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Introduction

Few issues involving transportation or public safety have come under more attack and revision than motorcycle helmet laws. The U.S. government tied highway construction funding to the passage of helmet laws in 1967. Shortly thereafter, almost all states had passed "universal" helmet laws for all motorcyclists. By the late 1970s, the federal government's ability to tie highway funding to helmet laws came under attack and soon many states rescinded their helmet laws (1). Today helmet laws are universal for motorcyclists in 20 states and the District of Columbia, age-limited in 26 states, and absent in 4 states; Ohio mandates helmet use only for riders or passengers < 17 years old (Figure 1).

Previous studies have shown increases in frequency and severity of TBI in motorcyclists who do not wear helmets (2,3). Motorcyclists are at the highest risk to suffer a spinal cord injury among all motor vehicle users (4). Traumatic injuries of the brain and spine are two of the leading causes of death and disability in young adults. Mandatory helmet laws work, resulting in increased use of helmets by nearly 95% (5,6). Thus, it is vital to healthcare economics and public safety to understand the impact of helmet use during a motorcycle collision. In this study, we compare the healthcare and socioeconomic costs of motorcycle accident victims relative to helmet use.

Methods

We performed a retrospective review of the trauma registry from our Level I Trauma Center to identify patients admitted from January 2003 to December 2004 after a motorcycle collision. Data were analyzed to determine injury patterns and hospital costs relative to helmet use for patients.

Results

Of the 224 patients involved in motorcycle collisions who presented to our Level I Trauma Center, almost 30% suffered a head injury. 75 (33%) wore helmets and 139 (62%) did not wear a helmet; helmet use was indeterminate in 10. There were no age differences between groups. Average patient age was 40 years; ages ranged 16 to 77 years for riders without helmets versus 19 to 67 years for those with helmets (Table 1). The *male:female* ratio was higher among riders who did not wear helmets (7:1) compared to helmeted riders (5:1) (Figure 2).

The healthcare and socioeconomic costs of not wearing a helmet were substantial after a motorcycle collision. Those without helmets more often suffered head injuries, required longer and more expensive hospital stays, and experienced worse outcomes (Table 1).

Head injury occurred in 59 (42%) of the 139 of riders without helmets compared with only 7 (9%) of the 75 helmeted riders ($p < 0.0001$). Injury to the spinal column or cord occurred in 34 (24%) of riders without helmets and 14 (19%) of helmeted riders; this difference was not significant (Figure 3).

Length of hospital stay for after a head injury averaged 8 days for riders without helmets versus 4 days for helmeted riders. Average length of hospital stay for motorcyclists with a spinal injury also showed a 4-day difference for those without helmets and those with helmets (11 versus 7 days, respectively).

Average hospital costs were larger for riders without helmets (\$48,594) compared with helmeted riders (\$34,535). Differences become even greater when considering only riders with a head injury—costs averaged \$61,017 for those without a helmet and \$22,359 for those with a helmet (Figure 4). Hospital costs for motorcyclists sustaining a spinal injury also showed a difference between riders without helmets and those with helmets (\$65,589 vs \$47,879).

Among those with head injuries, all riders who wore helmets had insurance. However, 21 of the 59 (32%) riders without helmets had either no insurance, or only carried Medicare or Medicaid ($p = 0.03$) (Figure 5).

Discharge disposition for the 7 helmeted riders with head injury was home in 5 (71%), to rehabilitation in 1 (14%), and death in 1 (14%). Among the 59 riders without helmets only 27 (45%) went home, 19 (32%) went to rehabilitation, 3 (5%) went to nursing homes, and 10 (17%) died (Figure 6).

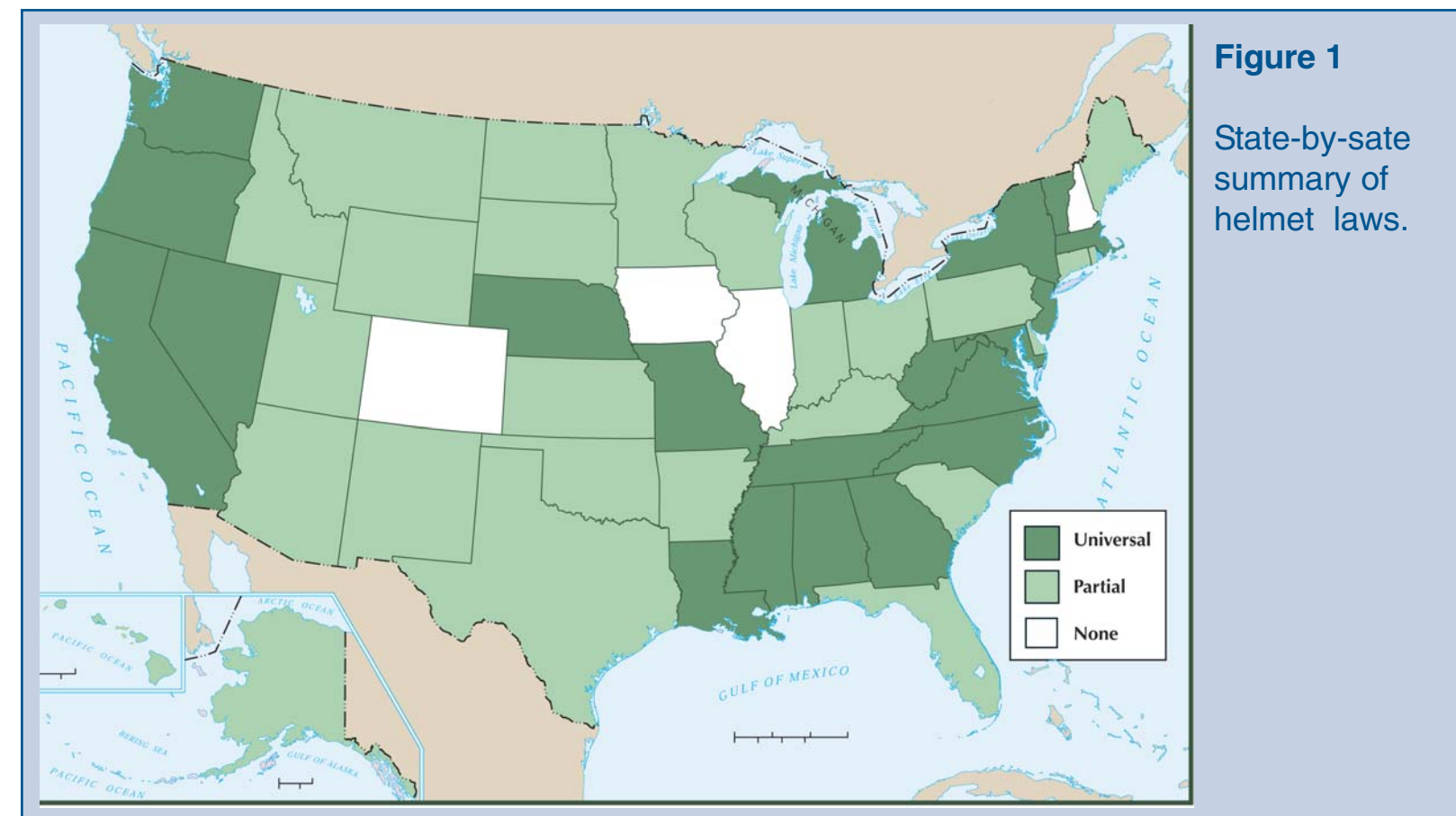


Figure 1

State-by-state summary of helmet laws.

Table 1. Head injuries after motorcycle collisions in victims (with and without helmets): a comparison of healthcare costs and outcomes.

Description	Helmet (n = 7)	No helmet (n = 59)
Hospital costs	\$22,359	\$61,017
Length of hospital stay	4 days	8 days
Discharge		
Home	5 (71%)	27 (45%)
Rehabilitation	1 (14%)	19 (32%)
Extended care	0 (0%)	3 (5%)
Fatalities	1 (14%)	10 (17%)

Figure 2

Total motorcycle crash victims with and without helmets. Average age was 40 years for both groups.

Total 224 patients
Average age 40 years
M:F Ratio: helmet (5:1)
no helmet (7:1)

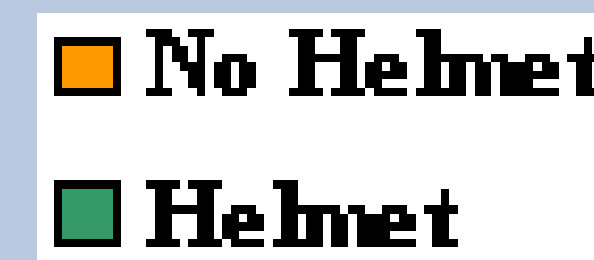
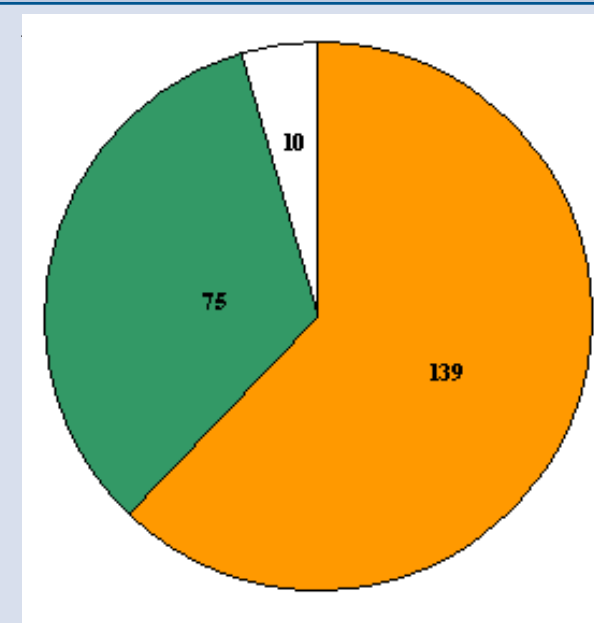


Figure 3

Percentage of head and spinal injuries in motorcyclists with and without helmets. Differences in the head injury group are significant ($p < 0.0001$).

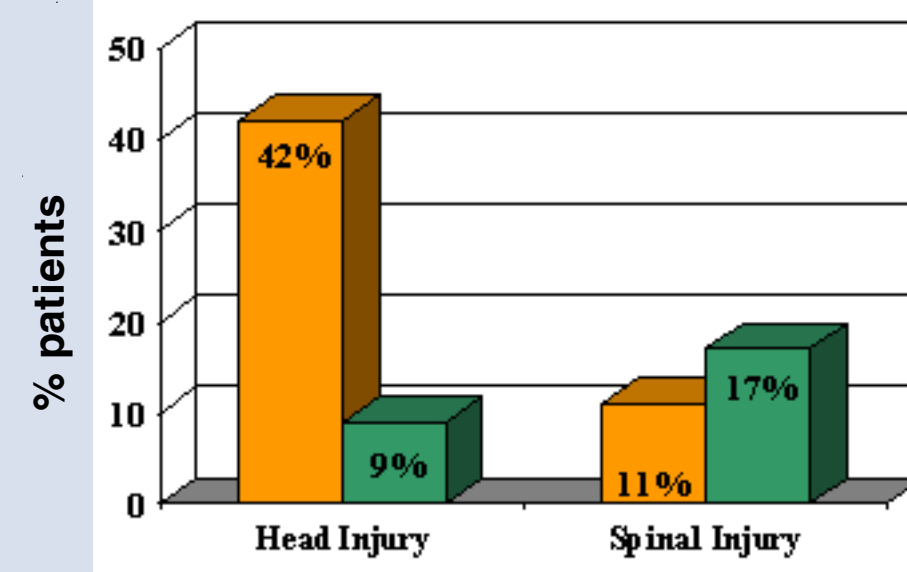


Figure 4

Hospital costs relative to injury pattern and helmet use. After head injury, costs averaged about \$61,000 versus \$22,360 for patients without versus with helmets, respectively.

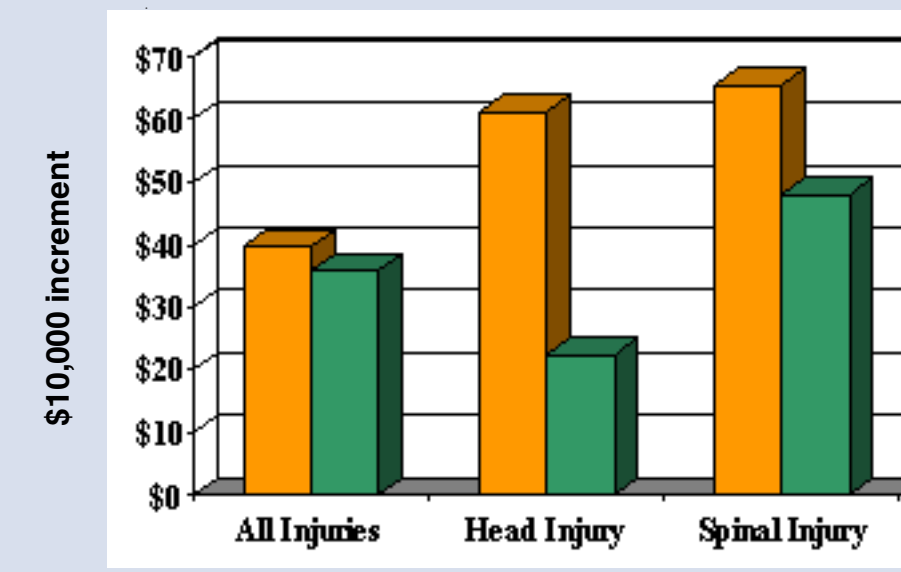


Figure 5

Insurance Coverage varied. All motorcyclists with helmets carried insurance. However, 32% of patients without helmets either had no insurance or only Medicare.

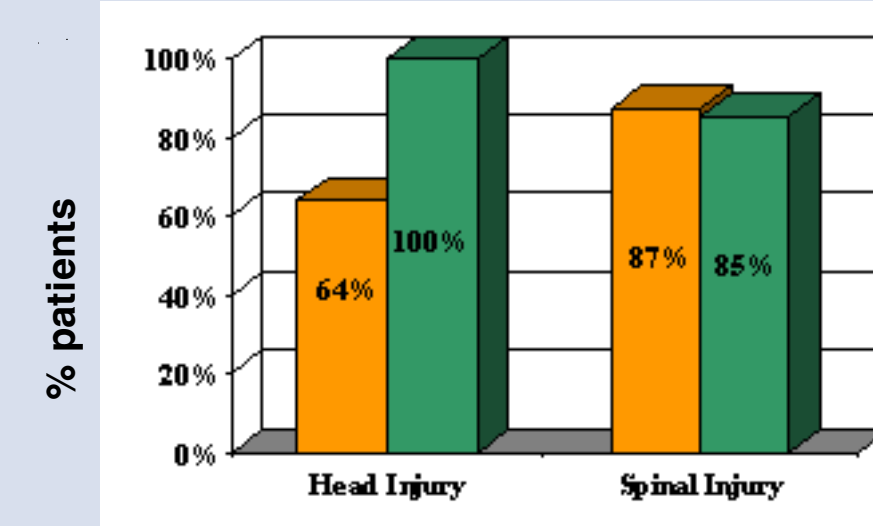
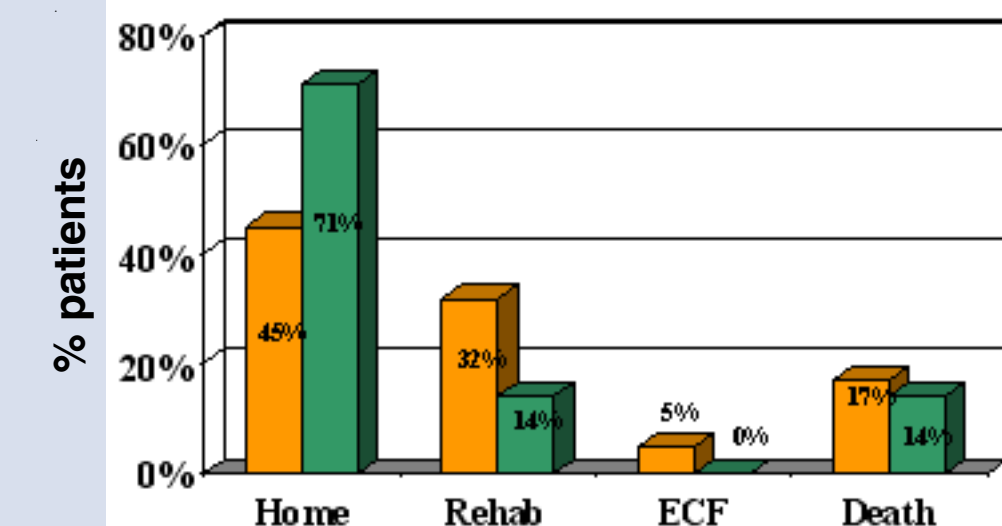


Figure 6

Disposition after head injury. Without helmets, only 45% of patients were discharged home versus 71% who wore helmets.



Conclusions

Of 224 patients who survived a motorcycle accident long enough to be brought to our Level I Trauma Center, only one-third were helmeted at the time of the accident and 30% had suffered a head injury. In the Cincinnati Tri-state area only motorcyclists under 17 years of age are required by law to wear helmets.

Riders without helmets showed increased rates of brain injuries, higher rates of morbidity and mortality, longer length of stays with higher hospital costs, and increased need for long-term medical care and assisted living when compared with riders who wore helmets. In addition, those not wearing helmets less often carried private health insurance. There was no increase in the risk of spinal cord injury in helmeted riders.

The healthcare and socioeconomic costs of not wearing a helmet were substantial to these patients, with taxpayers and local communities assuming much of these costs. This information should be considered in any legislative efforts regarding motorcycle helmet use.

Our study confirms the 50+ years of data that motorcycle helmet use reduces the risk and cost of head injury (7).

U.S. Supreme Court summation:

“From the moment of injury, society picks the person up off the highway; delivers him to a municipal hospital and municipal doctors; provides him with unemployment compensation if, after recovery, he cannot replace his lost job, and if the injury causes permanent disability, may assume the responsibility for his and his family’s subsistence. We do not understand a state of mind that permits the plaintiff to think only he himself is concerned.”

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