Helmet use amongst injured and non-injured motorcyclists in Malaysia

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Abstract

This paper describes an investigation of helmet wearing and type of helmet worn amongst crash-involved and non-crash-involved riders. Participants who attended an outpatient oral and maxillofacial clinic for treatment took part in a survey on helmet-wearing behaviour and crash involvement. Overall, there was a high reported wearing rate; however, the findings showed that many riders did not wear a helmet for very short trips, and a substantial proportion did not fasten the buckle. More importantly, relatively high proportions of motorcyclists wore helmets that may not offer them optimal protection in a crash.

For those who have been involved in a crash, the most frequent injuries sustained were to the lower limbs. Comparisons between crash-involved and non-crash-involved riders also revealed some demographic and behavioural differences such as age, gender and licensure. Implications for the overall safety and reduction of head and facial injuries are discussed, including the protective features of different types of helmets, wearing status, programs aimed to increase wearing rates of helmets that will offer optimal protection, and rider sub-groups to whom initiatives should be targeted.

Keywords

Motorcyclist safety, Helmet, Crash risk, Behaviour, Countermeasure

Introduction

Road-traffic crashes are a major public health issue worldwide. Each year, an estimated 1.3 million people die on the world's roads, and a further 20 to 50 million people are injured while using the road transport system [1]. The WHO also reports that a high proportion of these deaths and injuries (up to 90%) occur in low- and middle-income countries, and this number is increasing. Indeed, it has been estimated that unless immediate action is taken, road deaths will rise to the fifth leading cause of death by 2030, resulting in an estimated 2.4 million fatalities per year [2]. Coupled with this are enormous costs to individuals, families and the community, with an estimated economic cost of USD518 billion each year.

Malaysia, a middle-income country, is a rapidly developing multi-racial nation. Over the last 10 to 15 years, Malaysia has experienced significant economic expansion with growth in population, industrialisation and motorisation. Private vehicle ownership has increased dramatically and a high proportion of privately owned vehicles are motorcycles: between 1997 and 2007 there was a significant increase in the number of registered motorcycles from 4,328,117 to 9,433,640 [3]. The high number of motorcycles is also seen in neighbouring countries - for example, in Thailand, Singapore, Vietnam and Taiwan.

The motorcycle is regarded as an important mode of daily transport in many nations, particularly in Asian countries, and is mainly used for commuting and running daily errands. Motorcycle ownership and use is popular in Malaysia for a number of reasons, including low vehicle purchase price and insurance surcharge rates, low running costs, the ability for drivers to obtain a motorcycle licence as young as 16 years old, and ease of travel on congested roads (riders can reach their destination faster and cheaper than in a car or on public transport). A recent survey on motorcyclists' receptiveness towards changes in various transport policies and vehicle ownership showed that many Malaysian road users still favour motorcycles as a mode of transport and, although the Government increased the motorcycle insurance premium recently, this did not discourage them from owning motorcycles [4].

Unfortunately, Malaysia has an associated high level of road trauma, approximately four to five times higher than countries with good road safety performance (such as Sweden, the Netherlands, the United Kingdom, etc.), and much of the trauma is due to motorcycle crashes. Road crashes have become one of the major causes of mortality and morbidity and are the second leading cause of deaths in males between the age of 15 and 64 years [5]. In 2008, 6527 people died on Malaysian roads and close to 25,800 were injured, and 3898 (59.7%) of these deaths were motorcyclists (even though they make up approximately 50 per cent of the vehicle fleet).

Motorcyclists are an extremely vulnerable road user group due to their lack of protection and they carry a high risk of death. Per vehicle mile travelled, motorcycle riders have approximately 30 times the relative risk of death in a crash than people driving other types of motor vehicles, and they are also approximately eight times more likely to be injured [6-8]. Despite the many efforts the Malaysian government, industry and community organisations have made to reduce motorcycle crashes, motorcycle-related trauma remains high.

One of the most effective ways of reducing fatalities and serious injuries and improve outcome amongst motorcyclists (particularly as a result of head injuries) is to increase helmet wearing [9-14]. Helmets significantly reduce the probability of head and neck injuries by 53 per cent and lead to a 72 per cent reduction in the probability of death [15]. In contrast, unhelmeted motorcyclists sustained a substantially higher rate of facial and brain injuries compared to helmeted riders [16].

Helmet laws were introduced in Malaysia in 1973 and it is compulsory for all motorcycle users (both riders and pillion passengers) to wear them whenever they are on the road. In addition to legislation, standards for helmet type were also introduced and set by the Standards and Industrial Research Institute of Malaysia (SIRIM). To date, SIRIM has issued two certifications for helmets, the MS.1:1969 in 1969 and MS.1:1996 in 1996, and is currently updating test criteria. Since the introduction of these initiatives, helmet usage increased tremendously and a reduction of 30 per cent in number of motorcycle fatalities from time of legislation to 1980 was reported [17]).

Despite their demonstrated effectiveness, there seems to be a limit to the protection afforded by helmets against head and facial injury. Design characteristics of helmets have been shown to affect the severity of head injuries even amongst helmeted motorcyclists [18]. In addition, a helmet is only effective if it is fitted and worn properly. Non-helmeted riders usually sustain more serious forms of head injury and are three times more likely to sustain craniofacial soft tissue injuries compared with helmeted riders [19]. Moreover, there is evidence to suggest that many Malaysian riders and pillions do not wear a helmet, and for those who do wear a helmet, there is a high proportion of non-buckling of the strap [20].

To date, there is little literature addressing helmet-wearing behaviour and the possible impact on overall safety in Malaysia. This paper aims to provide a better understanding of helmet-wearing behaviour amongst riders and to examine some factors associated with helmet choice and wearing status.

Methods

Patients who were attending an out-patient university-based oral and maxillofacial surgery clinic, Universiti Kebangsaan Malaysia, for (any dental or facial) treatment were randomly selected and invited to take part in this study. The only inclusion criterion was that they were currently a regular motorcycle rider, riding at least three times a week. From a total of 150 invited patients, 115 participants completed a questionnaire (a participation rate of 77%).

The questionnaire was divided into three sections and was designed to elicit information on i) demographic characteristics (e.g., ethnicity, age, gender, education level), ii) riding information such as travel patterns and license status, helmet wearing behaviour and attitudes to helmet purchase, and iii) motorcycle crash history and details of any previous collisions.

Results

The findings of the survey are described below. First, the overall characteristics of the sample are presented. This is followed by descriptions of riding patterns, helmet-wearing behaviour and licensure. Last, some contributing factors to crash involvement are presented.

Sample characteristics

Participants were asked some general demographic questions. They were also asked to report if they had been involved in a motorcycle collision in the previous two years, and a high proportion of the total sample (62%) indicated that they had. Demographic characteristics of both groups and overall are presented in Table 1.

Overall, the majority of the sample was male (with a ratio of 4.3 males to 1 female) and young, aged between 21-30 years, with another 20 per cent aged between 31 and 50 years. Further, most participants were Malay and either a university student or government/other organisation office worker.

The crash-involved group consisted of a high proportion of young riders (most were aged between 21 and 30 years) and a high proportion of males (87%). Compared with the non-crash-involved group, crash-involved riders were younger ($\chi^2(5)=11.8$, $p<0.05$), and more likely to be male ($\chi^2(1)=4.99$, $p<0.05$).

Riding behaviours

With regard to riding behaviours and experience, the majority of riders (94%) reported that they had a current and valid licence, and over half of them (56%) obtained their licence when they started riding. A substantial proportion (44%), however, reported that they did not have any legal licence when they started riding.

The majority of participants were experienced riders, riding their bikes daily either to work or study places or to run daily errands, and most of their trips (70%) were made in urban environments, within the metropolitan area of Kuala Lumpur. The remainder of the sample lived and worked within the Klang Valley, which is a relatively urban and densely populated area of Malaysia.

Analyses were undertaken to determine differences between the crash-involved and non-crash-involved groups. Generally, there were no differences between the two groups regarding helmet use and type of helmet worn. With regard to licensure, two factors were examined: the duration of time between obtaining licensure and starting to ride, and riding experience prior to the crash. The crash-involved group started to ride 0.8 years (SD: 3.92) before obtaining their licences. This was slightly less than the non-crash-involved group, who started to ride approximately 1.3 years before obtaining their licences. This difference was not significant ($p>0.05$). In addition, the mean duration between the year of obtaining the licence and the collision was 6.6 years. Together, these findings suggest that both groups were fairly experienced riders.

Table 1. Summary of demographic characteristics of survey participants by group

Demographic variable	Proportion (%) of non-crash-involved riders (n=44)	Proportion (%) of crash-involved riders (n=71)	Proportion (%) of all riders (n=115)
Age group:			
11-20 years	2.3	4.2	3.5
21-30 years	61.4	70.4	67.0
31-40 years	9.1	8.5	8.7
41-50 years	22.7	4.2	11.3
51-60 years	2.3	11.3	7.8
61-70 years	2.3	1.4	1.7
Gender:			
Male	70.5	87.3	80.9
Female	29.5	12.7	19.1
Ethnicity:			
Malay	65.9	64.8	65.2
Chinese	22.7	26.8	25.2
Indian	6.8	5.6	6.1
Indonesian	4.5	2.8	3.5
Education level:			
Primary school	2.3	1.4	1.7
Secondary school	38.6	28.2	32.3
Tertiary	56.8	54.9	55.7
Other	2.3	15.5	10.4
Employment status:			
Professional	6.8	12.7	10.4
Gov./office worker	27.0	31.0	29.6
Self-employed	9.1	11.3	10.4
University student	45.5	36.6	40.0
Unemployed	11.4	8.5	9.6

Note: While desirable to include demographics of the general population of riders in Malaysia to gauge representativeness of the study sample, these data are not available in Malaysia.

Participants were then asked some questions regarding their helmets and use of the helmet. Approximately 70 per cent of the study participants reported that they wore their helmet every time they rode their motorcycle, regardless of trip distance. In contrast, a substantial proportion (27%) reported that they preferred to wear their helmet only when they travelled more than five kilometres per trip. In addition, a small proportion (3%) wore their helmets only when riding on main roads.

It is also interesting to note that a higher proportion of males reported wearing their helmet every time they rode, compared with females (72% vs 63%), and more females indicated they only wore their helmet on long distance trips compared with their male counterparts (36% vs 25%). These differences were not statistically significant.

In response to questions regarding type of helmet, the majority (71%) wore open-face helmets, and over half of them were equipped with visors, while 22 per cent did not have any visor attached. A high proportion (82%) of these riders confirmed that their helmet was SIRIM-certified as conforming to standards. An additional 16 per cent were not sure if their helmets reached minimum standards, while a small proportion (2%) wore non-SIRIM-approved helmets. The remainder of the sample reported that they wore half-shell (non-standard) helmets.

A series of questions regarding criteria used when purchasing a helmet were asked. Figure 1 shows the reported primary reason for choosing helmets by both groups. The most important decisive factor in purchasing a helmet was safety and this was observed in 68 per cent of the participants. Other decisive factors included aesthetics (14%), low price (7%) and brand name (6%). A further five per cent of participants did not need to make any decision about helmet purchase as the helmets were given as free gifts on purchase of their bike.

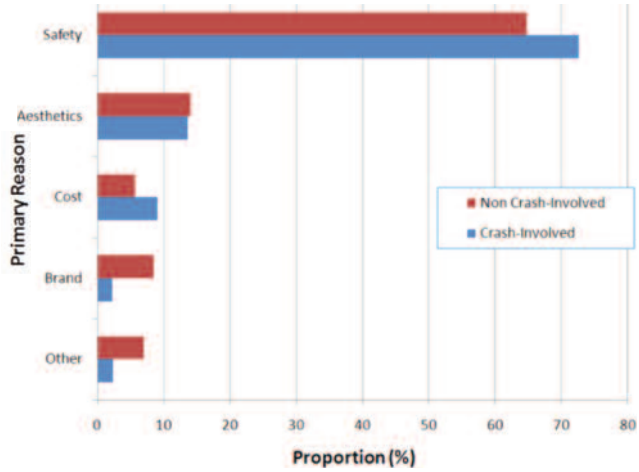

Figure 1. Primary reasons for choice of helmet type at purchase

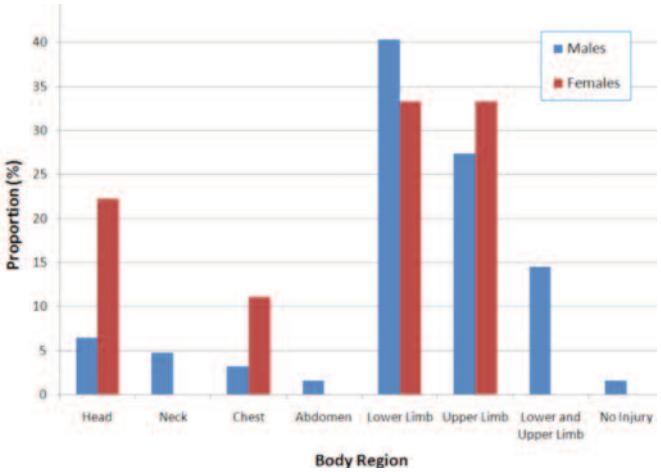

Figure 2. Body region injured by gender: crash-involved group

Interestingly, the crash-involved group were more likely to report that safety was the primary reason for helmet purchase compared with the non-crash-involved group (72% vs 65%), more concerned with cost (9% vs 6%) and less likely to be concerned about the brand of the helmet. These differences were not significant, however.

Collision experience

Of those participants who reported having crashes within the last two years, some additional questions were asked regarding the circumstances and outcomes of the crash. All crash-involved participants sustained some form of injury. Figure 2 shows the proportions of body region injured.

By far, the most frequently injured body region was the lower limb, with up to 40 per cent of the crash-involved group reporting sustaining these injuries. Upper limbs were also most frequently body region injured, with smaller proportions of head, neck, chest and abdominal injuries.

Gender differences are noted here. Females were more likely to have sustained head, chest and upper limb injuries compared with males. These differences did not reach significance, however, and may be due to the small number of female crash-involved participants (n=9).

General discussion

Motorcycle helmets are effective in protecting the head from serious injury; however, there are many types of helmets available and some may not be as protective as others. Moreover, helmets are only effective if fitted and worn properly. This study set out to understand in more depth some of the issues surrounding helmet wearing by Malaysian motorcycle riders, and to examine differences between groups of crash-involved and non-crash-involved riders.

The groups of riders in this study were relatively experienced riders, having had a licence, on average, for 6 to 8 years, and rode frequently in urban environments. There was a reported high rate of helmet wearing, with the majority of riders reporting wearing a helmet; however, a substantial proportion also failed to buckle their helmets. The majority of riders wore open-faced helmets, some equipped with a visor. While many of these were reported to be SIRIM-certified helmets, it is doubtful that all helmets complied with national standards. A substantial proportion also reported wearing non-standard half-shell type helmet. It is of some concern that, first, no full-faced helmets were worn amongst this group, and, second, many wore non-standard helmets.

The evidence is clear that full-face helmets offer the best protection to the cranium as well as the face compared with open-face or half-head helmets. For example, Rocchi et al. [21] showed that the most severe form of craniomaxillofacial injuries with neurological complications occurred in patients who did not wear any helmet at all, and the majority of facial fractures occurred in patients wearing open-face/half-head helmets.

Full-face helmets offer facial protection in addition to impact protection. The principal feature is a chin bar that extends outwards, wrapping around the chin and jaw area. The vision port allows the wearer a maximum range of sight, in line with the requirements for peripheral and vertical vision. In contrast, open-face helmets offer only limited protection for the jaw and chin and may or may not have retractable visors to protect the eyes. Similar to the open-face helmet, the half-head helmet does not protect the chin or the jaw area and is rarely equipped with a visor. It may or may not have ear flaps attached to the retention system.

It was of concern, however, that at least 30 per cent of the participants wore a helmet that did not reach government standards, and many of these were half-shell helmets (also known as 'tortoise' helmets). These helmets have never achieved SIRIM standards. In fact, most of these half-shell helmets have stickers that indicate 'Not for motorcyclist use', and sale of these (and any other non-standard helmet) was prohibited in Malaysia in 2009. However, these helmets are still currently on the market and used widely.

In Malaysia, a full-face face is not as popular as other types of helmet. This is probably due to the hot and humid climate and the congested feeling when wearing a full-faced helmet. An additional reason for its non-popularity is likely related to cost, as full-face helmets are over five times more expensive than open-face helmets. Interestingly, our sample of riders indicated that safety was the overriding reason for purchasing a helmet, with cost being of primary concern to only seven per cent of riders. However, none of these riders had full-face helmets. Perhaps if they had been asked specifically about reasons for not purchasing a full-face helmet, cost may have been a more predictive factor.

Differences in the effectiveness among various types of helmets have not been well examined. Moreover, factors that determine the dislodgment of a helmet during a crash, apart from not securing it properly, has not been very clear [22]. While there are suggestions that type of helmet worn and securing of the strap may contribute to injury risk [21, 22], there is a clear need to understand more fully the protective nature of different helmet types as well as performance of helmets when not secured correctly.

Our findings also demonstrated that, while the majority of riders reported wearing their helmets every time they went out riding, almost a third reported wearing their helmets only during long distance riding or when they were using main roads. This confirms previous findings showing reduced helmet compliance for short distance travel [20]. A common scenario in this country is not wearing a helmet when on short trips running daily errands near residential or working places. Higher compliance is observed during longer distance trips and may be related to fear of enforcement activities, as well as fear of crash involvement [20].

In addition, our results showed that, surprisingly, female riders were less likely to report wearing their helmet during every trip and more likely to wear it only on longer distance trips, compared with their male counterparts. While this difference did not reach statistical significance, it is an issue that is worth further investigation, particularly as our injury data suggest that female riders were more likely to suffer head injuries.

Dislodgement of a helmet during a collision is also of concern. A substantial proportion of the current sample reported not buckling their strap. These findings confirm previous findings amongst Malaysian riders. Compliance is only accomplished when motorcyclists have their helmet properly secured; however, Kulanthayan et al. [20] reported that more than 50 per cent of adult riders do not fasten their helmets properly. They also noted that helmet non-compliance was more common amongst young males with limited riding experience (riding less than a year and travelling short distances). In addition, recent roadside surveys on restraint and helmet use in the Klang Valley revealed low compliance, with up to 40 per cent of riders and pillions not fastening their helmets [23].

Regarding factors that may be associated with increased crash risk, we found few differences between the crash-involved and non-crash-involved group. Both groups were experienced riders, rode in similar environments, reported similar helmet-wearing rates, and were similar demographically. Two factors, however, emerged as predictive of crash involvement; these were gender and age, with the crash-involved group more likely to have been younger and male, compared with the non-crash-involved group.

Implications and conclusions

The findings from this study confirm previous studies and add some new information on helmet-wearing behaviour, despite limitations of a small sample size and potential recruitment bias. Head injuries are a leading cause of death, even in helmeted riders, and the type of helmet worn can affect the severity of injury. Moreover, for optimal head and face protection, helmets must be worn and worn properly. The findings of this study suggest, however, that proper wearing of effective helmets is not widespread in Malaysia.

Programs that raise the awareness of the benefits of 'buckling up' and purchasing a good helmet that will protect the head and face in the event of a crash should be considered. These can be incorporated in the licensing procedure and training programs to better prepare riders for on-road riding. Moreover, they should target young male riders. In addition to education and training programs, increased enforcement of helmet wearing and proper fastening on all roads, including minor roads in residential areas, should be a priority. Without adequate enforcement, it is a more difficult task to change behaviour. Any effort to promote the use of well designed helmets that reach standard criteria will be beneficial for Malaysian riders.

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iRAP assessment of risk on national highways in Bangladesh

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Abstract

Bangladesh faces significant road safety challenges. As many as 55 people are reportedly killed in traffic crashes each day. Like many low-income countries, vulnerable road users (including pedestrians, motorcyclists and bicyclists) account for a large proportion of road deaths. In 2010, with the support of the FIA Foundation and local road safety organisations, iRAP undertook a risk assessment of two of Bangladesh's main highways, the N2 and N3. These roads experience death rates in the order of 10 times higher than equivalent highways in Australia. In the case of the N2, this is despite the fact that major upgrades were undertaken as recently as 2005.

This paper provides an overview of the iRAP project; it includes an explanation of the iRAP approach to assessing risk and proposing countermeasures, and provides a summary of key results. The assessments showed that the majority of the N2 and N3 are rated 2 stars or less (out of a possible 5 stars) for car occupants, pedestrians, motorcyclists and pedestrians, indicating a relatively high level of risk of death or serious injury. To mitigate this risk, a series of investment plan options were developed for each road. These generally focused on the provision of wider shoulders, safety barriers, pedestrian footpaths and crossings and safer intersections. The most comprehensive of the plans identified the potential to reduce deaths and serious injuries by 36% on the N2 and by 44% on the N3.

Keywords

Bangladesh, iRAP, Road safety, Risk assessment, Countermeasures.

Introduction

Although road safety in Australasia has steadily improved in recent decades, the same cannot always be said of the Asia Pacific. It is estimated that around half of the world's deaths – more than 3500 each day – occur in the region [1]. Without preventative measures, the number is projected to increase by 144% in South Asia and 80% in East Asia and the Pacific between 2000 and 2020 [2].

One country that is facing a considerable road safety challenge is Bangladesh, where as many as 55 people are killed in traffic crashes daily. Like many low-income countries, vulnerable road users (including pedestrians, motorcyclists and bicyclists) account for a large proportion of road deaths. It is estimated that pedestrians account for more than half (54%) of all reported road deaths in Bangladesh [1].

The challenge of catering for a vast mix of road users in a country that has little more than half the land area of Victoria, Australia, a population of 160 million and an economy that is growing at 6% to 7% per annum, is evident in the results of recent iRAP assessments [3]. The iRAP Bangladesh Pilot Project was initiated by the FIA Foundation for the Automobile and Society as means of supporting the Roads and Highways Department (RHD), Bangladesh University of Engineering and Technology (BUET), BRAC (formerly the Bangladesh Rural Advancement Committee), the Centre for Injury Prevention Research Bangladesh (CIPRB) and Chevron in their road safety efforts.