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MOPEDS: The high cost of cheap and poorly legislated transportation for negligent drivers

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ABSTRACT

INTRODUCTION: This study evaluates the impact of moped crashes in North Carolina, a state with lenient moped legislation by(1) describing the characteristics of moped crashes and (2) estimating the cost burden of moped-related injuries.
METHODS: Health and public records of moped crash subjects treated at our hospital were reviewed. Direct costs were billed hospital charges. Indirect costs based on age and outcomes were calculated.
RESULTS: Between 2008–2013, 368 subjects were involved in 373 moped crashes. 52% of drivers were intoxicated. 38% of drivers had prior DWIs and 26% had prior revoked licenses. Hospitalized subjects (n = 305) had a combined 2687 hospital days, 695 ICU days and 449 trips to the operating room for treatment of their injuries. Average hospital charges were $70,561 per subject. Total direct and indirect costs of moped injuries were over $26 million and $81 million respectively. Medicaid absorbed most of the direct cost ($13.7 M). Estimated direct cost of moped crashes across the state totaled $133 million.
CONCLUSION: Healthcare and financial ramifications of moped collisions are substantial. Laws governing moped drivers and stricter penalties for intoxicated drivers are needed.

1. Introduction

Mopeds are powered two-wheeler (PTW) vehicles that are a popular means of transportation due to their inexpensive cost and ease of operation. They typically have an automatic transmission with a central footrest and have no external gear shifting. Unlike motorcycles and higher-speed scooters, mopeds contain a motor with less than 50cc displacement and legally cannot exceed a speed of 30mph on a level surface. Despite the low maximum speed of these vehicles, moped drivers involved in accidents are at high risk for severe injury (Brintzenhoff et al., 2011; Christmas et al., 2011; McHugh and Stinson, 1984; Miggins et al., 2011; Wentzel et al., 2017; Braun et al., 2014). Alcohol (Christmas et al., 2011; Brintzenhoff et al., 2011; Miggins et al., 2011) and drug use (Miggins et al., 2011) are significant risk factors for severe moped crashes. Some argue that states without moped legislation propagate a “legal loophole” that allows those without driver’s licenses or those who have had their driver’s license revoked for dangerous driving practices to legally take the road (Brintzenhoff et al., 2011; Christmas et al., 2011). Evidence supporting the existence of a moped legal loophole dates as far back as 30 years (McHugh and Stinson, 1984).

Most states have adopted some form of moped driving legislation and now only three states do not require some form of licensure to operate a moped – North Carolina, Indiana and Virginia. Before July 2015, North Carolina was the only state among those three that did not require a title, registration, inspection or liability insurance for moped operators as well. This made North Carolina the most lenient state with regard to moped driving legislation. Passage of legislation for moped operation in the state of North Carolina has been particularly challenging. After multiple failed attempts to pass laws mandating licensing, registration and/or financial liability for mopeds drivers, the North Carolina General Assembly recently passed legislation in two consecutive years (Shepard, 2013, 2014) that has narrowed the legal loophole, requiring all moped operators to register their moped, display a moped license plate and obtain liability insurance in order to operate a moped. However, the societal, financial and safety implications of the moped legislative loophole have not previously been reported.

The purpose of our study was to comprehensively evaluate the repercussions and societal burden of moped crashes in North Carolina, a state without moped licensure. We intended to (1) describe the characteristics of moped crashes and moped operators and (2) estimate the cost burden of traumatic injuries seen at both our hospital and at the state level. We hypothesized that moped crashes involved a large number of intoxicated drivers and resulted in severe injuries that

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required significant healthcare resources and financial costs.

2. Methods

We conducted an institutional review board–approved retrospective review of the hospital trauma registry for all patients who sustained injuries in a moped crash between Jan 2008 and Dec 2013. Subjects were treated at a level 1 trauma center in Charlotte, NC, the largest city in North Carolina with a metropolitan population size of 2.4 million. Patients were excluded if they were injured outside of the state of North Carolina or if they were not North Carolina residents.

2.1. Patient injury data

After identification of the subject population, specific patient data were extracted from the trauma registry and hospital records. This abstraction included demographic characteristics (age, sex, race, employment status, primary payer), crash characteristics (mechanism of collision, whether the subject was the driver or passenger and helmet use), injury characteristics (injury type, injury severity, mortality), and serum drug and alcohol screening test results at the time of presentation. Injury severity was assessed using Injury Severity Score (ISS) and lowest Glasgow Coma Score (GCS) at presentation. ISS scores of > 15 were used as a threshold for severe injury. Injuries were also grouped using ICD-9 diagnoses codes (800–959) for traumatic injuries, excluding superficial traumatic injuries (910–924). Special attention was focused on ICD-9 coding for injuries with higher potential for long-term disability such as head injuries or specific orthopaedic injuries (pelvic injuries, spinal column injuries, long bone fractures and open fractures). Hospital stay information included method of hospital transfer, emergency department (ED) disposition (death, treat and release, admission), hospital length of stay, intensive care unit (ICU) admission and length of stay, mechanical ventilation use and length of stay, number of operative procedures and discharge destination (death, home, home with health services, skilled nursing facility or rehabilitation facility).

2.2. Patient criminal record data

Criminal records for all study subjects was obtained using a public computer search of the North Carolina Department of Public Safety (NCDPS) Offender Public Information Database (North Carolina Department of Public Safety, 2015). The database provides information on convictions for any misdemeanors or felonies that occurred in the state of North Carolina. Drug, alcohol and traffic-related convictions, license revocations were identified and recorded.

2.3. Direct and indirect cost Data

Direct costs were obtained from the individual billed charges per subject, which were obtained from the trauma registry. Indirect costs were the combined lifetime medical costs and work loss costs as estimated by the Center for Disease Control and Prevention's WISQARS™ Cost of Injury Module (Lawrence et al., 2011; Center for Disease Control and Prevention, 2017). The WISQARS™ Cost of Injury Module uses databases from the Healthcare Cost and Utilization Project to provide age and gender-specific cost estimates stratified by mechanism, intent of injury, diagnosis, body region and disposition. The indirect cost includes the combined estimations for indirect medical costs via the hospitalized injury costing methods calculated by Finkelstein et al. (2006) as well as work loss costs (e.g. lost wages and benefits and self-reported household services). Indirect medical costs included facility and non-facility components of the inpatient stay, rehabilitation and nursing home costs, follow-up costs up to 7 years and ambulance transportation costs. Indirect costs were estimated for each moped case based on age group, sex and hospital disposition to one of three outcomes: death, inpatient hospitalization or ED treat and release (i.e., treated in the ED but not hospitalized) (Lawrence et al., 2011). Moped is not a codified mechanism of injury in the WISQARS™ database, so cost estimates were based on the average combined cost of motorcycle and bicycle injuries, using an assumption that the characteristics of moped crashes (and thus the overall costs) would be more severe than most bicycle crashes and less severe than most motorcycle crashes. Previous literature supports the assumption that moped crashes are less severe than motorcycle crashes (Blackman and Haworth, 2013; Moskal et al., 2012).

2.4. State crash data

In addition to the data collected from patients treated at our hospital, state crash report data was obtained from the North Carolina Crash Data Query Web Site – a publicly accessible data analysis tool provided by the University of North Carolina Highway Safety Research Center (HSRC) that compiles data reflecting crash, vehicle, and person information for crashes in North Carolina. The data is based on a static copy of 2001–2013 crashes extracted from the NCDOT live crash database. Extracted data of interest included crashes involving specific vehicle types and injury severity per year during the study period (2008–2013). In the database, injuries reported in NCDOT crash reports (Oakley, 2012) were classified as: Fatal Injury (K); Disabling Injury (A); Evident Injury (B); Possible Injury (C); No Injury(O) or Unknown. Vehicle types queried for comparison consisted of mopeds, passenger vehicles, motorcycles and pedalcycles (bicycles). Epidemiological data of interest included the number of crashes per year per vehicle type and incidence of mortality and morbidity (e.g fatal injury, disabling injury or evident injury) by vehicle type. The NC Department of Transportation (Oakley, 2012) defines fatal injury as a death that occurs within 12 months of a crash resulting from injuries sustained in that specific road vehicle crash. Disabling injury is any injury obviously serious enough to prevent the person injured from performing his normal activities for at least one day beyond the day of the collision. Evident injury is an obvious injury, other than killed or disabling, which is evident at the scene but would not necessarily prevent the person from carrying on his normal activities, i.e bruising, swelling or limping that may require medical evaluation.

Statewide direct costs were calculated by multiplying the average hospital bill for our study populations by the number of moped crashes in state that reported disabling or evident injuries (assuming that crashes of this severity would warrant ED or in-patient treatment).

3. Results

3.1. Population

During the six-year study period, 373 crashes involving 368 subjects (353 drivers, 15 passengers) were identified. There were 5 subjects (5 drivers) with a second crash recorded in the trauma registry during the study period. An additional 23 subjects had another moped crash requiring medical attention that occurred outside of the study period. Median subject age at the time of crash (n = 373) was 43 years (range, 3–90 years). Eleven subjects (3.1%) were under the state legal driving age of 16 years (range, 6–15 years). Moped riders (n = 368) were predominantly male (89%) and white (66%). Approximately 39% of moped riders (141/373) were employed at the time of injury. Medicaid was the most common payer (45%, 167/373). The majority of moped crashes (55%) involved another vehicle (204/373). An isolated crash due to loss of vehicle control was reported in 37% of cases (139/373). Helmet use was reported in 78% of crashes (291/373) (Table 1).

3.2. Injuries

The mean ISS (n = 369) was 11.8 (range, 1–75). Over 25% of