



## Observation of motorcycle helmet use rates in Michigan after partial repeal of the universal motorcycle helmet law

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### ABSTRACT

Motorcycle crashes result in a significant health burden, including many fatal injuries and serious non-fatal head injuries. Helmets are highly effective in preventing such trauma, and jurisdictions that require helmet use of all motorcyclists have higher rates of helmet use and lower rates of head injuries among motorcyclists. The current study examines helmet use and characteristics of helmeted operators and their riding conditions in Michigan, following a weakening of the state's universal motorcycle helmet use law in April 2012. Data on police-reported crashes occurring during 2012–14 and from a stratified roadside observational survey undertaken in Southeast Michigan during May–September 2014 were used to estimate statewide helmet use rates. Observed helmet use was more common among operators of sports motorcycles, on freeways, and in the morning, and least common among operators of cruisers, on minor arterials, and in the afternoon. The rate of helmet use across the state was estimated at 75%, adjusted for roadway type, motorcycle class, and time of day. Similarly, the helmet use rate found from examination of crash records was 73%. In the observation survey, 47% of operators wore jackets, 94% wore long pants, 54% wore boots, and 80% wore gloves. Protective clothing of jackets and gloves was most often worn by sport motorcycle operators and long pants and boots most often by riders of touring motorcycles. Findings highlight the much lower rate of helmet use in Michigan compared with states that have a universal helmet use law, although the rate is higher than observed in many states with partial helmet laws. Targeted interventions aimed at specific groups of motorcyclists and situations where helmet use rates are particularly low should be considered to increase helmet use.

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## 1. Introduction

### 1.1. Burden of motorcyclists' injuries and benefits of helmets

Fatal and non-fatal motorcycle crashes are a significant public health burden in the United States, resulting in 4295 deaths and 92,000 non-fatal injuries in 2014 (Institute for Highway Safety [IIHS], 2016a, 2016b). Although motorcycles represented only 3% of registered vehicles in 2014, motorcyclists accounted for 13% of all traffic fatalities (Federal Highway Administration, 2015; IIHS, 2016a). There is clear evidence regarding the effective-

ness of helmets in preventing and reducing the severity of head injuries (Cook et al., 2009; Crompton et al., 2010; Houston and Richardson, 2008; Markogiannakis et al., 2006; Mayrose, 2008). Non-helmeted motorcyclists, compared with those wearing helmets, have a 40% increased risk of a fatal head injury and a 15% increased risk of a non-fatal head injury (National Highway Traffic Safety Administration [NHTSA], 2008). NHTSA (2014) estimated that the lives of 1630 motorcyclists were saved in 2013 because they were wearing a helmet.

### 1.2. Universal helmet laws

As of March 2016, only 19 states and the District of Columbia have universal helmet laws, and laws requiring some motorcyclists' use are in place in 28 states (IIHS, 2016c). There is no motorcycle

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helmet use law in Illinois, Iowa, or New Hampshire. Helmet use rates are consistently higher in states with universal helmet laws (Mayrose, 2008; NHTSA, 2008). In 2014, 91% of motorcyclists who died in crashes in states with universal helmet use laws were wearing helmets, compared with 40% in states with partial helmet use laws and 28% in states without universal helmet use laws (IIHS, 2016a). Using data from the National Occupant Protection Use Survey (NHTSA, 2015), observed use of DOT-compliant helmets (i.e., helmets that meet federal performance standards for preventing injury or death and excluding helmets often referred to as “novelty helmets”) in 2014 was 89% in states with universal helmet laws and 48% in other states.

### 1.3. Factors associated with helmet use

#### 1.3.1. Use of crash and observational data

An examination of the factors associated with helmet use may provide a foundation for targeting public health intervention strategies. While previous research has identified correlates of increased crash risk among motorcyclists, few studies have looked at factors associated with helmet use or non-use. This study examines such factors using observational and crash data following the repeal of a universal helmet law. We also examine the likely degree of concordance between rates of helmet use in crash data and rates observed in roadside surveys, which gives insight into the potential value of using more readily collected crash data in understanding the characteristics of those who use a helmet. This is particularly important given the expense and challenge of conducting observational studies that reflect a representative sample of motorcyclists within a state. Crash data, however, are routinely collected by U.S. states and may provide a useful and inexpensive estimate of overall helmet use and could help target public health campaigns in states without universal laws. This approach has been useful in estimating seat belt use rates. After correction for sample selection, data on seatbelt use in fatal crashes from NHTSA's FARS database produced comparable estimates to observed seat belt use from the National Occupant Protection Use Survey (Islam and Goetzke, 2009).

#### 1.3.2. Identified factors associated with helmet use

Some previous research suggests that helmet use varies depending on the road type, weather conditions, and day of the week. NHTSA's National Occupant Protection Use Survey examines various factors related to observed compliant helmet use. In the most recent 2014 national survey (NHTSA, 2015), helmets were worn more frequently on expressways (81%) compared with surface streets (58%), and more often in fast traffic (72%) compared with medium-speed (57%) and slow traffic (62%). Also, there was some greater use in clear weather (65%) compared with light precipitation (55%), and similar rates of use on weekends (64%) and weekdays (65%). Gkritza (2009) examined factors associated with helmet use in an observational survey. The study was conducted in Iowa between 2000 and 2006 and found 36% use rates among operators and 39% among passengers. There were higher rates of helmet use early in the riding season (April compared with August) and in the morning (7–10 am) compared with later in the day (10 am–3 pm or 3 pm–6 pm). Helmet use rates were also higher on freeways/arterial roads compared with local roads, and on cloudy or rainy days compared with sunny days. The study did not examine motorcycle class, day of the week, or driver age or sex. Another observational study found that motorcyclists on weekends (compared with weekdays) were more likely to wear non-DOT-compliant (i.e., novelty) helmets than DOT-compliant helmets in a jurisdiction with a universal helmet use law (Peek-Asa et al., 1999).

There is evidence that self-reported helmet use (McCartt et al., 2011) and helmet use in crashes differ by motorcycle class. Helmet use among fatally injured motorcyclists during 2000 and 2003–08

was highest among those on sport motorcycles (82%) and lowest for those on cruiser, standard, and touring motorcycles (49% each) (Teoh and Campbell, 2010). Further, based on Ohio police-reported crash data from 2006 to 2010, Schneider et al. (2012) reported that riding a newer motorcycle and being at fault in a crash were associated with lower helmet use rates.

### 1.4. Study objective

Helmet use is associated with reduced head injuries and fatalities (Cook et al., 2009; Crompton et al., 2010; Markogiannakis et al., 2006; Mayrose, 2008; NHTSA, 2014). On April 13, 2012, Michigan implemented a partial repeal of the universal motorcycle helmet use law. The current Michigan law requires motorcyclists younger than age 21 to wear DOT-compliant helmets on public roadways (Michigan Legislature, 2012). The law also requires unhelmeted motorcyclists age 21 or older to have at least \$20,000 in health insurance coverage and to either have passed a motorcycle safety course or have held a motorcycle endorsement for a minimum of 2 years.

The current study examines helmet use among motorcyclists in Michigan following the partial repeal of the universal helmet use law. A prior statewide roadside observational survey in Michigan that was weighted by motorcycle registrations estimated helmet use to be 73% in 2013 (Savolainen et al., 2013), but it is unknown if this rate remained stable in subsequent years or how this rate compares with helmet use in crash data. The study uses observational data collected in 2014 to estimate overall helmet use and to examine differences in helmet use by roadway type, time of day, and day of week. We also observed characteristics of helmeted operators, including the type of helmet used and class of motorcycle ridden. The study aim is thus to estimate state-wide use and understand characteristics of helmet users following the repeal of a universal helmet law.

## 2. Method

Observational data of motorcycles and motorcycle operators were collected on roadways in Southeast Michigan to identify helmet use and were combined with data on helmet use among operators involved in police-reported crashes to produce statewide helmet use estimates. Use of other protective gear (jacket, pants, footwear, gloves) was also observed. More detail on data sources and analysis methods appears below.

### 2.1. Observation data

#### 2.1.1. Observation sites: roadway type and selection

The observational survey of motorcycle helmet use was conducted in seven counties of Southeast Michigan. The area is the most populous part of Michigan and reflects both urban and rural areas. The National Functional Classification (NFC), a system that classifies roads according to type on a scale of 1–7 (Michigan Department of Transportation [MDOT], 2014a), and traffic volume were utilized to select sites. Selected observation sites included interstates and freeways (NFC 1 and 2), principal arterials (NFC 3, typically connecting routes between cities within urban areas), minor arterials (NFC 4, connecting routes more local in nature), and minor roadways (NFC 5, 6, and 7, collector roads, e.g., serving schools, business, and residential areas or other local roads). Average vehicle miles travelled (VMT) on NFC classified roads across all of Michigan for all vehicle types suggests that interstates/freeways (NFC 1 and 2) accounted for 16% of total VMT, principal arterials (NFC 3) accounted for 22% of total VMT, and minor arterials (NFC 4) accounted for 23% of total VMT in 2013 (Michigan Department of Transportation (MDOT, 2014b).

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