time of day, and season. The majority of bicyclist injuries involving motor vehicles occurred during daylight hours (78.6%) and at non-intersections (60%). About 15% of injuries occurred in the dark in areas with streetlights. In the winter, around 40% of bicyclist injuries occurred between noon and 6 p.m. In the spring, more than half of the bicyclist injuries occurred from noon to 6 p.m. (51.3%). In the summer, over 30% of the bicyclist injuries occurred in each of the 3-hour time periods from 6 p.m. to 3 a.m. In the fall, the largest percentage of bicyclist injuries occurred from 6 a.m. to 9 a.m.

Figure 1: Percentage of Fatal and Non-Fatal Bicyclist Injuries in Relation to Bicyclist Location, Light Condition, and Time of Day and Season, 2007-2013*



*Time of day is divided into eight 3-hour time intervals starting at midnight, and season is defined by months.

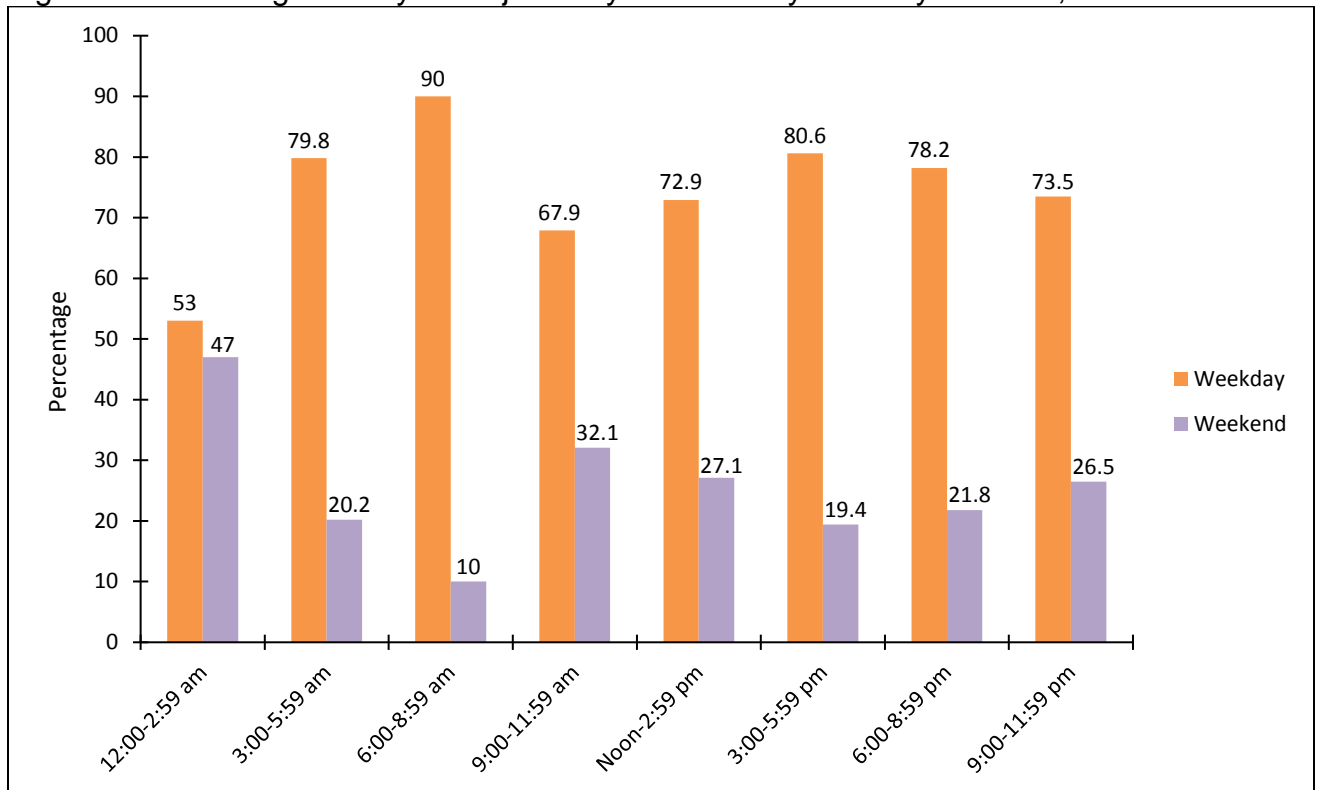
Source: CHP SWITRS data sets 2007-2013

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Time of Day and Day of the Week

Figure 2 provides information on the time of day and the day of the week of bicyclist traffic injuries. Over a quarter (26.9%) of total bicyclist traffic injuries occurred between 3 p.m. and 6 p.m. (data not shown). The majority of bicyclist injuries occur on weekdays; over two-thirds for every time period except midnight to 3 a.m. For example, 90% of bicyclist injuries during the daylight hours of 6 to 9 a.m. occurred on weekdays.

Figure 2: Percentage of Bicyclist Injuries by Time of Day and Day of Week, 2007-2013*



*Time of day is divided into eight 3-hour time intervals starting at midnight, and day of week is defined as weekday (Monday-Friday) and weekend (Saturday-Sunday).

Source: CHP-SWITRS data sets 2007-2013

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Age Groups

Tables 3 and 4 display the numbers and rates of fatal and non-fatal total traffic and bicyclist injuries involving motor vehicles by age group from 2007 to 2013. Unfortunately, there are no reliable estimates of how long and how often bicyclists are on the roads to determine exposure to motor vehicle traffic, therefore rates are calculated using population numbers. Total traffic crash fatality rates were highest among the 15-24 age group (12.5) and 65+ adults (12.2). In contrast, the highest rates of bicyclist fatalities involving motor vehicles were among 45 and older age groups (Table 3).

Table 3: Total Traffic and Bicyclist Fatalities by Age Group, 2007-2013

Age Group (Years)	Number of Total Traffic Fatalities	Number of Bicyclist Fatalities	Total Fatality Rate*	Bicyclist Fatality Rate*
0-14	848	61	1.6	0.1
15-24	4,867	107	12.5	0.3
25-34	3,857	100	10.4	0.3
35-44	2,880	132	7.9	0.4
45-54	3,384	203	9.3	0.6
55-64	2,599	169	9.2	0.6
65+	3,682	146	12.2	0.5
Total	22,117	918	8.5	0.4

*Age specific rates per 100,000 using California Population data (CDoF-[CDPH-EPI Center](#))

Source: CHP-SWITRS data sets 2007-2013

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Among non-fatal traffic injuries shown in Table 4, the 15-24 age group had the highest rates for both total traffic crash injuries (1056.5) and bicyclist injuries (64.6).

Table 4: Total Non-Fatal Traffic and Bicyclist Injuries by Age Group, 2007-2013

Age Group (Years)	Number of Total Non-Fatal Injuries	Number of Bicyclist Non-Fatal Injuries	Total Non-Fatal Injury Rate*	Bicyclist Non-Fatal Injury Rate*
0-14	119,344	12,467	222.4	23.2
15-24	410,919	25,135	1056.5	64.6
25-34	312,604	14,689	839.1	39.4
35-44	247,696	11,072	675.5	30.2
45-54	242,194	12,620	663.2	34.6
55-64	161,802	7,180	572.1	25.4
65+	151,406	3,764	500.3	12.4
Total	1,645,965	86,927	629.3	33.2

*Age specific rates per 100,000 using California Population data (CDoF-[CDPH-EPI Center](#))

Source: CHP-SWITRS data sets 2007-2013

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Gender

Table 5 displays the number and rate of bicyclist injuries (both fatal and non-fatal) in crashes involving motor vehicles by gender and age group. More than three-fourths (77%) of the 87,845 bicyclist injuries in traffic crashes were males. The highest injury rates for males (92.7 per 100,000) and females (28.9 per 100,000) was among the 15-24 age group. Overall, the male bicyclist injury rate was 51.6 per 100,000 male California residents, which is four times higher than the female injury rate (12.6 per 100,000 female California residents).

Table 5: Bicyclist Injuries in Traffic Crashes by Age & Gender, 2007-2013

Age Group (Years)	Number of Total Injuries*	Total Injury Rate*	Number of Male Injuries	Male Injury Rate*	Number of Female Injuries	Female Injury Rate*
0-14	12,528	23.4	10,042	36.6	2,006	7.6
15-24	25,242	64.9	18,683	92.7	5,405	28.9
25-34	14,789	39.7	10,642	55.8	3,413	18.8
35-44	11,204	30.6	8,659	46.9	1,999	11.0
45-54	12,823	35.1	9,918	54.7	2,268	12.3
55-64	7,349	26.0	5,949	43.5	1,046	7.2
65+	3,910	12.9	3,285	24.9	368	2.2
Total	87,845	33.6	67,178	51.6	16,505	12.6

Note: Total includes 4,154 unknown gender

*Age-specific rate per 100,000 using California Population data (CDoF- [CDPH-EPI Center](#))

Source: CHP-SWITRS data sets 2007-2013

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Alcohol Involvement

Alcohol involvement is defined in SWITRS as at least one driver or non-occupant (bicyclist) involved in the crash having had consumed alcohol.⁵ Documentation of alcohol involvement does not indicate that a crash or fatality was caused by the presence of alcohol.⁶

Table 6 shows data on alcohol involvement in all traffic crashes by age group, while Table 7 shows data on alcohol involvement in crashes with bicyclist injuries by age group. Fatality numbers and the corresponding rates for traffic crashes and bicyclist injuries with alcohol involvement were small; thus fatal and non-fatal injuries were combined. Alcohol involvement of the driver or non-occupant was reported in 7.5% of motor-vehicle involved injuries (125,654 out of 1,668,082 total injuries) and 5.5% of bicyclist injuries (4,815 out of 87,845) from 2007-2013. Total traffic crash and bicyclist injury rates with no alcohol involvement were highest in 15 to 24 years old individuals (954.4 per 100,000). The highest rate of traffic injuries with alcohol involvement was for teenagers and young adults between 15 to 34 years of age (114.6 and 88.6 per 100,000, respectively).

Table 6: Alcohol Involvement in All Traffic Crashes by Age Group, 2007-2013

Age Group (Years)	Number of Crashes Without Alcohol Involvement	Rate of Crashes Without Alcohol Involvement*	Number of Crashes With Alcohol Involvement	Rate of Crashes With Alcohol Involvement*
0-14	117,304	218.6	2,888	5.4
15-24	371,229	954.4	44,557	114.6
25-34	283,469	760.9	32,992	88.6
35-44	232,273	633.4	18,303	49.9
45-54	230,203	630.4	15,375	42.1
55-64	157,257	556.0	7,144	25.3
65+	150,693	498.0	4,395	14.5
Total	1,542,428	589.8	125,654	48.0

*Age-specific rate per 100,000 using California Population data (CDoF- [CDPH-EPI Center](#))

Source: CHP-SWITRS data sets 2007-2013

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Table 7 shows that bicyclist injury rates without alcohol involvement were highest in 15-24 and 25-34 year olds (62.7 and 37.0 per 100,000, respectively). Bicyclist injury rates with alcohol involvement were highest in 45 to 54 and 25-44 year olds (3.3 and 2.7 per 100,000 respectively).

Table 7: Alcohol Involvement in Bicyclist Injuries by Age Group, 2007-2013

Age Group (Years)	Number of Injuries Without Alcohol Involvement	Rate of Injuries Without Alcohol Involvement*	Number of Injuries With Alcohol Involvement	Rate of Injuries With Alcohol Involvement*
0-14	12,441	23.2	87	0.2
15-24	24,370	62.7	872	2.2
25-34	13,778	37.0	1,011	2.7
35-44	10,225	27.9	979	2.7
45-54	11,634	31.9	1,189	3.3
55-64	6,826	24.1	523	1.8
65+	3,756	12.4	154	0.5
Total	83,030	31.7	4,815	1.8

*Age specific rate per 100,000 using California Population data (CDoF- [CDPH-EPI Center](#))

Source: CHP- SWITRS data sets 2007-2013

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Fatal Injuries by County

For each county with more than 25 bicycle fatalities in motor vehicle crashes, Table 8 represents the total traffic fatalities, bicyclist fatalities, bicyclist fatality rate per 100,000 population, and rank based on fatality rate.

As indicated by the ranking, the highest bicyclist fatality rates were in San Joaquin (0.6) and Sacramento counties (0.6). Five counties have rates higher than the state average of 0.3. The bicyclist fatality percentages of total traffic fatalities by county ranged from a low of 1.2% (El Dorado) to a high of 7.1% (Sacramento) compared to the state average of 4.2% (percentages not shown). Fourteen counties reported zero bicyclist fatalities during the 2007-2013 study period.

Table 8: Motor Vehicle and Bicyclist Traffic Crash Fatality Rates by County, 2007-2013

County*	Number of Total Traffic Fatalities	Number of Bicyclist Fatalities	Bicyclist Fatality Rate**	Rank Based on Bicyclist Fatality Rate
San Joaquin	584	27	0.6	1
Sacramento	808	57	0.6	2
Fresno	887	35	0.5	3
Riverside	1,636	65	0.4	4
Orange	1,093	76	0.4	5
Contra Costa	404	25	0.3	6
San Bernardino	1,849	49	0.3	7
San Diego	1,606	68	0.3	8
Santa Clara	655	38	0.3	9
Los Angeles	4,431	195	0.3	10
Alameda	551	31	0.3	11

*Forty seven counties had less than 25 fatalities, and thus were excluded from the list

** Age adjusted bicyclist fatality rates per 100,000 using California Population data (CDoF- [CDPH-EPI Center](#)) and Year 2000 US Standard Population Weights) is a seven-year cumulative rate for fatalities.

Source: CHP-SWITRS data sets 2007-2013

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Non-Fatal Injuries by County

Table 9 represents the total traffic non-fatal injuries, bicyclist non-fatal injuries, non-fatal bicyclist injury rates per 100,000 residents, and non-fatal bicyclist injury rank based on non-fatal injury rates for each county with at least 25 bicyclist injuries.

The highest county bicyclist injury rate was in Inyo county (255.7 per 100,000), followed by Santa Cruz (222.7) and Yolo (221.4) counties. Nineteen counties have non-fatal injury rates higher than the state average of 135.9. The non-fatal bicyclist percentages of total traffic injuries by county ranged from a low of 1.1% (Calaveras), to a high of 11.8% (Santa Cruz) compared to the state average of 5.3% (percentages not shown).

Table 9: Motor Vehicle and Bicyclist Non-Fatal Injury Rates by County, 2007-2013 (continued on page 10)

County*	Number of Traffic Non-Fatal Injuries	Number of Bicyclist Non-Fatal Injuries	Non-Fatal Bicyclist Injury Rate**	Rank Based On Non-Fatal Bicyclist Injury Rate
Inyo	1,268	47	255.7	1
Santa Cruz	10,497	1234	222.7	2
Yolo	7,232	656	221.4	3
Humboldt	6,437	384	212.4	4
Marin	9,427	951	205.4	5
Tehama	2,819	125	194.4	6
Sacramento	72,644	3919	189.3	7
Santa Barbara	18,217	1630	186.1	8
Orange	135,950	8506	181.5	9
San Luis Obispo	10,099	833	170.1	10
Del Norte	1,459	60	168.9	11
Santa Clara	63,221	5038	166.4	12
Alameda	61,725	4445	162.3	13
Butte	8,165	508	160.7	14
Ventura	35,009	1886	156.6	15
Los Angeles	519,976	28196	152.0	16
Lassen	1,291	25	151.5	17
Sutter	4,485	198	150.1	18
Sonoma	20,093	1201	139.9	19
Plumas	988	29	135.1	20
Napa	6,751	336	133.7	21
Yuba	2,555	98	133.3	22
Stanislaus	25,290	1084	131.1	23
San Mateo	23,561	1647	130.2	24
San Benito	2,187	73	129.1	25
San Joaquin	32,367	1260	126.9	26
Shasta	8,539	313	122.9	27
Contra Costa	31,334	1729	122.1	28
San Diego	129,227	6481	115.0	29
Solano	16,814	553	112.5	30
Mono	828	32	109.3	31
Placer	12,627	438	106.9	32
Amador	2,305	36	103.3	33
Glenn	1,151	29	101.3	34
Merced	11,825	431	99.9	35

County*	Number of Traffic Non-Fatal Injuries	Number of Bicyclist Non-Fatal Injuries	Non-Fatal Bicyclist Injury Rate**	Rank Based On Non-Fatal Bicyclist Injury Rate
San Francisco	31,494	3696	98.5	36
Monterey	14,170	674	94.9	37
Tulare	18,091	629	94.2	38
Mendocino	4,217	114	93.5	39
Lake	2,808	53	91.6	40
Kings	5,814	169	90.5	41
Kern	34,255	895	89.2	42
Riverside	82,601	2411	88.8	43
San Bernardino	86,563	2258	83.6	44
Siskiyou	2,042	32	78.2	45
Tuolumne	3,123	42	77.8	46
Imperial	5,458	162	70.4	47
Madera	6,812	111	69.1	48
Fresno	33,002	886	66.3	49
El Dorado	6,721	203	65.1	50
Calaveras	2,360	25	63.4	51
Nevada	3,999	90	30.3	52

*Six Counties had less than 25 non-fatal injuries, and thus were excluded from the list

** Bicyclist injury rate (Age adjusted rates per 100,000 using California Population data (CDoF-[CDPH-EPI Center](#)) and Year 2000 US Standard Population Weights) is a seven-year cumulative rate for non-fatal injuries

Source: CHP-SWITRS data sets 2007-2013

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Summary

This report uses the CHP-SWITRS data to provide a broad overview of both fatal and non-fatal traffic-related injury characteristics of bicyclists in California from 2007 to 2013. There were nearly 1.7 million fatal and non-fatal total traffic injuries during the study period. Bicyclist traffic injuries comprised 5.3% (n=87,845) of the total traffic injuries, of which 99% were non-fatal injuries. The bicyclist injury rate increased by 21% from 28.4 per 100,000 residents in 2007 to 34.4 in 2013.

This report provides a detailed look at many of the characteristics and circumstances surrounding motor vehicle related fatal and non-fatal bicyclist injuries. Data are presented on characteristics by location, age groups, gender, alcohol involvement in bicyclist injuries, and includes breakdowns by county numbers, rates, and rankings. About 60% of bicyclist injuries occurred at non-intersections and during day light hours. The 15-24 age group had the highest rates of non-fatal bicyclist injuries involving motor vehicles, whereas the highest rates of bicyclist fatalities were among 45 and older age groups. The vast majority (98.6%) of bicyclist injuries occurred in urban areas and urban areas had higher rates controlling for population size. Alcohol involvement was reported in 5.5% of non-fatal bicyclist injuries, compared to 7.5% for non-fatal traffic injuries. There is a wide variation in the rates of bicyclist fatalities and non-fatal bicyclist injuries across counties. For instance, Sacramento County ranks #2 for bicyclist fatalities and #7 for non-fatal bicyclist injuries. Similarly, San Joaquin County ranks #1 for bicyclist fatalities and #26 for non-fatal bicyclist injuries.

This report is intended to provide useful information for identifying potential areas for bicyclist safety improvements. Some of the identified evidence-based behavioral practices for bicyclist traffic safety that both motorists and bicyclists can follow include: (1) sharing the road with bicycles – in California, the Three Feet for Safety Act requires motorists to give bicyclists who are traveling in the same direction three feet of clearance when passing;⁷ (2) biking in a bike lane when available; (3) staying alert (e.g., not driving or cycling under the influence of alcohol or other drugs); (4) being visible (e.g., wearing brightly colored clothing or reflective material); and (5) obeying the same rules and traffic laws as motor vehicle operators. In addition, there are environmental counter measures that have a direct impact on the likelihood of fatality for bicyclists in general (e.g., separate bike lanes, etc.).⁸ With the high numbers of bicyclist injuries overall, and the increasing bicyclist injury rates in California, this report highlights the importance of addressing bicyclist traffic safety and may serve as guidance for counties in formulating policy decisions aimed at decreasing bicyclist injuries and improving traffic safety.

Methods

Definitions

Bicyclists, as defined for this report, are cyclists including riders of two-wheel, non-motorized vehicles; tricycles; and unicycles powered solely by pedals. A traffic crash is defined as an incident that involved one or more motor vehicles where at least one vehicle was in transport and the crash originated on a public traffic way such as a road or highway. Crashes that occurred on private property, including parking lots and driveways, are excluded. Bicyclist crashes in this report exclude bicyclist crashes that do not involve motor vehicles. Collision records indicating a bicyclist victim were obtained from SWITRS data.

Data Sources

The California Highway Patrol (CHP) Statewide Integrated Traffic Records System (SWITRS) data sets from 2007 to 2013 were used for the analyses presented in this report.

Limitations

Data for the seven years (2007 to 2013) were combined due to low numbers in some counties. Confidence intervals and population rates have been presented to mitigate some of these issues to the extent possible. Bicyclist injury rates are calculated based on the number of injuries divided by the overall state or county population. Unfortunately, this method does not take into account the actual exposure of bicyclists to traffic (i.e., how many and for how often/long bicyclists are in or near traffic areas). This limitation is due to the lack of reliable or generalizable measures of bicyclist behavior, and may mask important differences in exposure across many traffic situations. Therefore, it is suggested that caution be paid during data interpretation.

Acknowledgements

Funding for the Crash Medical Outcomes Data (CMOD) Project is provided by a grant from the California Office of Traffic Safety through the National Highway Traffic Safety Administration. For further information about this report, contact [CMOD Project](#).



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- ¹ Alliance for Biking & Walking, [Bicycling and Walking in the United States: 2016 Benchmarking Report](#).
 - ² National Highway Traffic Safety Administration, Traffic Safety Facts: Bicyclists and Other Cyclists. [DOT HS 812 151](#).
 - ³ The total number of Bicyclist injuries presented here may differ from those of Center for Health Statistics and Informatics (death data) and the Office of Statewide Health Planning & Development (inpatient hospitalization and Emergency Department data) due to the different procedures used to acquire and process the data.
 - ⁴ Health Resources & Services Administration, [Defining Rural Population](#).
 - ⁵ SWITRS Codebook, [SWITRS Party Sobriety Variable](#).
 - ⁶ NHTSA Definition of Alcohol Involvement – [FARS-GES 2014 Traffic Safety Facts](#)
 - ⁷ [AB 1371](#) (Bradford), Chapter 331, Statutes of 2013; [California Vehicle Code § 21760](#).
 - ⁸ Governors Highway Safety Association, 2014. [Spotlight on Highway Safety: Bicyclist Safety](#).