

# A Pilot Study of Motorcycle Injury Epidemiology in Taiwan

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## Abstract

**Background:** Motorcyclist casualties are continually increasing in Taiwan; however, research on the epidemiology of their injuries is still limited.

**Methods:** We conducted a study using a structured questionnaire. Information on riding behaviours was collected through this questionnaire.

**Results:** Totally 190 patients completed their questionnaires. Mean age of patients was 40.64 years. Average LOH was 7.1 days, 25.9% needed the ICU and 13.04% had ISS  $\geq$  16. Repeated motorcycle accidents were relatively common.

**Conclusions:** Our results demonstrate an overview of motorcyclist injuries in Taiwan, thus piloting an evaluation of epidemiology on motorcyclist injury and providing important references for a subsequent nationwide questionnaire study.

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## Introduction

Industrialisation in Taiwan began in the 1960s. At that time, the general public's income was low, and most of the people could not afford to buy a car. Since a convenient public transportation system had not yet appeared, inexpensive, light motorcycles naturally became the primary means of transport for daily activities. Although today Taiwan is considered as a more economically developed country, motorcycles are still used as major transport by students, housewives and office workers [1].

Motorcycle users are vulnerable to road accidents and are eight times more likely to sustain an accident resulting in a severe injury or death than car users [2]. Recently a time-trend study of traffic injury-related medical expenditures in Taiwan from 2003 to 2012 reported that the total hospitalisation medical expenditure of motorcycle riders increased from US\$ 25 million in 2003 to 41.8 million in 2012 [3].

In Taiwan, although motorcycle injuries are a prominent issue, research on the epidemiology is still limited. Our study aimed to investigate the epidemiology of motorcyclist injury, focusing on the riding behaviours and daily riding behaviours. We used a questionnaire to collect the riding information among hospitalised motorcyclists and provide important information for a subsequent nationwide study.

## Materials and Methods

### Study design

This study included motorcyclist casualties who were hospitalised from 1 February 2015 to 30 April 2016 in a medical center located in the metropolitan Taipei city. We included only motorcycle riders or passengers who were  $\geq$ 18 years old and able to provide consent. The exclusion criteria included being a non-national or those who could not read the questionnaire. This study was approved by the Institutional Review Board of our university and the affiliated hospitals (no: N201510012).

We acquired a list of patients and their telephone numbers from the hospital, and obtained the patients' agreement for our investigation by telephone. Then, the researchers mailed the consent form and

the questionnaire to the patients. Data collected from the returned questionnaires were used for analysis.

### Questionnaire design

We sorted out the details of variables focusing on riding behaviours and considered these variables as candidate items for the questionnaire. These variables mainly included the following two categories: daily riding behaviours and riding behaviours before the accidents. Then, a meeting including experts in injury control, transportation safety and clinical medicine was held. The questionnaire was constructed according to decisions by consensus and contained a total of 62 items, including 42 items related to riding behaviours. Table 1 summarises these riding behavior variables in the questionnaire.

### Results

We used external codes in the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) and ICD-10-CM for motorcycle accidents to apply for a list of patients hospitalised due to motorcycle injuries within the 15-month study period. Information on 442 patients was provided by the hospital, and the final number of patients for liaising was 434, since there were three non-nationals and five patients who died after hospitalisation. Totally, 216 patients agreed to participate in the survey, and 190 completed and returned their questionnaires, resulting in a response rate of 43.8%.

### Descriptive analysis

There were 109 male patients (63.68%) in our series. The mean age was 40.64 years; 81 patients (42.63%) were young adults aged 22-44 years, and 68 patients (35.79%) were middle aged from 45 to 64 years.

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A total of 138 patients (73.02%) answered having had at least one motorcycle accident during the year before their hospitalisation.

Daily riding behaviours [10]	Riding behaviours before the accident
Errors	Helmet use and type
Ordinary violations	Protective gear use
Aggressive violations	Presence of pillion passenger or load carried
	Consumption of alcohol, medicine or stimulating refreshment
	Riding speed (km/h)
	Being at fault
	Attention distraction
	Reason of failure to dodge an obstacle

Table 1: Summary of the riding behaviour variables in the questionnaire according to their attributes.  
km/h: kilometre per hour

The peak period for accidents occurred in the afternoon (12:00-17:59 h), as reported by 61 patients (38.36%). The peak hour (h) for accidents was between 08:00 and 09:00 h (9.43%). Of the total sample, 167 patients were motorcycle riders (90.76%).

Seventeen patients (11.97%) answered that the speed limit of the road at the accident scene was 60 km/h or higher, implying that these patients were riding a heavy motorcycle ( $\geq 250$  cc) on the expressway during the accident. Among the 62 patients (37.58%) who answered that the maximal speed exceeded 41 km/h, 24 patients (38.71%) answered that they had been riding over 60 km/h.

Only eight patients (4.35%) were not wearing a helmet. Ninety patients used the open-faced type (51.14%), followed by full-face type (32 patients, 18.18%) and half-coverage type (30 patients, 17.04%). Most patients (153 patients, 81.82%) were not using protective gear. Among the 17 patients riding on the expressway (limited road speed  $\geq 60$  km/h), only five patients were using protective gear (29.41%).

Regarding the pattern of collisions, single-vehicle accidents were the most common (57 patients, 30.48%), followed by accidents with a car or a motorcycle (49 patients, 26.20%, and 37 patients, 19.78%, respectively). Negligence by other vehicle users (94 patients, 52.81%) was the most common cause of collisions, followed by self-negligence (44 patients, 24.72%) and unfavourable environment (40 patients, 22.47%).

Six patients (3.19%) answered that they had taken medications for insomnia, common cold, heart diseases, or psychiatric diseases before their accident. Six patients (3.21%) consumed alcohol or stimulating refreshments such as betel nut and energy drinks before riding. Forty-eight patients (25.4%) reported being in an inadequate physical or mental state before the accident. Mind wandering and fatigue were most common (18 patients, 9.52%, each). Fourteen patients (7.45%) reported doing other things while riding before the accident, including six patients (3.19%) who were using an electronic device.

There were 27 items in the questionnaire regarding the daily riding behaviour of patients. The five most common dangerous behaviours of daily riding were ignoring the need to check the wear on tyres before riding; ignoring the need to check the function of the headlights, turn

signals and brake lights before riding; violating the speed limit on the roads; failing to notice pedestrians crossing the road when turning into a lane and overtaking slow moving vehicles driving/riding at the inside lanes.

We applied the Chinese version of the five-level EuroQol five-dimensional questionnaire (EQ-5D-5L) [4] to query about the patients' prognosis. Fourteen patients (7.41%) had major difficulties with daily activities and needed assistance, and 20 patients (10.58%) suffered from chronic physical pain.

Regarding various injury indicators, the average LOH was 7.07 days, and 21 patients (11.05%) had an LOH  $> 14$  days; 49 patients (25.93%) needed the ICU, five patients (2.63%) needed a ventilator, 24 patients (13.04%) had an ISS  $\geq 16$  and 12 patients (6.35%) were staying in a long-term care facility after hospital discharge.

## Discussion

Our study showed that repeated motorcycle accidents were relatively common. The impacts of these repeated accidents on the victims, their families and the social resources should garner more attention. Determining the factors causing repeated motorcycle accidents and the effect of these repeated accidents on the subsequent motorcycle injury severity warrants further investigation [5].

Our results showed that a vast majority of motorcyclists wore the helmet, which may be due to the fact that the research hospital is located in the Taipei metropolitan area where helmet-use law is more strictly enforced. A nationwide study is essential for analysing the habit of helmet use [6]. The average age of patients who were not wearing a helmet was 45 years. This finding is inconsistent with the previous reports that demonstrated the adolescents' tendency of risky riding behaviours such as resistance against wearing a helmet [7-10]. Limited sample size may have contributed to this difference.

Majority of the patients answered that they practiced safe riding behaviours, but it is difficult to draw conclusions because of the relatively small sample size. However, our results reveal the most common dangerous riding behaviours that should be clearly investigated in the future. We also showed that motorcyclist casualties who need assistance for their daily activities or suffered from chronic physical pain were primarily 18-60 years old (71% and 75%, respectively), and the impact on their quality of life and productivity is worthy of further research.

## Conclusions

We revealed the epidemiology of motorcyclist injury in Taiwan and suggested some important issues of injury prevention for further evaluation, such as repeated motorcycle injuries, riding fast, stimulating refreshments, aggressive riding habits and motorcyclists' medical condition. Our study also provided a preliminary picture of the impacts of motorcyclist injuries on the victims and their families.

## Author Contributions

CL conceived and designed the study. CCW and SHY have contributed substantially in data collection and analyses. CCW has contributed preparation of the first draft guided by CL. All authors have approved the final version to be published.

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## Competing Interests

The authors declare that they have no competing interests.

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