

A surprisingly large number of injuries occurred among those with recent ocular surgery. This should be investigated further, as such cases were responsible for over a third of injuries to those over age 60.

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Fatal and Severe Injury: Scooter and Moped Crashes in California, 1985

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Abstract: Fatal and severe injury crashes for scooters and mopeds in California for 1985 were compared with those for motorcycles during the same year. Scooters had more than twice the injury crash rate of mopeds but one-half the rate of motorcycles. Age of injured drivers and crash patterns for scooters, mopeds, and motorcycles varied significantly. (*Am J Public Health* 1990; 80:1122-1124.)

Introduction

In the past 15 years, the use of mopeds and scooters in the United States has increased markedly¹; by 1987, there were an estimated 360,000 scooters and 170,000 mopeds in use.²

Some information is available on injuries from moped crashes³⁻¹³ but virtually none on injuries involving scooters. Unlike motorcycles, mopeds and most scooters are not designed for traveling long distances or at high speeds and are not legal for use on freeways in California and most other states. We examine fatal and severe injury crashes for operators of mopeds and scooters in California during 1985 and compare their crash rates and other characteristics to those of motorcycles.

Methods

Definition, Criteria, and Crash Data Source

A moped is a two-wheeled, motor-powered bicycle with an automatic transmission and 12- to 17-inch wheels; almost all have an engine displacement of 49 cc or less. As single rider vehicles, they are not designed to carry passengers. Models made before 1981 may have pedals for propulsion.¹⁴⁻¹⁸

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A scooter is a two-wheeled, motor-powered vehicle with an enclosed engine, automatic transmission, 10- to 12-inch wheels, and engine displacement ranging from 50 cc to 250 cc. Scooters have a floorboard, no pedals for propulsion, and may have a passenger seat.^{14,18,19}

In California, the operator of a scooter must pass the same licensing tests as motorcycle operators; scooters must be registered annually. A moped may be operated with any class of driver's license. Annual registration is required for scooters and mopeds without pedals, including mopeds manufactured since 1981.²⁰

This research was limited to moped and scooter crashes on public roads in California during 1985 that resulted in either a fatal or severe injury to the driver of the vehicle. General methods of crash injury data collection are contained in an earlier report.²¹ Severe injuries are those resulting in a distorted body member or a laceration from which blood flows freely. Off-road injury crashes were excluded.

Fatal and severe injury crashes were identified from the computerized Statewide Integrated Traffic Records System maintained by the California Highway Patrol.

Crash Data and Exclusions

Of the 322 crashes of two- and three-wheel motor vehicles that were not street-legal motorcycles, the following were excluded: 81 off-road motorcycles, 33 all-terrain vehicles, 18 other vehicles that could not be identified.

Information on the vehicle identification number, vehicle license plate number, make, model, and model year was abstracted from the original crash report.

The 1985 California Department of Motor Vehicles registration file provided information on 156,114 two- or three-wheeled vehicles after all motorcycles were excluded. Off-road or all-terrain vehicles (16,649) and scooters or mopeds with registrations expiring before 1985 or first sold in 1986 (41,572) were also excluded. The number of scooters and mopeds at risk of crashing during 1985 was 97,893 in the State of California.

The date on which the vehicle was first sold or registered in California and the registration expiration date were used to

TABLE 1—Fatal and Severe Injury Scooter, Moped, and Motorcycle Crash Rates per 10,000 Registered Vehicle-Years, California, 1985

Vehicle	Crashes	Registered Vehicle Years	Crash Rate	Standard Error*
Scooters	131	34,174	38	3
Mopeds	59	37,286	16	2
Total**	190	75,907	25	2
Motorcycles***	1,832	246,562	74	2

*Calculated as (crashes)^{1/2}/(registered vehicle-years).

**The total includes 4,447 registered vehicle-years for scooters and mopeds that could not be classified as to type.

***Motorcycle data from reference 21.

estimate potential use-months during 1985. The scooters and mopeds registered in 1985 represented 75,907 potential use-years.

The 17-character Vehicle Identification Number was used to distinguish scooters and mopeds from other two- and three-wheel motor-powered vehicles.

Data on motorcycle crashes from a previous report²¹ are included for comparison. The chi-square statistic was used to test for homogeneity between results for scooters, mopeds, and motorcycles.

Results

Almost 69 percent of the 190 total crashes involved scooters and 31 percent involved mopeds. Scooters had more than twice the crash rate of mopeds, although both rates were considerably less than the rate for motorcycles (Table 1).

The percentages of fatal injury crashes were 8.5 for mopeds, 11.4 for scooters, and 19.6 for motorcycles. The odds of motorcycle fatal injuries compared to those of mopeds and scooters was 1.9 (95% confidence interval = 1.2, 2.9).

Over 59 percent of injured scooter operators and almost 41 percent of injured moped operators were under 20 years of age (Table 2), compared with less than 20 percent of injured motorcycle operators. Nearly 5 percent of the scooter crashes and about 7 percent of the moped crashes involved an operator less than 15 years of age.

In the fatal and severe scooter and moped crashes, 79 percent of the operators were male. Over 98 percent of injured motorcycle operators were male.

Broadside (either vehicle) collisions accounted for 41 percent of the scooter crashes and 51 percent of the moped crashes (Table 3). With the data available, we could not distinguish which vehicle was struck in broadside collisions.

Scooters and mopeds have considerably higher proportions of broadside and rear-end collisions than do motorcycles. Motorcycles, however, overturned* and hit objects more often than did scooters and mopeds.

Scooters and mopeds crashed most frequently in spring and fall, and the highest proportion of crashes occurred on Monday and Friday. More than 60 percent of all scooter and moped crashes occurred between noon and 8:00 pm, and fewer than 10 percent occurred between 2:00 am and 10:00 am. Motorcycles crashed most frequently in the summer and on Saturdays and Sundays. Fifty-one percent of motorcycle crashes occurred between noon and 8 pm.

*Defined by the California Highway Patrol as falling to the ground without a preceding collision.

TABLE 2—Number and Cumulative Percentage of Fatal and Severe Injury Scooter and Moped Crashes According to Age of Operator, California, 1985

Age (years)	Scooters			Mopeds			Motorcycles		
	Number	Percent	Cumulative Percent	Number	Percent	Cumulative Percent	Number	Percent	Cumulative Percent
<15	6	4.6	4.6	4	6.8	6.8	6	0.3	0.3
15-19	71	54.6	59.2	20	33.9	40.7	352	19.4	19.7
20-24	19	14.6	73.8	16	27.1	67.8	674	37.0	56.7
25-29	10	7.7	81.5	3	5.1	72.9	362	19.9	76.6
30+	24	18.5	100	16	27.1	100	425	23.4	100.0
All Ages	130*	100.0		59	100.0		1,819*	100.0	

*Age was unknown for one scooter operator and 13 motorcycle operators.

TABLE 3—Fatal and Severe Injury Scooter, Moped, and Motorcycle Crashes by Collision Type, California, 1985

Collision Type	Scooters		Mopeds		Motorcycles	
	Number	Percent	Number	Percent	Number	Percent
Impact with another vehicle	107	81.7	52	88.1	1191	65.0
Head-on	18	13.7	6	10.2	179	9.8
Broadside	54	41.2	30	50.8	610	33.3
Rear-end	24	18.3	9	15.2	215	11.7
Sideswipe	11	8.4	7	11.9	187	10.2
No other Vehicle	24	18.3	7	11.9	641	35.0
Hit object	13	9.9	2	3.4	363	19.8
Overturn	7	5.3	4	6.8	245	13.4
Other	4	3.0	1	1.7	33	1.8
All Types	131	100.0	59	100.0	1832	100.0

Over 87 percent of fatal and severe scooter and moped crashes occurred in urban areas. About 95 percent of the crashes occurred on streets and roads that are not state highways compared with 79 percent of motorcycle crashes.

Discussion

Scooters have a higher crash rate than mopeds. This could represent different usage patterns or a different crash risk with similar usage.

The higher percentage of severe injury crashes as opposed to fatal crashes, for mopeds and scooters compared with motorcycles, suggests different patterns of use and speed capabilities of these vehicles.

The higher proportion of scooter and moped crashes involving a collision with another motor vehicle may be due to their frequent use in urban areas and their decreased visibility to other motorists due to their smaller size.

Teenagers had the highest number of fatal and severe injury scooter and moped crashes, which is consistent with the observation that these vehicles are used principally by adolescents and young adults.^{8,14} Because scooter and moped crashes occur mostly among teenage drivers, countermeasure efforts might be most effective if directed specifically toward this population.

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