

Highway Loss Data Institute Bulletin

Helmet Use Laws and Medical Payment Injury Risk for Motorcyclists with Collision Claims

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INTRODUCTION

According to the National Highway Traffic Safety Administration (NHTSA, 2008a), motorcycle registrations increased by 75 percent during 1997-2006. Analysis by the Insurance Institute for Highway Safety of data from the Fatality Analysis Reporting System shows that fatalities in motorcycle crashes increased by 128 percent during the same period. Unlike automobiles, motorcycles offer little if any occupant protection. Only 20 percent of automobile crashes result in injury or death, whereas 80 percent of motorcycle crashes have this outcome (NHTSA, 2005).

To reduce or prevent head injuries, motorcycle helmets are designed to cushion and protect riders' heads from impacts during crashes. States began adopting laws to require helmet use in 1967; by the early 1970s, almost all states had universal motorcycle helmet laws ("universal" in the sense that laws covered all riders). However, since the mid-1970s, some states have repealed their motorcycle helmet laws, and many others have limited them to cover riders younger than a certain age; age requirements for these young riders range from 14 to 20. As of November 2009, 20 states have universal helmet laws, and 27 states have partial helmet laws; Illinois, Iowa, and New Hampshire have no mandatory helmet laws (Appendix A).

When all motorcyclists are required to wear helmets, use rates approach 100 percent, compared with about 50 percent when there are no helmet laws or laws that apply only to some riders (NHTSA, 2005; Ulmer and Northrup, 2005). According to NHTSA, 97 percent of motorcyclists observed in states with universal helmet laws were wearing helmets in 2008, compared with 100 percent in 2002. In states without such laws, helmet use was 53 percent in 2002 and 54 percent in 2008 (NHTSA, 2008b; Glassbrenner, 2005).

When used, helmets reduce the likelihood of crash fatality by 37 percent, and unhelmeted motorcyclists are three times more likely than helmeted riders to suffer traumatic brain injuries in the event of a crash (NHTSA, 2005). Not surprisingly then, research has shown large fluctuations in fatal crashes among motorcyclists when states have changed helmet use laws. For example, when Florida weakened its universal law in 2000 to apply only to riders younger than 21, fatal crashes increased about 21 percent (Ulmer and Northrup, 2005).

The effect of such law differences may be smaller for insured injuries because most injuries to motorcyclists are not life threatening. Still, some effect would be expected because head injuries are more likely without helmets, and any head injury is likely to precipitate medical treatment. The purpose of this study was to quantify the relationship between state helmet laws and the rate that medical payment claims arise from collision claims. The study included 49 states except Alaska was excluded due to very low motorcycle exposure.

METHODS

Insurance coverages

Motorcycle insurance covers damage to vehicles and property as well as injuries to people involved in crashes. Different insurance coverages pay for physical damage versus injuries. Different coverages also may apply depending on who is at fault. In the present study, two different insurance coverage types were examined: collision and medical payment. Collision insures against physical damage to a motorcycle sustained in a crash. Generally, when a collision claim is filed the driver is at fault. Medical payment covers injuries sustained by the motorcycle operator. The simplest approach would be to compare medical payment losses by state and group them according to whether the helmet law in that state applied to all riders. However, there is much seasonal variation in motorcycle claim frequencies, and that variation differs among states. Additionally, state laws can limit the maximum payment for a claim under medical payment coverage, making it difficult to compare claim severities at the state level.

Concurrent coverage and injury rate

To alleviate problems arising from seasonal and state variations in collision claim frequencies and medical payment claim severities, the metric used to evaluate the effect of helmet laws was the proportion of motorcycle collision claims with an associated medical payment injury claim or injury risk given a crash. Inclusion criteria were that a motorcycle had to have both collision and medical payment coverage at the time of the claim. Study motorcycles were 2001-09 models during 2002-09 calendar years, amounting to a total of 1,110,383 years of exposure, 25,770 collision claims, and 13,317 medical payment claims.

Law status and study design

Each state was classified as having no law, a partial law, or a universal law. States coded as partial law states had helmet laws that applied only to riders below a given age threshold. Age thresholds varied among states, with some states requiring helmets for riders younger than 18 and others requiring them for riders younger than 21.

Helmet law for most states remained unchanged during the study period. Colorado, Louisiana, and Pennsylvania changed their helmet laws, so loss data for calendar years when these states changed their laws were excluded. For example, Colorado reinstated coverage for riders 17 and younger in July of 2007. To reflect the law change, Colorado was classified as a no law state through 2006 and reclassified as a partial law state for 2008; loss data for 2007 was excluded.

Two study designs were used. The first design compared injury rates among three helmet law groups for riders of all ages. The second design combined riders older than 21 in partial and no law states into a single group that was not subject to mandatory helmet use laws. The combined group was compared with riders older than 21 in universal law states. North Carolina and Massachusetts were excluded from this analysis because rider age in these states is mostly unknown in the HLDI database.

Class standardization and state weighting

Previous HLDI reports have documented variation in claim frequencies by motorcycle class. Because class distributions of motorcycles vary among states, injury rates were standardized at the state level to the national distribution of motorcycles in this dataset. For example, Hawaii had the highest proportion of exposure for super sport motorcycle, almost 19 times that for Kentucky. However, Hawaii's proportion of exposure for cruisers was about half that for Kentucky, which had the highest proportion of exposure for cruisers (Appendix B). Because the study dataset is a subset of the HLDI database for the coverages studied, insufficient loss data were available to produce results for each class at the state level. Consequently, some motorcycle classes were combined. Sport and unclad sport motorcycles were combined; scooter, chopper, dual purpose, standard and sport touring motorcycles were combined as "other." The standardized injury risk for each state then was weighted by its proportion of exposure in its respective helmet law group. The class standardized/state weighted injury rates then were summed to generate a single injury rate for each of the law groups.

Estimating statistical significance

Using injury risk for universal law states as the baseline, differences in injury rates were calculated between baseline and partial law states and between no law states and baseline. The standardized and weighted injury rates for no law states, partial law states, and universal law states were denoted as y_0, y_1 and y_2 respectively. A log transformation was made on the ratio of y_i/y_j , where $i, j = 0, 1$ or 2 and $i \neq j$ to test the hypothesis that the ratio is 1. y_i was derived as follows:

$$\sum_{l,m} StateWeight_l * classWeight_m * injury\ rate_{l,m}$$

where l is the index of a given state in the corresponding helmet law category, and m is the index of a given motorcycle class. Variance of injury rates by state and class over helmet law was estimated as follows:

$$var\left(\frac{x}{y}\right) \approx \frac{var(x)}{y_0^2} + \left(\frac{x_0}{y_0^2}\right)^2 var(y) - 2\left(\frac{x_0}{y_0^3}\right) cov(x, y)$$

where x_0 and y_0 denote the mean of claims x and y where Poisson distribution applied. Asymptotic normal approximation then was used, and Z scores were derived to compute the two-sided p-value. The same inference procedure also was applied in the second analysis.

RESULTS

Figure 1 shows injury rates for the three helmet laws groups. Overall, more than half of collision claims resulted in associated medical payment claims. Injury risk was estimated at 0.52 for universal law states, 0.53 for partial law states, 0.55 for no law states.

Table 1 lists results of the first analysis that compared injury rates among the three helmet law groups for riders of all ages. Injury risk was estimated to be 6 percent higher for no law states than for universal law states ($p = 0.01$). Injury risk for partial law states fell in between, an estimated 3 percent higher than for universal law states ($p = 0.09$). Injury risk for no law states was an estimated 3 percent higher than for partial law states, but this difference did not reach statistical significance ($p = 0.2$).

TABLE 1 INJURY RATES BY HELMET LAW GROUP						
	EXPOSURE (YEARS)	COLLISION CLAIMS	MEDPAY CLAIMS	STANDARDIZED AND WEIGHTED RATES	RELATIVE RATES	P-VALUE
No law	201,516	4,346	2,321	0.549	1.06	0.01
Partial law	479,585	9,884	5,247	0.534	1.03	0.09
Universal law	429,281	11,540	5,749	0.520	1	
Total	1,110,383	25,770	13,317			

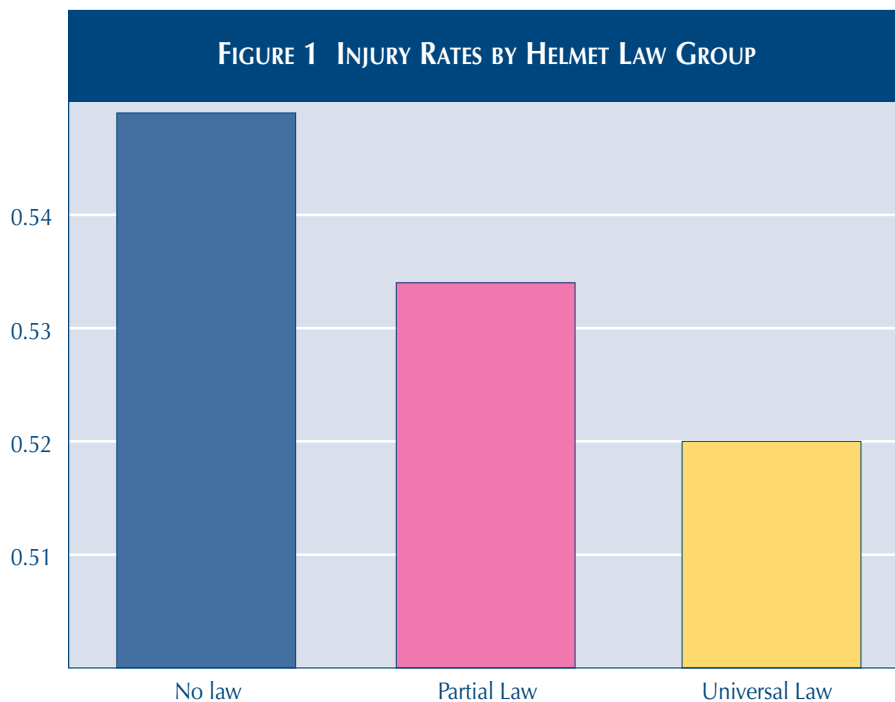
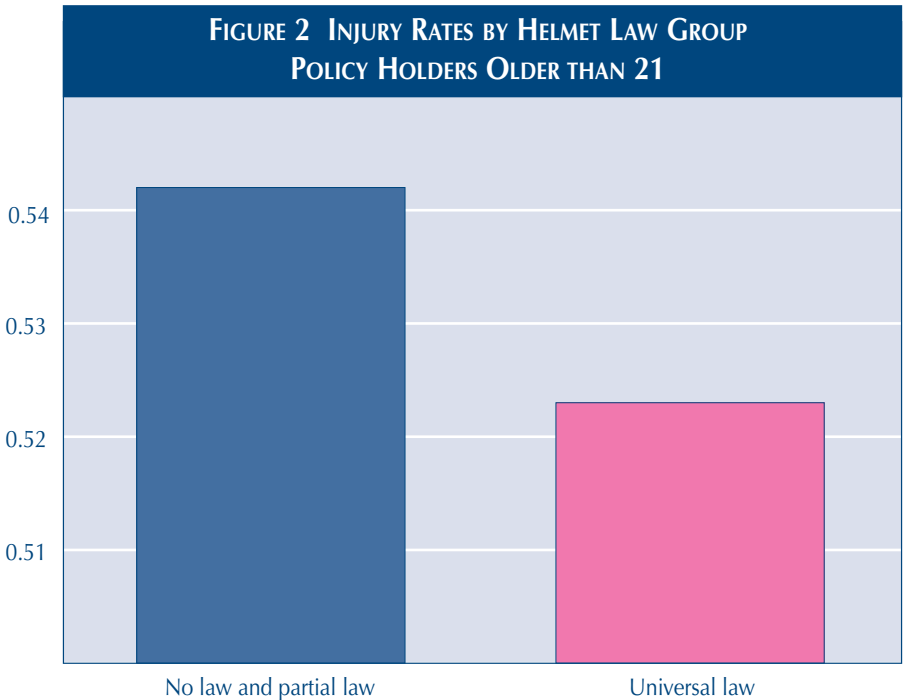


Table 2 lists results of the second analysis that examined injury rates for riders older than 21 in partial and no law states compared with universal law states. Results are further illustrated in Figure 2. The injury rate for riders older than 21 in partial and no law states was estimated to be 4 percent higher than for universal law states, and this difference was statistically significant ($p = 0.02$).

TABLE 2 INJURY RATES BY HELMET LAW GROUP, POLICY HOLDERS OLDER THAN 21						
	EXPOSURE (YEARS)	COLLISION CLAIMS	MEDPAY CLAIMS	STANDARDIZED AND WEIGHTED RATES	RELATIVE RATES	P-VALUE
No law and partial law	647,694	12,937	6,921	0.542	1.04	0.02
Universal law	324,554	8,365	4,293	0.523	1	



Limitations

Information about the type of injury associated with a medical payment claim is not available in the HLDI database. Helmets obviously are designed to reduce head injuries, and knowing if a head injury occurred could greatly improve the analysis. It also is unknown whether or not a rider was wearing a helmet at the time of the crash. A rider could wear a helmet when not required by state law or could choose to violate the law by not wearing a helmet. Loss data for the youngest riders were too sparse to conduct an analysis for partial law states where helmet use is required for riders younger than 19.

CONCLUSION

Collision claims are less likely to result in medical payment claims in states with universal helmet laws compared with states with other types of helmet laws. Results indicate there is no statistical difference between states with partial helmet laws and states with no helmet laws.

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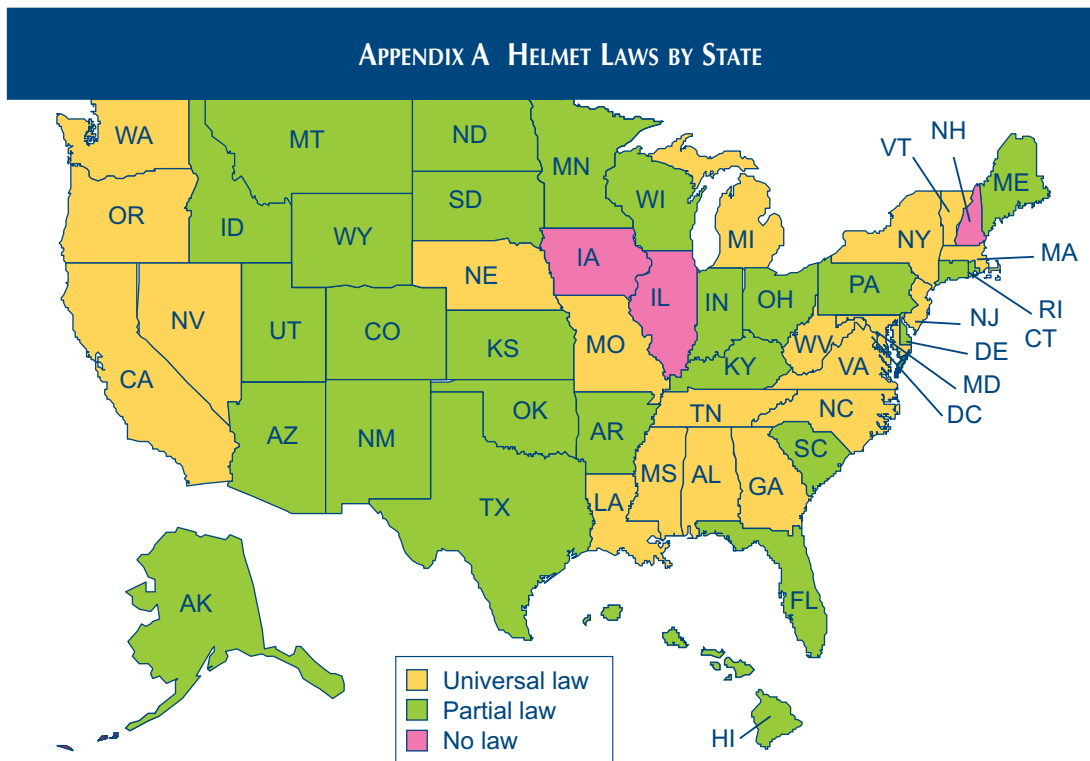
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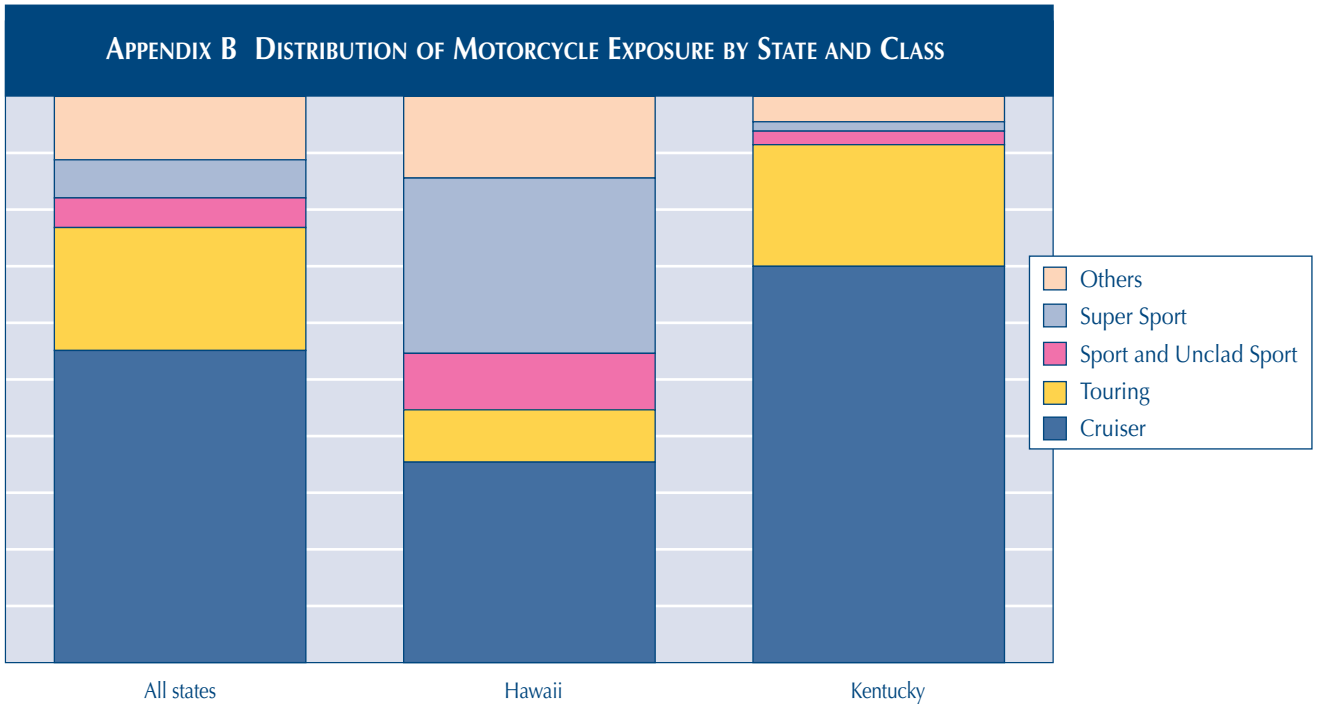
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