

The Effect of Helmet-Use on Motorcycle Trauma Outcomes*Daniel Wiznia, MD¹; Chang-Yeon Kim, BS, MS¹; Alex Goel, BS²; Michael Leslie, DO¹;**¹Yale School of Medicine, New Haven, Connecticut, USA;**²UCLA Geffen School of Medicine, Los Angeles, California, USA*

Background/Purpose: Partial motorcycle helmet laws have proven to be inadequate, as states with such laws have reported helmet use rates as low as 44%, accompanied by a steady rise in motorcyclist hospitalizations and fatalities. In this retrospective cohort study, we evaluated motorcycle trauma data at a regional Level I trauma center over a 12.5-year time period. The goal was to investigate the clinical and economic effects of the use of motorcycle helmets. We hypothesized that non-helmeted patients would have worse injury profiles and increased treatment costs. We also predicted that alcohol and drug use would not significantly alter these outcomes.

Methods: A retrospective review was conducted using data from a Level I trauma registry, from July 2, 2002 to December 31, 2013. All patients admitted to the hospital after a motorcycle crash were included in the study. Patients were stratified into helmeted and non-helmeted cohorts. Group differences were compared using Wilcoxon test for continuous variables and chi-square test for dichotomous outcomes. Regression models were created to evaluate predictors of helmet use, alcohol and drugs as confounding variables, and factors that influenced hospital costs.

Results: The registry included 986 eligible patients. Of this group, 335 (34%) were helmeted and 651 (66%) were non-helmeted. Age and alcohol/drug use were negative predictors of helmet use. Overall, non-helmeted patients had a worse clinical presentation, with lower Glasgow Coma Scale (GCS), higher ISS, higher incidence of loss of consciousness (LOC), longer intensive care unit (ICU) admissions, and higher incidence of head or face injuries. Non-helmeted patients were also twice as more likely to die from their injuries. Financially, non-helmeted patients incurred mean hospital costs of \$18,458 while helmeted patients incurred \$14,970. ISS, GCS, and ICU length of stay were correlated with increased hospital costs. Alcohol or drug use did not significantly affect hospital outcomes, and was a nonsignificant predictor of patient mortality when compared to helmet use.

Conclusion: Helmet use is associated with lower injury severity and increased survival after a motorcycle accident. These outcomes remained consistent even after controlling for alcohol and drug use. The medical and financial impact of a partial helmet law is devastating; these outcomes support stronger helmet education and enforcement in states with such laws.

Table 1. Demographic Information, Injury Profile and Outcome

	Helmet (n = 335)	No helmet (n = 651)	p-Value
Demographics			
Male (%)	301 (90.9)	574 (88.1)	NS
Age (years)	34.4	38.8	< 0.0001
Admission variables			
SBP	126	128	NS
LOC	95	245	0.003 (OR1.68)
GCS	14	13.2	< 0.0001
ISS	13.6	15.7	0.002
# of transfers	54	111	NS
Hospital course			
ICU LOS (d)	1.3	2.4	0.001
Ventilator use (d)	5.2	6.6	NS
OR visits (%)	61 (18.2)	116 (17.8)	NS
Hospital LOS (d)	7	8.5	NS
Injury incidence (%)			
Head	104 (31)	378 (58.1)	< 0.0001 (OR 3.08)
Face	69 (20.6)	305 (46.9)	< 0.0001 (OR 3.4)
Neck	4 (1.2)	5 (0.8)	NS
Chest	156 (46.6)	291 (44.7)	NS
Abdomen	78 (23.2)	138 (21.1)	NS
Cervical spine	24 (7.2)	69 (10.6)	NS
Thoracic spine	35 (10.4)	56 (8.6)	NS
Lumbar spine	33 (9.9)	63 (9.7)	NS
Upper extremity	198 (59.1)	379 (58.2)	NS
Lower extremity	228 (68.1)	458 (70.3)	NS
Mortality (%)	14 (4.2%)	49 (7.5%)	0.042 (OR 1.87)

SBP = Systemic Blood Pressure, LOC = Loss of Consciousness, GCS = Glasgow Coma Scale, ISS = Injury Severity Score, ICU = Intensive Care Unit, LOS = Length of Stay, d = days

Table 2 Charges and Payer Distribution

	Helmet (n = 335)	No helmet (n = 651)	p-Value
Mean charges (SE)	\$14,970 (\$818)	\$18,458 (\$723)	0.175
Private (%)	201 (60.0)	359 (55.1)	NS
Public (%)	101 (30.2)	236 (36.3)	0.060
Uninsured (%)	23 (6.9)	43 (6.6)	NS
Other (%)	10 (3)	13 (2)	NS

Table 3 Results by alcohol/drug use

	No alcohol or drugs			Alcohol or drugs		
	Helmet (n = 246)	No helmet (n = 402)	<i>p</i> -Value	Helmet (n = 89)	No helmet (n = 249)	<i>p</i> -Value
Demographics						
Male (%)	219	354	NS	82	220	NS
Age	35	38	.001	33	40	< .0001
Admission						
SBP	126	129	NS	128	126	NS
LOC	73	131	NS	22	114	< .0001
GCS	14	13.3	.001	13.7	13.1	.022
ISS	13.8	15.3	.049	13.2	16.4	.024
Transfers	40	72	NS	14	39	NS
Hospital course						
ICU time	.9	2.5	< .0001	2.5	2.3	NS
Ventilator days	4.4	7	NS	6.4	6.1	NS
OR visits	43	77	NS	18	39	NS
Hospital LOS	6.1	9.7	NS	9.5	8.2	NS
Mortality	12	33	NS	2	16	NS
Mean charges	\$12,801	\$18,643	.067	\$20,967	\$18,158	NS

The FDA has stated that it is the responsibility of the physician to determine the FDA clearance status of each drug or medical device he or she wishes to use in clinical practice.