Helmet use among motorcycle accident victims in the north-east region of Jamaica

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ABSTRACT
Currently in Jamaica, motorcyclists account for the largest group of fatalities among all road users. Between 2016 and 2018, a cross sectional study was conducted at the Saint Ann’s Bay Regional Hospital involving 155 participants. There were 98.7% males, ages ranged from 14-64 years and more than two thirds of the motorcyclists were under 40 years. Only 29.4% wore helmets, and of those motorcyclists, 52.8% indicated they were only riding for a short distance. Increasing age correlated with increased helmet compliance. Persons with motorcycles greater than 150 cubic centimetres were also more likely to wear a helmet. Interventions to promote increased helmet compliance should take these factors into account in conjunction with enhancing law enforcement.

Introduction
Motorcycle accidents continue to be a global epidemic and there is progressive increase in motorcycle use, injuries and associated fatalities in several countries (World Health Organization, 2004). Globally, powered two wheel vehicles (motorcycles) had the highest death rates compared to other travel modalities (World Health Organization, 2004). A similar trend is seen in Jamaica, where in 2017, motorcycle fatalities accounted for the highest proportion (30%) of road fatalities compared to other transportation modalities (McCarty, Ward, Ashley, & Toppin, 1993).

Data from the National Road Safety Council (NRSC) in Jamaica underscore the increasing problem of motorcycle associated fatalities. Between 2002 and 2009, the death rate due to motorcycle accidents was 1.21 per 100,000 population with annual fatalities ranging from 27 to 49 with a mean of 37 deaths per year. In 2013, there were 56 motorcycle fatalities compared to 49 deaths in private motor car drivers. A 177% absolute increase in motorcycle associated fatalities was noted between 2011 and 2015 (National Road Safety Council, 2018). These increases were concomitant with reports of a quadrupling of motorcycles purchased between 2011 and 2015 in the western region of the island (The Gleaner, 2015). In 2016, NRSC data revealed a motorcycle fatality rate of 4.04 per 100,000 population, compared to corresponding per 100,000 rates from the USA of 1.5 (2016) (National Motorcycle Institute, 2018), Columbia 5.7 (2013) (Hernández, Tovar, & Ruiz, 2016), and Thailand 28 (2013) (Nguyen, 2013). Accidents continue to be underreported in developing nations (Solagberu et al., 2006). Chichom-Mefire et al. (2015) found that head and limb injuries accounted for the majority of injuries from motorcycle accidents. They also noted that death was more frequent in riders than pillion passengers and was usually due to head injury. It was reported in that study that nearly all riders and pillion passengers did not wear helmets. Other studies have noted that head trauma is the most frequent and severe injury and 32.6% of victims died at the accident scene (Carrasco, Godinho, Barros, Rizoli, & Fraga, 2012). A Ghanaian study found that head injuries and fractures made up 32.2% and 28.6% of all motorcycle injuries respectively (Kudebon et al., 2011).

It has long been established that wearing a helmet while riding, reduces the incidence of head injuries (Wilson, 1989). Not only is wearing a helmet important but the quality of the helmet worn plays a role in the incidence and severity of head injury. Helmets, which had a harder outer shell with a thicker internal lining, are associated with significantly lower head injury rates than helmets with inferior designs (Olsen et al., 2016). Certain states in the United States of America have laws making helmet wearing mandatory and have near 100% compliance compared to states with more relaxed helmet laws, which have far less compliance and many more head injuries (Olsen et al., 2016). Jamaican law stipulates mandatory helmet use for motorcyclists (Ministry of Justice Jamaica, 2003). Helmets must be worn in accordance with international standards (eg British, Japanese and Federal (USA) motor vehicle standards) (Road Safety Unit, 2017).

Helmet use among motorcycle riders varies across developing countries. Prevalence of 4.3%, 47%, 56% and (93–99%), have been reported in studies from Nigeria, Ghana, Pakistan and Vietnam, respectively (Khan, Khan,
Aziz, Islam, & Shafqat, 2008; Nimako Aidoo, Bawa, & Amoako-Yirenkyi, 2018; Olakulehin et al., 2015; Olson et al., 2016; Passmore, Nguyen, Nguyen, & Olivé, 2010). Use is affected by factors such as sex, age, (Hernández et al., 2016; Hung, Stevenson, & Ivers, 2006; Nimako Aidoo et al., 2018), rider role (driver vs. pillion) (Khan et al., 2008; Olakulehin et al., 2015), helmet comfort (Fong et al., 2015; Khan et al., 2008; Nimako Aidoo et al., 2018; Papadaki et al., 2013), perception of ability of the helmet to prevent injuries, education level (Hung et al., 2006; Khan et al., 2008; Nimako Aidoo et al., 2018), distance travelled (Nimako Aidoo et al., 2018) and helmet ownership (Nimako Aidoo et al., 2018). The aforementioned studies suggest that younger riders were less likely to have consistent use than their older counterparts. Drivers more frequently used helmets than pillion riders. Physical discomfort associated with helmet use inhibits compliance. Lower educational attainment increased the risk of helmet non-use. Not owning a helmet reduced the chance of helmet use. With regard to gender, there are conflicting studies; some report that men are more likely to be compliant with wearing helmets than women (Hernández et al., 2016; Hung et al., 2006), some report no difference (Olakulehin et al., 2015; Siviroj, Peltzer, Pengpid, & Morarit, 2012) while others indicate men were less likely to wear helmets (Ranney, Mello, Baird, Chai, & Clark, 2010; Sreedharan, Muttapillymyil, Divakaran, & Haran, 2010).

Formal training in conjunction with receiving a formal license results in fewer motorcycle injuries (Baldi, Baer, & Cook, 2005). Motorcycle accidents continue to be a global epidemic and preventative measures continue to be underutilized (World Health Organization, 2018). Rider education coupled with a rigorous licensing routine can significantly reduce motorcycle accidents (Baldi et al., 2005). Against a background of increasing motorcycle fatalities in Jamaica, this study sought: to describe the socio-demographic profile of motorcycle rider accident victims; to ascertain helmet use prevalence; and to identify factors associated with helmet use.

Methods

Over a 28-month period (March 2016–June 2018), a cross-sectional study was conducted at the St. Ann’s Bay Regional Hospital in Jamaica, which serves as the main referral facility in the North-East Region consisting of the parishes of St. Ann, St. Mary and Portland.

Participants in the study were those presenting to the hospital’s Accident and Emergency Department with injuries sustained from motorcycle accidents. We included in the study all such riders and pillions. All the aforementioned persons were either admitted to the surgical ward or referred to the Orthopaedic Outpatient Clinic. A census was done of patients admitted to the surgery ward from the Emergency Department, as well as, those referred to the Orthopaedic Outpatient Department. A pre-tested, interviewer-administered questionnaire was used by trained members of the Orthopaedic team to collect data on socio-demographic characteristics, accidents circumstances and motorcycle specifications, physical injuries sustained and subsequent medical management, as well as compliance with legal requirements for riding a motorcycle. The interviews were done within 24 hours of the patient presenting to the Orthopaedic service, except when it was neurologically contraindicated. Where contraindications existed, interviews were deferred and done when deemed appropriate.

Data was analyzed using SPSS version 20 and descriptive summaries generated. Associations between variables were examined by bivariate analyses and the use of logistic regression. Informed consent was obtained from all participants in the study.

Results

Socio-demographic characteristics

One hundred and fifty five persons with motorcycle accidents participated in the study with the majority (98.7%) being males. Participants were between the ages of 14 and 64 years (median age = 28 years, IQR = 16.5 years). The plurality (48.3%) of motorcycle accidents occurred among persons in the age group 20–29 years, followed by the 30–39 years age category (20.3%). There was an equal proportion (12.4%) of motorcycle accidents among the 40–49 years and 50 and older age categories. Only 7.8% of motorcycle accidents occurred in the under 20 years age category. Most (63%) participants resided in the parish of St. Ann, followed by 18.2% in St. Mary. The remaining 18.8% were from other parishes. Almost 88% of persons were employed and at the time of the motorcycle accident, 91% were riders and 9% pillon riders.

Helmet use, insurance and driver’s licence among motorcycle accident victims

Among persons with motorcycle accidents, only 29.4% (n = 45) wore helmets. Of those (n = 108) who did not wear helmets, the majority (52.8%) indicated that they were riding for a short distance as the main reason for not wearing a helmet. The second commonest reason (28.7%) was for non-ownership of a helmet, while the remaining portion cited other reasons. Riding for only a short distance was identified as the main reason for not wearing a helmet among those aged 30 years or more. Among those <20 years old, only 27.3% identified short distance as the main reason for not wearing helmets (Table 1).

Approximately 25% (n = 141) of motorcycles involved in accidents were insured, and only 26.2% of the motorcycle riders had a valid rider’s license. No statistically significant association was found between having insurance and age category or employment status. Neither was there an

| Age category | Short distance | Does not own | Others | Total |
|--------------|----------------|--------------|--------|-------|
| Less than 20 | 27.3 (3)       | 36.4 (4)     | 36.4 (4) | 100.0 (11) |
| 20–29        | 46.6 (27)      | 31.0 (18)    | 22.4 (13) | 100.0 (58) |
| 30–39        | 83.3 (15)      | 5.6 (1)      | 11.1 (2)  | 100.0 (18) |
| 40–49        | 63.6 (7)       | 36.4 (4)     | 0.0 (0)  | 100.0 (11) |
| 50 and over  | 50.0 (5)       | 40.0 (4)     | 10.0 (1)  | 100.0 (10) |

Table 1. Main reasons for not wearing helmets.

Fisher’s Exact Test p value 0.041.
association between possessing a rider’s license and the variables age and employment status.

**Helmet use by socio-demographic and motorcycle characteristics**

Increasing age was found to be correlated with helmet use (Spearman’s rho = 0.261, p = 0.001). Table 2 below reflects helmet use disaggregated by socio-demographic variables.

**Table 2. Helmet use disaggregated by socio-demographic and motorcycle characteristics.**

| Helmet Use % (n) | Yes | No | Total | Chi Square | p-value |
|------------------|-----|----|-------|------------|---------|
| Gender           |     |    |       |            |         |
| Male             | 29.8 (45) | 70.2 (106) | 100.0 (151) | 1.00*    |         |
| Female           | 0.0 (0) | 100.0 (2) | 100.0 (2) |           |         |
| Age Category     |     |    |       |            |         |
| Under 20 year    | 8.3 (1) | 91.7 (11) | 100.0 (12) | 0.016    |         |
| 20–29 years      | 19.4 (14) | 80.6 (58) | 100.0 (72) |           |         |
| 30–39 years      | 41.9 (13) | 58.1 (18) | 100.0 (31) |           |         |
| 40–49 years      | 38.9 (7) | 61.1 (11) | 100.0 (18) |           |         |
| 50 and over      | 47.7 (9) | 52.3 (10) | 100.0 (19) |           |         |
| Employment       |     |    |       |            |         |
| Yes              | 36.1 (42) | 63.9 (75) | 100.0 (117) | 0.158    |         |
| No               | 15.8 (3) | 84.2 (16) | 100.0 (19) |           |         |
| Training         |     |    |       |            |         |
| Formal           | 100.0 (3) | 0.0 (0) | 100.0 (3) | 0.032*   |         |
| Informal         | 30.9 (42) | 69.1 (94) | 100.0 (136) |           |         |
| Rider Status     |     |    |       |            |         |
| Driver           | 32.4 (45) | 67.6 (94) | 100.0 (139) | 0.006*   |         |
| Rider            | 0.0 (0) | 100.0 (14) | 100.0 (14) |           |         |
| CC rating        |     |    |       |            |         |
| 150 cc and less  | 24.7 (24) | 75.3 (73) | 100.0 (97) | 0.067    |         |
| Greater than 150 cc | 39.2 (20) | 60.8 (31) | 100.0 (51) |           |         |
| Insurance        |     |    |       |            |         |
| Yes              | 57.1 (20) | 42.9 (15) | 100.0 (35) | <0.001   |         |
| No               | 21.9 (23) | 78.1 (82) | 100.0 (105) |           |         |
| Driver’s License |     |    |       |            |         |
| Yes              | 56.8 (21) | 43.2 (16) | 100.0 (37) | <0.001   |         |
| No               | 21.4 (22) | 78.6 (81) | 100.0 (103) |           |         |
| Time of Accident |     |    |       |            |         |
| Weekday          | 31.6 (25) | 68.4 (54) | 100.0 (79) | 0.684    |         |
| Weekend          | 27.1 (16) | 72.9 (43) | 100.0 (59) |           |         |
| Holiday          | 21.4 (3) | 78.6 (11) | 100.0 (14) |           |         |

p values based on Fishers Exact test.

Table 3. Predictors of helmet use and associated odds ratios.

| Variables       | B   | SE  | OR (95% CI) |
|-----------------|-----|-----|-------------|
| Age             | 0.05 | 0.02 | 1.05 (1.02–1.09)* |
| CC Rating       |     |     |             |
| 150 cc and less | –   | –   | Reference   |
| Greater than 150 cc | 1.00 | 0.46 | 2.72 (1.11–6.65)* |
| Insurance       |     |     |             |
| Yes             | 0.16 | 1.10 | 1.17 (0.14–10.13) |
| No              | –   | –   | Reference   |
| Driver’s License|     |     |             |
| Yes             | 1.55 | 1.08 | 4.72 (0.56–34.50) |
| No              | –   | –   | Reference   |

Denotes significant predictors at the 0.05 alpha level. B = Beta, SE = Standard Error, OR = Odds Ratio.

![Graph](https://via.placeholder.com/150)

\[ X^2 = 13.60 (2), P = 0.001 \]

“Other” include minor injuries such as lacerations, contusions and abrasions.
the criteria for logistic regression (age, CC rating, insurance and driver’s license). The significant predictors for helmet use were age and CC rating. For every one year increase in age, the odds of wearing helmet increased by 5% (95% CI = 1.02–1.09). Persons with motorcycles with CC rating >150 cc were 2.72 times more likely to wear helmets compared to those with corresponding CC rating of 150 cc or less.

**Helmet use and injury**

Injury profile varied significantly among motorcyclist by helmet use. Among 153 subjects, 62.7% had only orthopaedic injuries, 31.4% had both head and orthopaedic injuries, while the remaining portion had other injuries. Greater proportion of those who did not wear helmets (89.6%) had orthopaedic and head injuries compared to those who wore helmets (10.4%).

‘Other’ includes minor injuries such as lacerations, contusions and abrasions.

**Discussion**

Our results indicate that our younger patients, many of whom are young males in their economic primes, had higher rates of noncompliance of helmet use, with teenagers and persons in their twenties having the highest noncompliant rates at 92% and 81%, respectively. The potential for premature death and consequent loss to society cannot be ignored. Consequently, there is need for interventions targeting these age groups, incorporating behaviour change theories. Ali, Saeed, Ali, and Haidar (2011) have shown that using this approach can facilitate greater understanding of thought, attitudes, perceptions and actions relating to helmet use among motorcyclists.

In our study, 70% of our patients were not compliant with wearing a helmet. This is a cause for great concern. Cawich et al. in their study found a 39% helmet non-compliance rate seven years after the helmet laws were introduced (2010). Our study found a much higher non-compliance rate. Our non-compliance rate is also higher than the rate documented in St Lucia at 52.9% (Ogunlusi & Nathaniel, 2011) as is our head injury rate (31% versus 13.2%). The differences in head injury rates may be a result of the variation in helmet use. All of our 14 pillion riders did not wear helmets. Chichom-Mefire et al. (2015) found that in Cameroon, many pillion riders felt that protective gear is just for the rider. Our pillion riders need to be made aware that they potentially can suffer from significant injury.

Among non-compliant motorcyclists, more than half cited riding a short distance as their main reason for not wearing a helmet; not owing a helmet being the second most commonly cited reason.

Factors such as inability to afford a helmet, deeming a helmet uncomfortable and wanting to be easily recognized have been reported in the literature (Nimako Aidoo et al., 2018). We posit that these factors apply to our local setting, given the prevailing socio-economic situation, our tropical climate and the popularity of the dread锁 hair style, making fitting a helmet difficult. Future helmet structure and design may need to take into account the aforementioned issues, if compliance is to be enhanced.

The engine size (cc rating) emerged as independently associated with helmet use: the greater the rating, the greater the compliance with helmet use. A similar trend has been reported from India (Wadhwaniya et al., 2017). This observation may be explained by: (a) the larger motorcycles being marketed and retailed as a package which includes a helmet along with other accessories and protective gear; and (b) in ‘big-bike’ culture in Jamaica, it is desirable to profile in complete and matching gears (‘racing profile’), which increases the likelihood of helmet use.

Riding a motorcycle without a helmet exemplifies risky behaviour. Bazargan-Hejazi, Zamani-Alavijeh, Hindman, Mohamadi, and Bazargan (2013) described four categories of risk takers riding motorcycles: risk managers; risk utilizers; risk calculators and risk takers. Risk managers thought that being competent protected you from injury, risk utilizers felt that risky riding was practical to fulfil certain obligations. Risk calculators felt that taking risks made injury less likely and risk takers did it for peer approval. Interventions to promote helmet use should recognize this diversity in risk-taking behaviour.

Balance, skill and coordination are required when riding a motorcycle; a task deemed more complicated than driving a motor car. Riders are required to make quick decisions and manoeuvre rapidly under emergency situations. Formal training and acquiring a formal license are means of acquiring these skills (Alicioglu, Yalniz, Eskin, & Yilmaz, 2008). Yet many riders’ lack formal training, drive without a license and laws about helmet use are not enforced (Chichom-Mefire et al., 2015). Absence of licensing requirements has been linked to increased rates of motorcycle accidents (Pérez et al., 2009).

In Jamaica, to obtain an insurance policy, a rider must have a formal licence. Having insurance suggests that the rider is competent and the motorcyclist and the motorcycle road worthy. However, in our study, among motorcyclists presenting to hospital, 74% had no license and 75% of the riders had no insurance. Although statistically not an independent predictor, higher rates of helmet use were noted among those with driver’s license and insurance compared to those without.

Enforcement of the law is an adjunct strategy to promote helmet use, and requires strong political will. Solagberu et al. (2006) have noted instances where such will is lacking or enforcement is variable and inconsistent. Insufficient police presence worsens this problem. The previously described finding relating to licensing, training, insurance and helmet use argue for greater attention to law enforcement. Imminent new road traffic laws and regulations propose to address some of these issues; however, the appropriate resources (human, financial and infrastructural) must be in place to ensure effective enforcement.

Our study has provided novel information on helmet use among motorcyclists in a developing country setting. It prospectively accumulated participants and data, decreasing the likelihood of information bias. Acknowledged limitations of the study are (1) the study being hospital based...
and (2) the study was confined to a specific geographic region in Jamaica.

Conclusion
Age and motorcycle engine size are factors influencing helmet use. Major reasons for non-use of helmets in our study setting were low perceived injury risk when riding for a short distance and lack of helmet ownership. Interventions to promote increased helmet use should take these factors into account. Nuanced educational messages along with enhanced enforcement is crucial to ensure a high compliance rate of helmet wearing. Enforcement should be applied consistently across all age groups and all types of motorcycles. We recommend that further studies, including qualitative inquiry, be done to provide further insights on behaviours relating to helmet use among motorcyclists.

Disclosure statement
No potential conflict of interest was reported by the authors.

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