

## Short commentary

### Older Motorcyclists not Wearing a Helmet Properly and Drunk Riding: Evidence from a Linked Dataset

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#### Abstract

Motorcycles are a major means of transportation for older adults in many developing countries, and motorcycle safety is an important issue in an aging society. This study linked data on cause of death and inpatient expenditure (from a data set on hospital admissions) with data on traffic accidents, which were gathered by Taiwan's Ministry of Health and Welfare and Taiwan's National Police Agency, respectively. The data were analyzed to determine how wearing a helmet affected injury severity (especially head injuries) among the older motorcyclists who died in crashes and had worn a helmet; 65% of these motorcyclists who died in an accident and wore a helmet had a head injury. Policymakers should educate the public on how to properly wear and fasten a helmet and how to verify that a helmet has met quality standards. Regarding drunk riding, the injury severity was alarming among motorcyclists in accidents whose breath alcohol concentration (BrAC) or blood alcohol content (BAC) level was under the limit. The BrAC or BAC level being under the limit, if it is conflated with not engaging in drunk riding, can be ignored with regard to its effects.

**Keywords:** Drunk-riding blood alcohol limit; Helmet wearing and head injury; Injury severity; Older motorcyclists

#### Introduction

Motorcycles are the main means of transport in numerous developing countries. Furthermore, motorcycles are a crucial means of transport for the elderly population because they enable older adults to maintain mobility and perform outdoor activities. Chen [1] reported that a large portion of older people in Taiwan ride motorcycles for

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several trip purposes (e.g., shopping, visiting a friend and seeing a doctor), especially in rural districts. Encouraging safety among elderly motorcyclists is critical. Numerous studies have investigated and reported the negative impact of motorcyclists not wearing a helmet and drunk riding on road traffic death and serious injury. This research leads to the question of whether helmet-related safety problems are less problematic among the older motorcyclists if the crash data analysis results demonstrate that the rate of older motorcyclist wearing a helmet is high and whether drunk riding is less problematic for older motorcyclists if the number of older drunk-riding motorcyclists with breath alcohol concentration (BrAC) levels exceeding the conviction standard is low. Studies conducted in numerous different countries and areas have consistently concluded that wearing a helmet can reduce the risk of death or severe injury among motorcyclists in a traffic crash [2-12]. Furthermore, studies [7-12] exploring the effect of wearing different types of helmets on the severity of motorcyclists' deaths and injuries concluded that the optimal helmet for protecting the motorcyclist's head is full-face helmets. Several studies have concluded that other types of helmets are as effective as full-face helmets in reducing motorcyclists' risk of death or severe injury, such as modular [9,10] or open-face helmets [9,12]. Novelty helmets are the least effective type of helmets. Rice et al., [9] reported that the adjusted fatal injury risk among people wearing novelty helmets was the highest among the five types of helmets investigated in their study. Furthermore, Yu et al., [12] indicated that improper helmet use (e.g., wearing a loosely fastened helmet) may compromise any potential protection. They reported that among 458 motorcyclists admitted to the hospital, 108 (28.7%) motorcyclists' helmets had come off.

The aforementioned studies had certain sampling problems caused by limited available resources. Some studies did not include motorcyclists who had died and some studies were conducted on motorcyclists who went to the hospital for medical treatment. Therefore, exploring the effect of helmet use on the motorcyclists' injury severity in a crash in greater detail by using the traffic crash data from an entire country is warranted. This study aimed to clarify injury severity and head injury among older motorcyclists throughout Taiwan. In Taiwan, an official data set on traffic accidents is compiled by the National Police Agency (NPA) of the Ministry of the Interior. In NPA accident reports, injury severity is classified into the following levels: dying within 24 h, dying within 24 h and 30 days, injured, not injured and unknown. However, the number of victims for the second category of dying within 24 h and 30 days is underreported: the police do not have to investigate and report on an accident if the victim died between 24 hours and 30 days of a traffic accident; these individuals are classified as injured instead. The NPA data set is also limited by a lack of detail in its levels for injuries, where an individual classified under injured can either be lightly or seriously injured. Thus, this study linked the NPA data with data on cause of death and inpatient expenditures, which allowed this study to redefine the levels of injury severity to hospitalization, minor injury, no injury and unknown. The data on cause of death and inpatient expenditure are compiled by Taiwan's Ministry of Health and Welfare (MOHW), and this study linked the

MOHW data and NPA data using each individual's national identification number. In addition, because information on the victims who died at the scene is reported in the traffic accident report, the linked data also covered individuals who died at the scene of the accident.

As illustrated in table 1, the fatality rate of older motorcyclists not wearing a helmet was 8.9%, which is much higher than the rate among older motorcyclists wearing a helmet (1.4%). However, among the 2,479 older motorcyclists who died in crashes, 1,656 had worn a helmet. As illustrated in table 2, among the 1,656 older motorcyclists who died in crashes and had worn a helmet, 1,077 were head injured (65%). In addition, 10,356 older motorcyclists who had worn a helmet in crashes were head injured and hospitalized. Different types of helmets are used in Taiwan. Many people do not like to wear full-face helmets because of the hot and humid weather in Taiwan. Some people even wear novelty helmets. Helmets probably fall during traffic accidents. Furthermore, many people ignore the problem of helmet life-span (i.e., manufacture date). The ability of the helmets to protect the motorcyclist's head may also be affected after a helmet drop. Improperly wearing or using a helmet could cause head injury resulting in death among motorcyclists. The safety concept of properly wearing, fastening, and verifying a qualified helmet should be promoted.

Helmet status	Injury Severity				Total
	Death	Hospitalization	Minor injury	No injury	
Wearing a helmet	1,656 (1.4)	25,906 (21.5)	85,010 (70.6)	7,920 (6.6)	120,492
Not wearing a helmet	300 (8.9)	1,069 (31.7)	1,847 (54.8)	154 (4.6)	3,370
Unknown	523 (3.2)	4,370 (26.8)	10,192 (62.6)	1,204 (7.4)	16,289
<b>Total</b>	<b>2,479</b>	<b>31,345</b>	<b>97,049</b>	<b>9,278</b>	<b>140,151</b>

**Table 1:** Injury severity analysis for among older motorcyclists with different helmet wearing statuses.

Helmet and injury statuses	Injury Severity			
	Fatalities	Subtotal	Hospitalization	Subtotal
Wearing a helmet, head not injured	579	1,656	15,550	25,906
Wearing a helmet, head injured	1,077		10,356	
Not wearing a helmet, head not injured	51	300	424	1,069
Not wearing a helmet, head injured	249		645	
Unknown, head not injured	135	523	2,127	4,370
Unknown, head injured	388		2,243	
<b>Total</b>	<b>2,479</b>		<b>31,345</b>	

**Table 2:** Injury severity analysis for senior motorcyclists' helmet wearing and head injury statuses.

In addition to the safety problems associated with helmet status, numerous studies [2,4,6-8,10-12] have also indicated that alcohol use is associated with high risks of death or severe injury among motorcyclists. Different countries have set drunk-driving penalties at different alcohol exhalation concentrations. Several studies [4,8,11,12] have only classified the subjects in their studies based on the two categories of "drunk riding" and "not drunk riding," whereas other

studies [6,7,10] set particular levels to group their subjects. For example, Wiratama et al., [6] used the conviction standard of 0.15 mg/L to group subjects into two groups and the BrAC level below 0.15 mg/L group was collapsed with the category of not drunk riding. The effect of the BrAC level under the conviction standard was thus ignored. Chen et al., [2] compared odds ratio values in models of all violation behaviors and determined that drunk riding is a serious problem (the odds ratios for drunk riding were the highest). Older motorcyclists who were riding under the influence of alcohol were more likely to be fatally injured than older motorcyclists who were riding sober, especially older motorcyclists with a BrAC level of less than or equal to 0.15 mg/L (i.e., under the conviction standard of the BrAC level). Motorcycles and cars are operated differently. Motorcycles only have two wheels, and a slight mishandling can easily cause a crash. Older motorcyclists may be affected by drunk riding and improper handling problems, resulting in serious casualties caused by traffic accidents, even if the BrAC level is below 0.15 mg/L. More precise BrAC level categories are more favorable for exploring the effects of different drunk riding levels on motorcyclists' injury severity. In addition to penalties (e.g., insurance costs or penalties), revocation or suspension of motorcyclist's licenses, and setting a low legal blood alcohol limit, further drunk riding management strategies should be considered to alleviate the drunk riding problem, especially among repeat offenders (e.g., enforcing medical treatments for alcohol addiction).

## Conclusion

Many studies have reported that wearing a helmet and riding sober ameliorate the risks of death and serious injury among motorcyclists. Existing studies have been methodologically limited by data sets that covered only some motorcyclists (e.g., including only motorcyclists who were in the hospital) and not all (e.g., excluding motorcyclists who died). Thus, to investigate the effect of helmet use and drunk riding on injury severity among all older adult motorcyclists in Taiwan, this study linked three official, national-level sets of data on traffic accidents, cause of death, and inpatient expenditure to redefine the injury severity levels in the government data set on traffic accidents. In this study's results, among the 1,656 older adult motorcyclists who died in an accident and wore a helmet, 1,077 (65%) had a head injury. Additionally, 10,356 older adult motorcyclists who wore a helmet in an accident had a head injury and were hospitalized. Government authorities should not only mandate helmet wearing but also educate motorcyclists on the dangers of wearing a novelty helmet, how to wear and fasten a helmet on properly, and how to verify whether a helmet meets safety standards. With regard to the effect of drunk riding on the risks of death and severe injury among motorcyclists, several studies have ignored the effect of a BrAC under the limit. Chen et al., [2] noted the alarming severity of injury among older adult motorcyclists with BrAC  $\leq$  0.15 mg/L (under the limit). Future studies are thus recommended to investigate drunk riding even for BrAC or BAC levels under the limit.

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