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Repeal of the Michigan helmet law: the evolving clinical impact

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Abstract

BACKGROUND: Michigan repealed a 35-year mandatory helmet law in April 2012. We examined the impact of this legislation on a level 1 trauma center.

METHODS: A retrospective cohort study comparing the 7-month period before and the 3 motorcycle seasons after the helmet law repeal.

RESULTS: A total of 345 patients were included in the study. Nonhelmeted riders increased from 7% to 28% after the repeal. Nonhelmeted crash scene fatalities were higher after the repeal (14% vs 68%). The nonhelmeted cohort had significantly higher in-patient mortality (10% vs 3%), injury severity score (19 vs 14.5) and abbreviated injury scale head (2.2 vs 1.3). Non-helmeted riders also had increased alcohol use, intensive care unit length of stay and need for mechanical ventilation. The median hospital cost for the non-helmeted cohort was higher ($P < .05$).

CONCLUSIONS: The impact of the Michigan helmet law repeal continues to evolve. Three years after this legislative change, we are now observing increased injury severity score, higher in-patient mortality, and worse neurologic injury.

On April 13th, 2012, the State of Michigan (MI) repealed a 35-year mandatory motorcycle helmet law. This allows riders who are over the age of 21, who have had a valid motorcycle license for at least 2 years or completed a motorcycle safety course and have acquired at least $20,000 in additional medical insurance to ride without a helmet.

One year after the repeal, we published the early clinical impact of this legislative change. Motorcyclists not wearing helmets quadrupled after the repeal. Although hospital mortality was unchanged, nonhelmeted motorcyclists (NHMs) more frequently died on the scene. Furthermore, the NHMs had a longer intensive care unit (ICU) length of stay (LOS) and mechanical ventilation time, increased hospital costs, and higher rates of alcohol intoxication.[1]

Today, the helmet law repeal remains controversial, despite an established body of evidence that demonstrates a

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clear safety benefit of motorcycle helmets. Multiple studies have shown that NHMs have a higher mortality rate than helmeted motorcyclists (HMs).[2–4] Other investigators have found that NHMs have a higher rate of lethal and nonlethal head injuries.[3–5]

The purpose of this study is to examine the ongoing clinical impact of the motorcycle helmet law repeal in the State of MI, now 3 years into its implementation.

Methods

Study design

Spectrum Health Butterworth Hospital is an 815-bed tertiary care center serving 13 counties in West Michigan. It is the only level 1 trauma center serving region 6, 1 of 7 regions in Michigan. After obtaining institutional review board approval, we retrospectively reviewed the medical records of all trauma patients admitted to the trauma service that were involved in a motorcycle crash during each motorcycle season from 2011 to 2014. We examined patient records during a 7-month period before the helmet law repeals (April 10, 2011 to November 10, 2011) and compared this to the same 7-month period each year after the repeal (2012 to 2014). Patients with an unknown helmet status were excluded from the study. Patient data from 2011 to 2012 have been reported previously.[1]

Data collected included age, sex, helmet status, mortality, injury severity score (ISS), abbreviated injury scale (AIS) head, ICU LOS, hospital LOS, mechanical ventilation time, admission Glasgow coma scale (GCS), hospital cost, alcohol intoxication (blood alcohol content $>.08\%$), and disposition. Data were also collected from the Michigan State Department of Transportation to determine crash scene fatalities for region 6.

Statistical analysis

Data were analyzed using IBM SPSS Statistics version 21 (Armonk, NY). Nominal data were compared using the chi-square or Fisher's exact test where applicable. Nominal values are expressed as percentages. Quantitative data were compared using the *t*-test or Mann–Whitney *U* test. Quantitative data are reported as mean ± standard deviation. Multivariate regression analyses were performed. Outcome variables included LOS, ICU LOS, vent days, death, and ICU admission. Independent variables were ethanol above the legal limit, age, and sex, as well as either helmet status (yes vs no) or group (prelaw vs postlaw) as the final independent variable. Significance was assessed at $P < .05$.

Results

A total of 345 patients were involved in a motorcycle crash and admitted to the trauma service during the study period. There were 296 men (86%), and the average age was 44. Seventy-nine riders presented from April 10, 2011 to November 10, 2011, before the helmet law repeal and 266 riders presented in the after 3 motorcycle seasons, from April 10 to November 10 2012 to 2014.

Demographic and clinical data for the prelaw and postlaw change groups are shown in Table 1. When comparing these 2 cohorts, age and sex were no different. However, when comparing helmet status, significantly more riders were NHMs in 2012 to 2014, compared with 2011 ($P < .001$). NHMs crash scene fatalities were more than 4 times higher in 2012 to 2014 compared with 2011, which was significantly different.

Table 2 shows comparisons between HMs and NHMs. Again, there were no differences in gender or age. The nonhelmeted group had a significantly higher hospital mortality rate compared with the helmeted group. ISS, AIS head, GCS, ICU stay, and the need for mechanical ventilation were all significantly higher in the nonhelmeted group as well. The nonhelmeted group had a higher median hospital cost ($27,760 vs $20,967, $P = .03$). This group was also more likely to be intoxicated on arrival ($P < .001$).

Multivariate analyses were used to determine predictors for the dependent variables LOS, ICU LOS, vent days, death, and ICU admission. Although alcohol intoxication was significantly related to helmet status in the univariate analysis, it was not a significant predictor for any of the dependent variables. Furthermore, none of the other independent variables tested were significant predictors.

Comments

Motorcycle helmet laws have generated controversy for several decades. The National Highway Safety Act, implemented in 1966, required that states mandate helmet use to receive federal highway safety and construction funds. This requirement was rescinded in 1976, when Congress revoked the authority of the US Department of Transportation to withhold state funds for helmet law noncompliance. A dramatic increase in motorcycle deaths was observed in the year after this legislative change. Despite this negative impact, many states weakened or rescinded their motorcycle helmet laws. Today, only 19 states and the District of Columbia maintain a universal helmet law. Partial helmet laws, requiring only certain riders (usually those younger than 18 or 21 years) to wear a helmet, are present in 28 states. Illinois, Iowa, and New Hampshire are the only states without a helmet law.[2] Michigan maintained its universal helmet law for 35 years until April 13th, 2012 when it was repealed, and a partial helmet law was approved in our State. We reported the clinical impact of this legislative change in the American Journal of Surgery 1 year after the repeal.

We found that motorcyclists not wearing helmets quadrupled in the first year after the repeal. Although hospital mortality was unchanged, NHMs more frequently died on the scene (14% vs 77%, $P = .007$). Furthermore,