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Research Report

Riding Behaviour of Motorcyclists in the Klang Valley



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MIROS

MALAYSIAN INSTITUTE OF ROAD SAFETY RESEARCH

ASEAN ROAD SAFETY CENTRE

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Abstract

This self-reported research used the Motorcycle Riding Behaviour Questionnaire (MRBQ) to study the riding behaviour of motorcyclists in the Klang Valley. The MRBQ includes questions on traffic errors, speed violation, stunts, safety equipment and control errors. In addition, information regarding the respondents' demographic details, riding experience, summons details, crash involvement of the respondents (if any) and injuries sustained in the crashes were also asked. 345 respondents have participated in this study. Data was collected at shop lots, shopping malls and various government agencies in various districts in the Klang Valley in order to attract respondents of all ethnicities, age groups and social economic status. Principal components analysis on the Malaysian version of the MRBQ showed a 5-factor solution; Safety Violations, Traffic Errors, Speeding, Safety Equipment and Precaution. Of these five components of riding behaviour, Safety Violations was the most frequently-reported behaviour among motorcyclists in the Klang Valley. Meanwhile, crash risk was defined as the number of summonses received by the respondents within the past 12 months. Positive relationships were found between the number of summonses received and safety violations and speeding behaviour, thus indicating that these two riding behaviours may be significant predictors of crash risk among motorcyclists who have also been issued with at least one traffic summons within the preceding 12 months.

1. Introduction

In Malaysia, the number of road fatalities has consistently been above 6,000 annually (2003 – 2012) 50 – 60% of which were motorcyclists. The typical type of motorcycles found in Malaysia are of small size with engine capacities of less than 150 cubic centimeters (cc). Small in size with little or no occupant protection and yet capable of high speed, motorcycles in Malaysia are the most vulnerable and hazardous vehicles on the road. Radin et al. (1995) estimated that Malaysian motorcyclists' relative risk of being killed or seriously injured (KSI) per kilometre travelled was 20 times greater than that of a car driver. 10,544,578 motorcycles were registered throughout Malaysia in the year 2012 (Royal Malaysian Police [RMP] data, 2012) compared to 9,947,189 motorcycles registered in 2011 (RMP, 2011). Of that number, 130,080 motorcycles were involved in road crashes (RMP, 2012) which is higher compared to the previous year when 129,017 motorcycles were involved in road crashes (Royal Malaysian Police [RMP], 2011).

Risk taking behaviour and the lack of riding skills are among the risk factors that aggravate the poor safety record of motorcyclists in Malaysia. In addition, the percentage of motorcycle riders aged 16-21 years involved in the crashes are constantly more than 30% each year. These statistics show the vulnerability of the young, unlicensed and novice motorcyclists in Malaysia which can be attributed to lack of riding skills and risk taking.

Motorcycles are considered one of the riskier modes of transport. The total motorcyclist fatality figure in 2012 was 3,751 which was 54.2% of the total recorded fatalities in Malaysia that year (RMP, 2012). Due to this large number, several studies have been done on motorcyclists in Malaysia in order to understand riding behaviour such as a risk-taking behaviour case study (Mohd Khairul Alhapiz et al., 2012), a study on risk-taking behaviour (Ahmad Hariza et al., 1999) a study on motorcyclist riding behaviour at curve

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entry (Choon Wah Yuen et al., 2014) and a helmet wearing compliance study (Azli et al., in press).

The present study examines self-reported risky riding behaviours of motorcyclists in the Klang Valley using an established behavioural measurement tool known as Motorcycle Riding Behaviour Questionnaire (MRBQ) developed by Elliot et al. (2007).

1.1 Objectives of the Study

The objectives of this study were as follows:

- i. To analyse the components of riding behaviour(s) most frequently reported by motorcyclists in Malaysia.
- ii. To investigate the influence of demographic factors such as gender, age and motorcycle engine capacity with the number of summonses received.
- iii. To determine the relationship between the riding behaviours of the motorcyclists with the number of summonses received.

The scope of the study was to focus on motorcyclists' riding behaviour. The outcomes of this study will be useful in understanding the riding behaviour of motorcyclists in Malaysia as reported by the motorcyclists themselves and can be used for future interventions and campaigns for motorcycle safety.

The following hypotheses were tested by this study:

- i. There are five (5) types of riding behaviours which are most frequently reported by motorcyclists in Malaysia.
- ii. There is a significant relationship among demographic factors such as gender, age and motorcycle engine capacity with the number of summonses received.
- iii. There are significant relationships between the riding behaviours of the motorcyclists with the number of summonses received.

1.2 Limitations of the Study

The data collection for this study was carried out only in urban and sub-urban areas of the Klang Valley. Therefore, the data collected may not fully represent the riding behaviour of motorcyclists in the rural areas.

There was also a lack of Chinese respondents in this study. This is because a majority of the Chinese potential respondents approached could not ride motorcycles whereas the Chinese potential respondents who could, declined participation in this study.

Since motorcycles are a cheap, convenient and time-efficient mode of transport, the disadvantage of trying to get participation was that most motorcyclists approached were usually in a hurry thus causing a high rejection rate of potential respondents.

2. Literature Review

The main focus of the literature review was studies which have used the MRBQ to analyse riding behaviour among motorcyclists. The MRBQ was selected as the tool for this study as it is an established questionnaire (Elliot, Baughan & Sexton, 2007; Motevalian et al., 2011; Ozkan et al., 2011).

2.1 Riding Behaviour Studies

Several studies measuring the riding behaviour of motorcyclists have been conducted in other countries using various measures other than the MRBQ.

Mohd Khairul Alhapi et al. (2012) conducted a case study in the Klang Valley, Malaysia to investigate the risk-taking behaviours among motorcyclists. They examined the relationship between demographic factors and risk-taking behaviours such as riding over the speed limit, riding without a crash helmet, riding without using signals riding without headlights on and not stopping at a three-way junction. Their findings were that a majority of the motorcyclists were male teenagers and an individual from this group was more prone to ride without a crash helmet and without a license compared to other age groups. A significant mean difference between the lower income group and several behaviours which are related to risk-taking showed that respondents of the lower income group tended to ride without wearing a crash helmet, ride without headlights and not stop at a three-way junction.

Another study using instrumented motorcycle was conducted to explore riding behaviour at curved entries in Kuala Lumpur (Choon Wah Yuen, Mohamed Rehan Karim, & Ahmad Saifizul, 2014). The study found that riding experience, travel mileage and distance from the curved entry influenced riding characteristics such as brake force, changes in speed and the throttle force applied.

Watson et al. (2007) conducted two (2) different studies to investigate the influence of psychological and social factors on motorcycle rider behaviour with the objective of developing a Rider Risk Assessment Measure (RRAM) which can assess a rider's intentions and self-reported behaviour in identifying high-risk riders. A focus-group methodology was used to conduct a qualitative study involving six factors of rider behaviour thought to influence safety, which were rider awareness, riding while impaired or not, motorcycle handling skills and the tendency to push limits, riding at extreme speeds to perform stunts and bending road rules. The other study carried out by Watson et al. (2007) used the survey methodology to examine the social and psychological factors thought to influence safety such as aggression and sensation seeking. The results found that rider intentions significantly predicted all six types of behaviours while a tendency for aggression and sensation seeking were found to be significant predictors for risk-taking behaviours. Another finding of the same study showed that risky rider intentions were mostly influenced by attitudes and sensation seeking while perceived behavioural controls was influenced by safer intentions. Although there were no significant correlations between the measures of intention and behaviour comprising the RRAM with self-reported crash involvement, significant correlations were found between the RRAM components and self-reported traffic offence involvement.

Sexton et al. (2006) conducted a research to investigate the differences in risk-taking attitudes and the different perceptions of risk among the various social and demographic groups of motorcyclists and to study the extent to which behaviour is influenced by attitudes by using tools such as interviews and self-reported postal surveys. Data on measures of risk acceptance and attitudes towards risk was obtained through the in-depth and semi-structured interviews while data on rider demographics, measures of behaviour, attitudes and riding style were obtained through the self-reported postal surveys on respondents of various backgrounds. They found that a majority of the riders were aware of and willing to accept the levels of motorcycling risk, and that only a few of the riders would consider giving up motorcycle-riding due to these risks. Three rider groups identified were "Risk Deniers", "Optimistic Accepters" and "Realistic Accepters" and based on the data analysis, an insight into their patterns of risk perception was obtained.

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Lenkeit, Hagoski and Bakker (2011) used a motorcycle riding simulator and questionnaires to conduct a study in Washington, DC, United States of America to investigate the braking control behaviour of non-expert motorcycle riders and the use of conventional brakes in emergency braking situations. The motorcycle riding simulator was used to expose participants to traffic situations in which various types of braking were required, from normal slowing to emergency braking. The response of the motorcycle, recordings of the rider control inputs and interactions with other vehicles were used to obtain data regarding braking behaviour while the questionnaires were used to obtain data on rider characteristics. These data were then analysed to find out the possible relationships between braking behaviour, rider characteristics and the outcome of the event. It was found that several riders used only the front brake while none of the riders used only the rear brake. However, the event outcome can be determined by the rider's initial braking with respect to magnitude and timing. Further analyses using linear and logistic regression showed that there was a poor correlation between the individual rider characteristics and the event outcome or braking behaviour.

2.2 MRBQ as a Tool to Measure Riding Behaviour

In 2007, Elliot, Baughan and Sexton developed a questionnaire in their study on errors and violations in relation to motorcyclists' crash risk in the United Kingdom which measures the riding behaviour of motorcyclists and also the type of behaviour which can predict the crash risk of motorcyclists. Respondents were also asked the number of motorcycle crashes they were involved in within the past 12 months, and the number of crashes in which they accepted a certain degree of the blame (blame crashes). Thus, the Motorcycle Riding Behaviour Questionnaire (MRBQ) was developed based on the Driver Behaviour Questionnaire (DBQ) which was developed by Reason et al. (1990).

The MRBQ consists of 43 items which measures the self-reported frequency of riding behaviours. A six-point likert scale was used to measure how often the riding behaviour occurred – never, hardly ever, occasionally, quite often, frequently and nearly all the time. According to their study, the components of riding behaviour consisted of traffic

errors, speed violations, stunts, safety equipment and control errors. Crash risk was defined as all of the crashes in which the motorcyclist was involved for the past year. 'Blame crashes' were those for which the motorcyclist accepted a certain degree of the blame. The researchers found that the crash risk of motorcyclists increased with exposure and decreased with age and riding experience. The crash risk of motorcyclists also increased with the number of traffic errors committed. For blame crashes, speed violations and control errors were significant factors in predicting the crash risk of motorcyclists.

Motevalian et al (2011) conducted a study in Iran to assess the reliability and validity of a Persian version of MRBQ. The MRBQ was translated to Persian by three bilingual expert translators using the translation – back translation method, and 15 new items were added to the revised version while 10 items of the original MRBQ were deleted. The Buss-Perry Aggression questionnaire was used concurrently on all of the subjects to assess the construct validity of MRBQ. Principle component analysis of the Persian MRBQ revealed six subscales, which were Speed violations (Cronbach's Alpha: 0.91), Traffic errors (Cronbach's Alpha: 0.79), Safety violations (Cronbach's Alpha: 0.85), Traffic violations (Cronbach's Alpha: 0.79), Stunts (Cronbach's Alpha: 0.80) and Control errors (Cronbach's Alpha: 0.73). Motevalian et al also reported the mean of each item which allows for specific identification of riding behaviours which are frequently reported by Iranian motorcyclists. The most frequently reported riding behaviour is to carry a passenger who is not wearing a helmet ($M=4.36$, $S.D.=1.64$) while the least reported riding behaviour is to crash into a parked vehicle and damage it and to the escape from the crash scene ($M=1.32$, $S.D.=0.77$). They also found that there were significant correlations between the subscales of the Buss-Perry aggression questionnaire and the MRBQ subscales, thereby showing that the 48-item Persian version of MRBQ is a suitable measure for studying motorcyclists' riding behaviour in Iran.

Another study, conducted by Ozkan et al. (2011), was done in Turkey to investigate the factor structure of the MRBQ among Turkish motorcyclists. The MRBQ was translated into Turkish by three researchers using the back-translation technique and administered in Turkish using an online survey. However, they retained the original 43 items as developed by Elliot et al. (2007). Principal components analysis showed a five-factor

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solution which were Traffic errors (reliability: 0.85), Control errors (0.62), Speed violations (reliability: 0.88), Stunts (reliability: 0.77) and Safety equipment (reliability: 0.80). Among their findings were that offences were predicted by speeding violations and that stunts were the main predictors of active accidents and offences. Annual mileage was related to a higher number of offences, active and passive accidents while age was related to a lower number of active and passive accidents.

2.2.1 Components of the MRBQ

The first component of riding behaviour in the UK version of the MRBQ (Elliot, Baughan & Sexton, 2007) which contributes to crash risk is traffic errors which consists of 13 items which are related to cognitive and information processing problems, for example “Fail to notice pedestrians crossing”. Sexton et al. (2004) in their study on the crash risk of motorcyclists in the United Kingdom highlighted traffic errors as consistent predictors of a motorcycle crash. The reliability of this component according to Elliot, Baughan and Sexton (2007) is 0.84.

Speed violations is the second component of the MRBQ which contributes to crash risk and consists of 12 items. An example of an item is “Exceed speed limit on country road”. Haworth et al (1997) in their study of motorcycle crashes conducted in Australia found that 23% of the cases studied involving motorcycle crashes were caused by violating the speed limit. The reliability of this component according to Elliot, Baughan and Sexton (2007) is 0.87.

The third component of the MRBQ is stunts which comprises seven items, such as “intentionally do a wheel spin”. Stunts are also significant factors of crash risk as found by Sexton et al. (2004) in their study on the crash risk of motorcyclists in the United Kingdom. The reliability of this component is 0.81 (Elliot, Baughan & Sexton, 2007).

The fourth component of the MRBQ which contributes to crash risk is safety equipment as the use of protective clothing and dipped headlights has been found to significantly

reduce injuries to the motorcyclist (Hole & Tyrrell, 1995). The reliability of this component is 0.70 and is made up of seven items (Elliot, Baughan & Sexton, 2007).

Control errors is the final component of the MRBQ and consists of seven items, such as "have difficulty controlling bike when speeding". Sexton et al. (2004) discovered in their study on the crash risk of motorcyclists in the United Kingdom that control errors occurred in a surrounding which shows that the errors are linked with riding styles which involve inattention, speeding and carelessness. According to Elliot, Baughan and Sexton (2007), the reliability for this component is 0.73.

From their study, Elliot, Baughan and Sexton (2007) found that the most frequently reported behaviour was the use of "Safety Equipment" (M=4.88, S.D.= 0.92). This was followed by "Speed Violations" (M=2.17, S.D.=0.78), "Control Errors" (M=1.85, S.D.=0.46), "Traffic Errors" (M=1.54, S.D.=0.38) and "Stunts" (M=1.45, S.D.=0.58).

However, the Persian version of the MRBQ obtained a different set of results when validated by Motevalian et al. (2011). When the Persian version of the MRBQ was subjected to principal components analysis, six factors were extracted which accounted for 36.44% of the total variance. 0.3 was selected as the cut off point for the loading value onto a factor.

The first factor extracted consisted of 11 items, all of which related to speed violations, thus, Factor 1 was named "Speed Violations" with a Cronbach's Alpha co-efficient of 0.91. The second factor was named "Traffic Errors" and consisted of 12 items. However, one item was not related to traffic errors ("Riding without putting prescription glasses") and was therefore excluded from this factor. The Cronbach's Alpha for the second factor was 0.79. Seven items loaded onto the third factor and related to safety rules. Thus, the third factor was named "Safety Violations" and the Cronbach's Alpha was 0.85.

The fourth factor consisted of five items and was named "Traffic Violations". The Cronbach's Alpha for this factor was 0.79. Factor 5 composed of seven items and was named "Stunts". However, three of the items were not related to stunts and were therefore excluded from the "Stunts" factor. The Cronbach's Alpha for the remaining

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four items was 0.80. The sixth factor consisted of six items and was named “Control Errors”. The Cronbach’s Alpha was 0.73.

From their study, Motevalian et al. (2011) found that the most frequently observed riding behaviour among Iranians was “Safety Violations” (M=2.90, S.D.=0.92), followed by “Traffic Violations” (M=2.76, S.D.=1.14), “Control Errors” (M=2.63, S.D.=0.78), “Traffic Errors” (M=2.45, S.D.=0.72), “Speed Violations” (M=2.18, S.D.=0.94) and “Stunts” (M=1.41, S.D.=0.78).

2.3 Factors Contributing to Road Crashes

Age is an important demographic factor in crash risk. As an example, adults are not as likely to drive while intoxicated, drive recklessly, to have unprotected sex, to engage in both minor and more serious antisocial behaviour and to use varied illicit substances as compared to youths (Arnett, 1992). In 2010, a majority of the motorcyclists (7,625) involved in motorcycle crashes in Malaysia were of the 16 – 25 age group compared to the other age groups (RMP, 2010). The fatal crash rates of young drivers are higher than the fatal crash rates of older drivers because young drivers are the ones with high risk-taking behaviour (Begg & Langley, 2000). In a study on fatal injuries of motorcyclists conducted in Malaysia, Pang et al. (1999) found that 56.4% of the fatalities were aged between 16 to 25 years old. Another study on crash characteristics of injured motorcyclists in Malaysia by Pang et al. (2000) found that 55.5% of the motorcyclists who were fatally injured and 56.4% who were seriously injured but survived were less than 25 years old.

However, Christie and Harrison (2001) investigated the motorcycle crash patterns for riders aged between 17 – 25 in New South Wales, Australia using the Roads and Traffic Authority (RTA) accident data and NSW Compulsory Third Party (CTP) Insurance Scheme claims register data to compare crash patterns between the younger riders and the older drivers. They discovered that riders aged more than 25 years are at a higher risk of being involved in a crash as compared to riders aged below 25 years old, other than inexperienced and unlicensed riders. This is due to several factors such as a more

stringent license module requirement and because of the increase of motorcycle license holders in the older age group.

Another important demographic factor in crash risk is gender. It was found that 13,738 of the motorcyclists (riders) who were involved in motorcycle crashes were male compared to the 1,988 riders who were female (RMP, 2010). According to McKenna et al. (1998), young male drivers tend to behave in a riskier manner compared to females and older drivers. Maycock et al. (1991) also suggested that young male drivers have a higher crash liability compared to females or older drivers. A previous study by Pang et al. (1999) on fatal injuries of motorcyclists in Malaysia found that only 6.5% of the fatally injured motorcyclists were females while in another study of crash characteristics of injured motorcyclists in Malaysia by Pang et al. (2000), it was found that 93.5% of all fatalities and 0.3% of the seriously injured were mostly male.

Riding experience is also an important factor in crash risk. Pang et al. (2000) in their study of crash characteristics of injured motorcyclists in Malaysia defined riding experience as the number of years a motorcyclist held a valid licence. According to their results, more than 50% of the fatally injured and seriously injured had a valid license for less than three years.

Although much is known about the factors which contribute to motorcycle crashes from road environment and vehicle perspectives, little is still known about the human factor perspective and aspects of the Malaysian rider's behaviour which contributes to motorcycle accidents as demographics alone cannot predict the crash risk of motorcyclists.

3. Methodology

The methodology of this study comprised three stages as shown in Figure 1. The first stage involved the development of the questionnaire, when the components of the questionnaire were identified, items suitable for inclusion were selected and the questionnaire was forward and back translated.

The second stage was data collection by survey. The procedure used to collect the data was also planned at this stage.

The third stage involved data cleaning and analysis using the Statistical Package for the Social Sciences (SPSS) version 20.

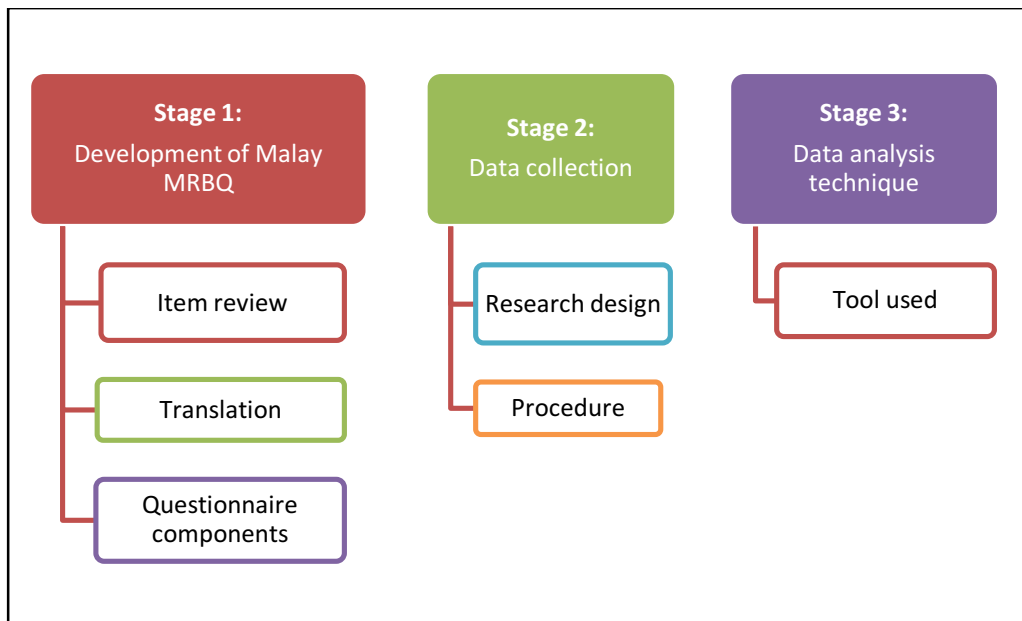


Figure 1 Stages of methodology

3.1 Development of the Malay MRBQ

3.1.1 Review of the MRBQ Items

Elliot, Baughan and Sexton's original MRBQ (2007) and Motevalian et al's Persian version of the MRBQ (2011) were reviewed again by the research team for suitability of the motorcyclists' context in Malaysia. The items of the original MRBQ (Elliot, Baughan & Sexton, 2007) are shown in Table 1.

Table 1 Original items of the original MRBQ

Items
Queuing to turn left on a main road, you pay such close attention to the main traffic that you nearly hit the vehicle in front
Fail to notice that pedestrians are crossing when turning into a side street from a main road
Exceed the speed limit on a residential road
Miss "Give Way" signs and narrowly avoid colliding with traffic having the right of way
Attempt to overtake someone that you hadn't noticed to be signalling a right turn
Race away from traffic lights with the intention of beating the driver/rider next to you
Ride so close to the vehicle in front that it would be difficult to stop in an emergency
Exceed the speed limit on a motorway
Ride between two lanes of fast moving traffic
Ride so fast into a corner that you scare yourself
Exceed the speed limit on a country/rural road
Ride when you suspect you might be over the legal limit for alcohol
When riding at the same speed as other traffic, you find it difficult to stop in time when a traffic light has turned against you
Distracted or pre-occupied, you belatedly realise that the vehicle in front has slowed and you have to brake hard to avoid a collision
Pull out on to a main road in front of a vehicle that you hadn't noticed, or whose speed you have misjudged
Disregard the speed limit late at night or in the early hours of the morning
Not notice a pedestrian waiting to cross at a zebra crossing, or a pelican crossing that has just turned red

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Not notice someone stepping out from behind a parked vehicle until it is nearly too late
Fail to notice or anticipate that another vehicle might pull out in front of you and have difficulty stopping
Get involved in unofficial 'races' with other riders or drivers
Attempt to do, or actually do, a wheelie
Unintentionally do a wheel spin
Intentionally do a wheel spin
Pull away too quickly and your front wheel comes off the road
Open up the throttle and just 'go for it' on country roads
Ride so fast into a corner that you feel like you might lose control
Change gear when going round a corner or bend
Skid on a wet road or manhole cover
Run wide when going round a corner
Find that you have difficulty controlling the bike when riding at speed (e.g. steering wobble)
Brake or throttle-back when going round a corner or bend
Wear a leather one-piece suit?
Wear a protective jacket (leather or non-leather)?
Wear protective trousers (leather or non-leather)?
Wear body armour (elbow pads, shoulder pads, knee pads, etc)?
Wear riding boots?
Wear gloves?
Wear bright/fluorescent clothing?
Wear bright/fluorescent strips/patches on your clothing?
Use dipped headlights on your bike?
Wear no protective clothing?
Have trouble with your visor or goggles fogging up?

Table 2 shows the original items of the Persian version of the MRBQ (Motevalian et al., 2011) which were also reviewed by the research team.

Table 2 Original items of the Persian version of the MRBQ

Items added
Cross a junction while the traffic light is red
Ride in the opposite direction of the traffic flow/road way

Ride on the sidewalk
Talk on a mobile phone while riding
Type text messages on a mobile phone while riding
Read text messages on a mobile phone while riding
Smoke a cigarette while riding
Carry more than one passenger on your motorcycle
Crash into a parked vehicle and damage it, but escape from the crash scene
Ride an impaired motorcycle
Ride without wearing a helmet
Carry a passenger who is not wearing a helmet
Have difficulty controlling your motorcycle when the car in front of you suddenly opens the door
Wear a helmet without fastening the straps?

After the reviewing process of the original items of the original MRBQ (Elliot, Baughan & Sexton, 2007) and the original items of the Persian version of the MRBQ (Motevalian et al., 2011) based on the suitability of the context for motorcyclists in Malaysia, the research team combined the items as shown in Table 3.

Table 3 Combined items of the Malay MRBQ

Section number	Items
C1	Queuing to turn left on a main road, you pay such close attention to the main traffic that you nearly hit the vehicle in front
C2	Fail to notice that pedestrians are crossing when turning into a side street from a main road
C3	Exceed the speed limit on a residential road
C4	Miss "Give Way" signs and narrowly avoid colliding with traffic having the right of way
C5	Attempt to overtake someone that you hadn't noticed to be signalling a right turn
C6	Race away from traffic lights with the intention of beating the driver/rider next to you
C7	Ride so close to the vehicle in front that it would be difficult to stop in an emergency
C8	Exceed the speed limit on a motorway

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C9	Ride between two lanes of fast moving traffic
C10	Ride so fast into a corner that you scare yourself
C11	Exceed the speed limit on a country/rural road
C12	Ride when you suspect you might be over the legal limit for alcohol
C13	When riding at the same speed as other traffic, you find it difficult to stop in time when a traffic light has turned against you
C14	Distracted or pre-occupied, you belatedly realise that the vehicle in front has slowed and you have to brake hard to avoid a collision
C15	Pull out on to a main road in front of a vehicle that you hadn't noticed, or whose speed you have misjudged
C16	Disregard the speed limit late at night or in the early hours of the morning
C17	Not notice a pedestrian waiting to cross at a zebra crossing, or a pelican crossing that has just turned red
C18	Not notice someone stepping out from behind a parked vehicle until it is nearly too late
C19	Fail to notice or anticipate that another vehicle might pull out in front of you and have difficulty stopping
C20	Get involved in unofficial 'races' with other riders or drivers
C21	Attempt to do, or actually do, a wheelie
C22	Unintentionally do a wheel spin
C23	Intentionally do a wheel spin
C24	Pull away too quickly and your front wheel comes off the road
C25	Open up the throttle and just 'go for it' on country roads
C26	Ride so fast into a corner that you feel like you might lose control
C27	Change gear when going round a corner or bend
C28	Skid on a wet road or manhole cover
C29	Run wide when going round a corner
C30	Find that you have difficulty controlling the bike when riding at speed (e.g. steering wobble)
C31	Brake or throttle-back when going round a corner or bend
C32	Cross a junction while the traffic light is red
C33	Ride in the opposite direction of the traffic flow/road way
C34	Ride on the sidewalk
C35	Talk on a mobile phone while riding

C36	Type text messages on a mobile phone while riding
C37	Read text messages on a mobile phone while riding
C38	Smoke a cigarette while riding
C39	Carry more than one passenger on your motorcycle
C40	Crash into a parked vehicle and damage it, but escape from the crash scene
C41	Ride an impaired motorcycle
C42	Ride without wearing a helmet
C43	Carry a passenger who is not wearing a helmet
C44	Have difficulty controlling your motorcycle when the car in front of you suddenly opens the door
D1	Wear a leather one-piece suit?
D2	Wear a protective jacket (leather or non-leather)?
D3	Wear protective trousers (leather or non-leather)?
D4	Wear body armour (elbow pads, shoulder pads, knee pads, etc)?
D5	Wear riding boots?
D6	Wear gloves?
D7	Wear bright/fluorescent clothing?
D8	Wear bright/fluorescent strips/patches on your clothing?
D9	Use dipped headlights on your bike?
D10	Have trouble with your visor or goggles fogging up?
D11	Wear a helmet without fastening the straps?

3.1.2 Translation Method

The translation method used to translate the Malay MRBQ items was the translation-back translation method as shown in Figure 2. Two different language experts were hired for this purpose. The first translator translated the questionnaire from English to Malay, while the second translator then translated the Malay version back to English. The second translator was not exposed to the original, English version of the questionnaire. Thus, the translated English version was then compared to the original English version to compare whether there were any differences or not in terms or sentence structures and meanings.



Figure 2 Malay MRBQ back-translation process

The forward and back translations revealed that there was not much difference between the original English MRBQ with the translated English MRBQ. Thus, this showed that the Malay translation of the MRBQ is reliable as a survey instrument to measure riding behaviour among Malaysian motorcyclists. The Malay version of the questionnaire items are in Appendix I.

3.1.3 Sections of the Malaysian Version of the MRBQ

The Malaysian version of the MRBQ was made up of four (4) sections. Section A sought demographic information of the respondent, such as age, ethnicity, gender, marital status, riding experience, the engine capacity of the motorcycles ridden, monthly income and education level. Section B asks questions about the motorcyclists' experience of being summonsed and their crash involvement over the past 12 months.

Section C asks the respondent to report the frequency of their riding behaviour. The 44 items in this section combines items from the original MRBQ developed by Elliot, Baughan and Sexton (2007) and also from the Persian version of the MRBQ. They covered items on control errors, safety violations, traffic violations and so on. A six-point Likert scale was used to measure how often the riding behaviour was carried out – never, hardly ever, occasionally, quite often, frequently and nearly all the time.

Section D asks respondents to report the frequency of the usage of safety equipment when riding their motorcycles. There are 11 items asked in this section, and a six-point Likert scale is also used to measure the frequency of the behaviour. The items in this section is also a combination of the items in the original MRBQ and Persian version of the MRBQ.

3.2 Data Collection

The main aim of this study was to obtain a self-report on riding behaviour from the motorcyclists themselves. Thus, the survey method was selected and the Malaysian version of the MRBQ was used as an instrument to collect data. Participants were asked to imagine themselves in the situations described and to select the frequency of their behaviour in that particular situation from a scale of 1 (“Never”) to 6 (“Nearly all the time”).

Data was collected using incidental sampling at various public locations throughout Klang Valley such as shopping malls and shop lots and various work organisations such as the Fire Department. The locations were also selected on the basis of ethnic majority in each location to ensure the representativeness of each ethnicity.

The requirements for the selection were that the potential respondent is a Malaysian citizen and the respondent can ride a motorcycle by himself/herself and not as a pillion rider only. The respondent must also ride regularly.

3.3 Technique of Data Analysis

The tool used to statistically analyse the data obtained in this self-reported study is the IBM SPSS (Statistical Package for the Social Sciences) Statistics version 20.

After the master coding of the MRBQ was developed, data was also entered using the IBM SPSS Statistics version 20 and cleaned for any missing data, typing errors during data key-in, aligning the positive and negative statements and so on.

Statistical analyses were conducted after the data cleaning process to determine the objectives of the study and prove the hypotheses.

4. Results and Discussions

This section discusses the results and findings of the study. There are four subsections namely components of riding behaviour, demographic profile, crash risk and crash involvement.

4.1 Components of Riding Behaviour

In the original MRBQ, a five-factor solution was obtained by conducting a principal components analysis on the 43 items. This showed that there were five main types of behaviour addressed by the MRBQ which were identified as traffic errors, speed violations, stunts, safety equipments and control errors. These five factors accounted for 41.2% of the total variance.

However, when Motevalian et al. (2011) assessed a modified version of the MRBQ to suit the Iranian culture, six (6) factors were extracted through principal components analysis which accounted for 36.44% of the total variance. The six factors were identified as speed violations, traffic errors, safety violations, traffic violations, stunts and control errors.

For this study, the 55 items of the MRBQ were subjected to principal components analysis (PCA) with varimax rotation using SPSS version 20.0. Prior to performing PCA, the suitability of data for factor analysis was assessed. Inspection of the correlation matrix revealed the presence of many coefficients of 0.3 and above. The Kaiser – Meyer – Oklin value was 0.919, exceeding the recommended value of 0.6 and Bartlett's Test of Sphericity reached statistical significance ($p = 0.0001$), supporting the factorability of the correlation matrix. The scree plot obtained from the PCA also indicated that there were five factors which accounted for 50.65% of the total variance. The overall reliability of the Malay MRBQ is 0.70.

21 items loaded onto the first factor with loading values of more than 0.3 as shown in Table 3. All 21 items were related to safety rules, thus this factor was named “Safety Violations” and accounted for 13.56% of the total variance whereas the Cronbach’s Alpha was 0.902. The mean of this factor was 38.54 while the standard deviation was 17.51.

The mean and standard deviation of each item is also displayed in the table below to show the specific riding behaviour frequently reported by the motorcyclists. From Table 4, it can be seen that the most frequently reported behaviour is to carry a passenger who is not wearing a helmet (M=2.29, S.D.=1.37) while the least reported behaviour is to ride when the motorcyclists suspects himself of being over the legal limit for alcohol (M=1.25, S.D.=0.80). This shows a similarity with the validation study of the MRBQ which was carried out in Iran by Motevalian et al.(2011), which also reported that Iranian motorcyclists admitted to frequently carry a passenger who is not wearing a helmet. However, this item was not a part of the original MRBQ developed by Elliot, Baughan and Sexton (2007). The respondents of this study also admit to frequently ride without wearing a helmet (M=2.25, S.D.=1.35) and to frequently wear a helmet without fastening the straps (M=2.18, S.D.=1.39).

Table 4 Factor loadings of the items which loaded onto the first factor and the mean and standard deviation statistics of the factor

Item no.	Item	Factor loading	Mean	S.D.
C12	Ride when you suspect you might be over the legal limit for alcohol.	0.349	1.25	0.80
C20	Get involved in unofficial ‘races’ with other riders or drivers.	0.493	1.99	1.31
C21	Attempt to do, or actually do, a wheelie.	0.563	1.49	1.04
C22	Unintentionally do a wheel spin.	0.614	1.85	1.13
C23	Intentionally do a wheel spin.	0.721	1.88	1.72
C24	Pull away too quickly and your front wheel comes off the road.	0.580	1.58	1.07
C25	Open up the throttle and just 'go for it' on country roads.	0.627	1.59	1.10

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C26	Ride so fast into a corner that you feel like you might lose control.	0.495	2.07	1.25
C32	Cross a junction while the traffic light is red.	0.387	2.07	1.20
C33	Ride in the opposite direction of the traffic flow/road way.	0.614	1.76	1.22
C34	Ride on the sidewalk.	0.661	1.68	1.11
C35	Talk on a mobile phone while riding.	0.549	2.00	1.22
C36	Type text messages on a mobile phone while riding.	0.605	2.05	3.13
C37	Read text messages on a mobile phone while riding.	0.516	1.99	1.29
C38	Smoke a cigarette while riding.	0.381	2.06	1.57
C39	Carry more than one passenger on your motorcycle.	0.482	1.77	1.17
C40	Crash into a parked vehicle and damage it, but escape from the crash scene.	0.480	1.37	0.89
C41	Ride an impaired motorcycle.	0.449	1.97	2.06
C42	Ride without wearing a helmet.	0.550	2.25	1.35
C43	Carry a passenger who is not wearing a helmet.	0.576	2.29	1.37
D11	Wear a helmet without fastening the straps.	0.345	2.18	1.39

Table 4 highlighted the issue of proper helmet wearing among motorcyclists. This finding is consistent with Azli and team's study which found that only 52% of the observed motorcyclists wear their helmet properly (Azli, et al., in press) even when helmet wearing law has been implemented in Malaysia since 1973. This finding could answer the question why motorcyclists' fatalities contributed by head injuries are high (Kulanthayan, Radin Umar, Ahmad Hariza, & Mohd Nasir, 2001; PDRM, 2012; Yen, et al., 1999). When helmet wearing rate is increasingly accepted among motorcyclists and worn properly, only then can the helmet fully function towards protecting the motorcyclists as necessary.

Helmets have been determined as promising, personal protective equipment for vulnerable motorcyclists. Proper helmet wearing could decrease the risk and severity of injuries by about 72% and decrease the likelihood of death by 39% (WHO, 2006). Another study by the World Health Organization (WHO, 2004) in Italy and the United States showed a reduction of 20% - 45% of fatal and serious injuries among users of motorised two-wheelers who wore helmets while riding. A study also showed that for

each 10% increase in helmet use, 1 life per 1 million inhabitants can be saved per year (Abbas, Hefny, & Abu-Zidan, 2011).

15 items loaded onto the second factor which accounted for 13.08% of the total variance and was identified as "Traffic Errors". Although one of these items (item C5: "Attempt to overtake someone that you hadn't noticed to be signalling a right turn") loaded more strongly onto factor 3 with a loading value of 0.549 compared to a loading value of 0.522 for factor 2, the item content was better suited with the items in Factor 2. Table 5 below shows the items and the factor loadings. On the other hand, item D11 ("Have trouble with your visor or goggles fogging up") was not related to traffic errors, and was therefore excluded from this factor. The Cronbach's Alpha for the scale "Traffic Errors" is 0.903. The mean of this factor was 30.99 while the standard deviation was 11.67. The most frequently reported riding behaviour for "Traffic Errors" is the trouble faced by motorcyclists when their visor/goggles fog up ($M=2.68$, $S.D.=1.50$) while the least reported behaviour is to not notice a pedestrian waiting to cross at a zebra crossing, or a pelican crossing that has just turned red ($M=1.92$, $S.D.=1.08$).

Table 5 Factor loadings of the items which loaded onto the second factor and the mean and standard deviation statistics of the factor

Item no.	Item	Factor loading	Mean	S.D.
C1	Queuing to turn left on a main road, you pay such close attention to the main traffic that you nearly hit the vehicle in front.	0.608	2.21	1.08
C2	Fail to notice that pedestrians are crossing when turning into a side street from a main road.	0.726	2.24	1.56
C4	Miss "Give Way" signs and narrowly avoid colliding with traffic having the right of way.	0.645	2.12	1.11
C5	Attempt to overtake someone that you hadn't noticed to be signalling a right turn.	0.522	2.32	1.22
C13	When riding at the same speed as other traffic, you find it difficult to stop in time when a traffic light has turned against you.	0.546	2.19	2.02
C14	Distracted or pre-occupied, you belatedly realise that the vehicle in front has slowed and you have to brake hard to avoid a collision.	0.516	2.36	1.16

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C15	Pull out on to a main road in front of a vehicle that you hadn't noticed, or whose speed you have misjudged.	0.646	2.14	1.09
C17	Not notice a pedestrian waiting to cross at a zebra crossing, or a pelican crossing that has just turned red.	0.627	1.92	1.08
C18	Not notice someone stepping out from behind a parked vehicle until it is nearly too late.	0.666	2.24	1.18
C19	Fail to notice or anticipate that another vehicle might pull out in front of you and have difficulty stopping.	0.577	2.25	1.20
C28	Skid on a wet road or manhole cover.	0.559	2.17	1.31
C29	Run wide when going round a corner.	0.522	2.28	1.61
C30	Find that you have difficulty controlling the bike when riding at speed (e.g. steering wobble).	0.490	2.23	1.24
C44	Have difficulty controlling your motorcycle when the car in front of you suddenly opens the door.	0.561	2.37	1.28
D10	Have trouble with your visor or goggles fogging up?	0.423	2.68	1.50

Eight items loaded strongly onto Factor 3, and all of these items were related to speeding. Thus, this factor was named “Speeding” and accounted for 12.92% of the total variance. The Cronbach’s Alpha of this factor was 0.80. Table 6 below shows the items and the factors loadings of the “Speeding” factor. The mean of this factor was 17.58 while the standard deviation was 8.05. The behaviour of racing away from the traffic lights with the intention of beating the driver/rider next to the motorcyclist was most frequently reported (M=2.98, S.D.=3.18) while the behaviour least reported was to exceed the speed limit on a country/rural road (M=2.18, S.D.=1.29).

Table 6 Factor loadings of the items which loaded onto the third factor and the mean and standard deviation statistics of the factor

Item no.	Item	Factor loading	Mean	S.D.
C3	Exceed the speed limit on a residential road.	0.581	2.33	1.35
C6	Race away from traffic lights with the intention of beating the driver/rider next to you.	0.667	2.98	3.18
C7	Ride so close to the vehicle in front that it would be difficult to stop in an emergency.	0.623	2.66	2.13
C8	Exceed the speed limit on a motorway.	0.706	2.88	1.42
C9	Ride between two lanes of fast moving traffic.	0.617	2.35	1.32
C10	Ride so fast into a corner that you scare yourself.	0.609	2.42	3.12
C11	Exceed the speed limit on a country/rural road.	0.697	2.18	1.29
C16	Disregard the speed limit late at night or in the early hours of the morning.	0.645	2.44	1.37

Another eight items also loaded quite strongly onto the fourth factor which accounted for 7.41% of the total variance. All of the eight items were related to the use of safety equipments by Malaysian motorcyclists, thus this factor was named as “Safety Equipments”. The items and the factor loadings are shown in Table 7 below. The Cronbach’s Alpha for this factor was 0.84. The mean of this factor was 17.58 while the standard deviation was 8.05. Wearing bright/fluorescent clothing was frequently reported by the motorcyclists ($M=3.08$, $S.D.=1.63$) compared to wearing body armour such as elbow pads, shoulder pads and knee pads ($M=1.49$, $S.D.=1.07$). However, as a whole, the “Safety Equipment” factor was not the most frequently reported riding behaviour among Malaysian motorcyclists as compared to motorcyclists in the UK who reported “Safety Equipment” as their frequently carried out riding behaviour (Elliot, Baughan & Sexton, 2007).

Table 7 Factor loadings of the items which loaded onto the fourth factor and the mean and standard deviation statistics of the factor

Item no.	Item	Factor loading	Mean	S.D.
D1	Wear a leather one-piece suit.	0.717	1.97	1.44
D2	Wear a protective jacket (leather or non-leather).	0.688	2.68	1.79

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D3	Wear protective trousers (leather or non-leather).	0.775	1.99	1.39
D4	Wear body armour (elbow pads, shoulder pads, knee pads, etc).	0.744	1.49	1.07
D5	Wear riding boots.	0.786	1.78	1.27
D6	Wear gloves.	0.683	2.15	1.55
D7	Wear bright/fluorescent clothing.	0.540	3.08	1.63
D8	Wear bright/fluorescent strips/patches on your clothing.	0.557	2.52	1.58

Only three items loaded onto Factor 5, all of which were related to the motorcyclists' cautious behaviour when riding as shown in Table 8 below. Thus, this factor was renamed as "Precaution" and accounted for 3.68% of the total variance while the Cronbach's Alpha was 0.42. The mean of this factor was 10.06 while the standard deviation was 4.30. The most frequently reported behaviour for the "Precaution" factor was to use dipped headlights on the motorcyclists' motorcycles (M=4.01, S.D.=2.93) while the least reported behaviour was to change gear when going round a corner or bend (M=2.78, S.D.=1.54).

This "Precaution" factor was not extracted in Elliot, Baughan and Sexton's (2007) study, nor was it extracted in Motevalian et al's (2011) Persian version of the MRBQ. Thus, it may be a cultural difference which caused the "Precaution" scale to be extracted from the Malaysian version of the MRBQ.

Table 8 Factor loadings of the items which loaded onto the fifth factor and the mean and standard deviation statistics of the factor

Item no.	Item	Factor loading	Mean	S.D.
C27	Change gear when going round a corner or bend.	0.338	2.76	1.56
C31	Brake or throttle-back when going round a corner or bend.	0.491	3.33	1.70
D9	Use dipped headlights on your bike.	0.545	3.94	2.83

Table 13 in Appendix II shows the details of the principal components analysis conducted and the loading values of each item, the mean scores and also the S.D. of each factor extracted. Based on the results, it was found that the most frequently reported riding

behaviour among Malaysian motorcyclists was “Safety Violations” (M=38.54, S.D.=17.51). The second most frequently reported behaviour was “Traffic Errors” (M=30.99, S.D.=11.67) followed by “Speeding” (M=20.02, S.D.=9.33), “Safety Equipment” (M=17.58, S.D.=8.05) and “Precaution” (M=10.06, S.D.=4.30).

The most frequently reported riding behaviour among Malaysian motorcyclists, which is “Safety Violations” is also similar to the most frequently reported riding behaviour among motorcyclists in Iran (Motevalian et al., 2011) which is also “Safety Violations” (M=2.90, S.D.=0.92). However, the results of the Malaysian MRBQ differ with the results of the UK MRBQ. Based on the study conducted by Elliot, Sexton and Baughan (2007), the use of “Safety Equipment” (M=4.88, S.D.=0.92) was the most frequently reported riding behaviour while “Stunts” was the least reported behaviour.

4.2 Demographic Profile

345 respondents participated in this study and all of the respondents could ride a motorcycle. A large majority of the respondents (89.0%) were Malay while only 1.4% were Chinese. 6.4% were Indians and 3.2% were a mix of other races such as Bidayuh and Kadazan. The ethnicity distribution of the respondents can be seen in Figure 3.

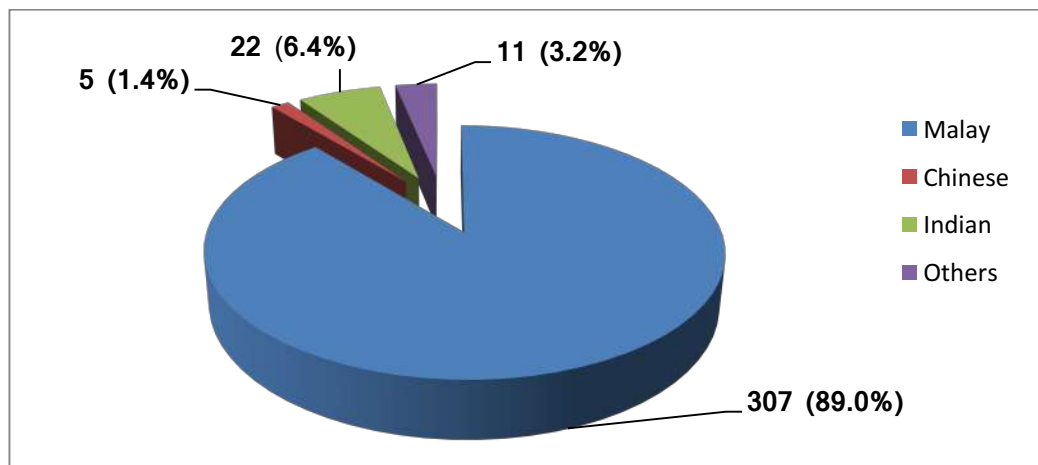


Figure 3 Ethnicity distribution of the respondents in this study

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Figure 4 shows that 78.6% of the respondents were male and the remaining 21.4% were female.

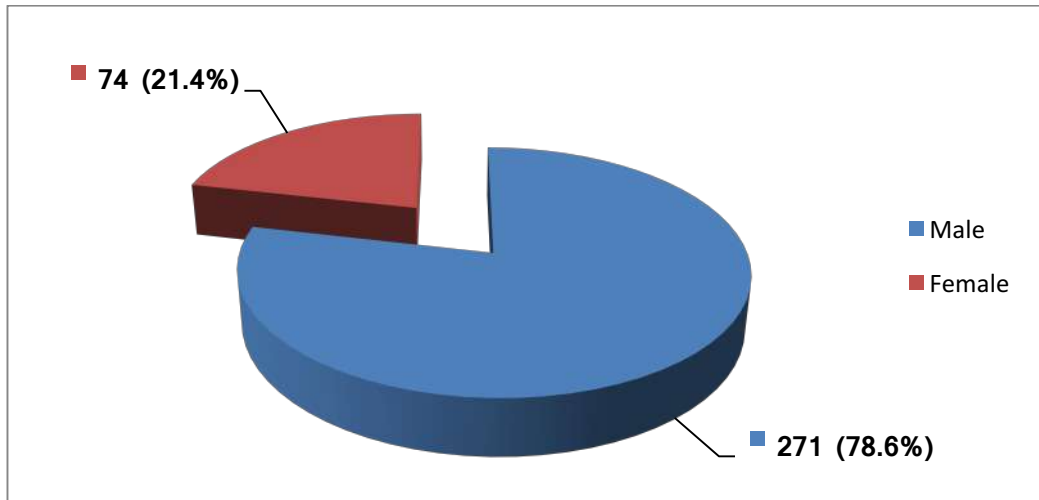


Figure 4 Gender distribution of respondents

As shown by Figure 5, most of the respondents were of the 21 – 25 year old age group (25.5%) and the 26 – 30 year old age group (23.2%). 13.0% were of the 16 – 20 year old age group, 12.2% were of the 31 – 35 year old age group, 8.7% were of the 36 – 40 year old age group, 6.7% were of the 41 – 45 year old age group and 2.9% were of the 46 – 50 year old age group. There were also respondents of the older age groups which were the 51 – 55 year old age group (4.9%), the 55 – 60 year old age group (1.7%) and even the 61 year old and above age group (1.2%).

Based on police data (RMP, 2012), two motorcyclist age groups most commonly involved in fatal accidents are the 21 – 25 age group (22.5%) and the 16 – 20 age group (21.5%). Therefore, the data collected in this study will reflect the behaviour of these age groups.

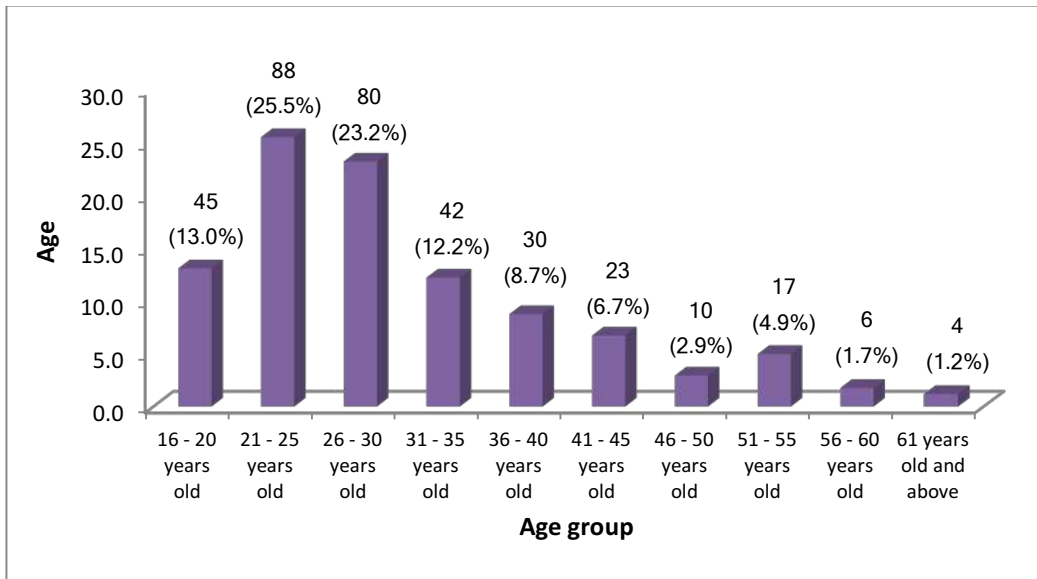


Figure 5 Age group distribution of respondents

The largest group of respondents (75.1%) were from the middle-income group whose monthly salary were from RM1,001 – RM5,000 while the second largest group of respondents (16.5%) were from the lower-income group who earn less than RM1,000 monthly. Only 0.6% of the respondents were of the high income group earning more than RM10,000 monthly while 2.0% of respondents earned around RM5,001 – RM10,000 monthly as shown in Figure 6.

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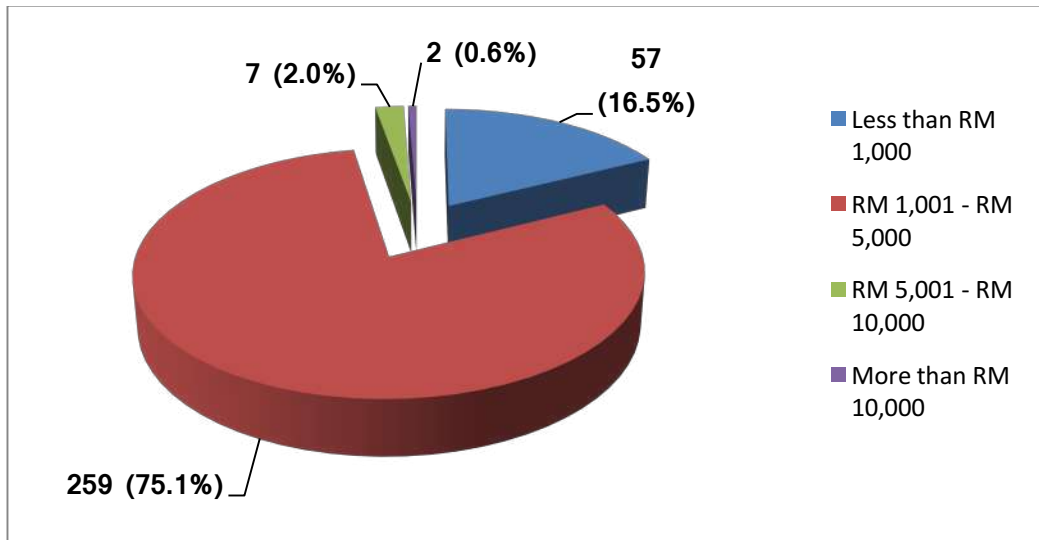


Figure 6 Monthly income distribution of respondents

Slightly more than half of the respondents were married (51.6%) whereas the remaining 47.5% of the respondents were single as shown in Figure 7.

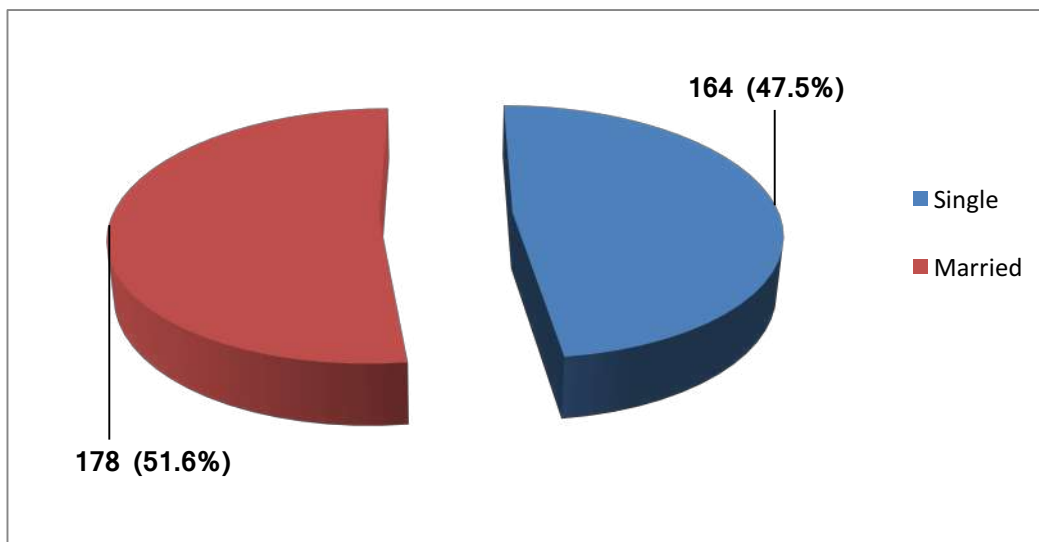


Figure 7 Marital status of respondents

Figure 8 shows the highest level of education achieved by the respondents. The majority had only until secondary school (55.1%), followed by 22.0% who completed their diplomas, 9.0% who were undergraduates and 3.2% had had only completed primary school. Only 0.9% were postgraduates.

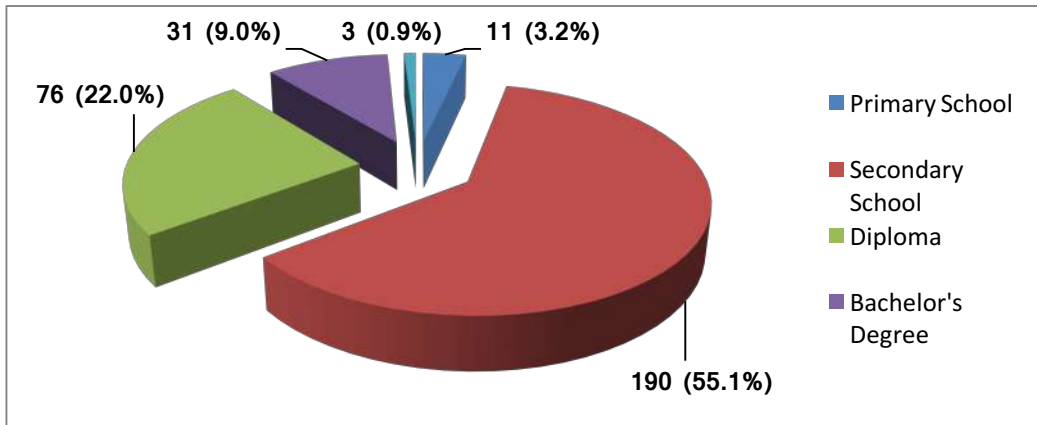


Figure 8 Education level of respondents involved in the riding behaviour study

The riding experience distribution of respondents can be seen in Figure 9. 68.4% had more than six years of riding experience, 16.8% had three to five years of riding experience while only 11.3% had less than two years.

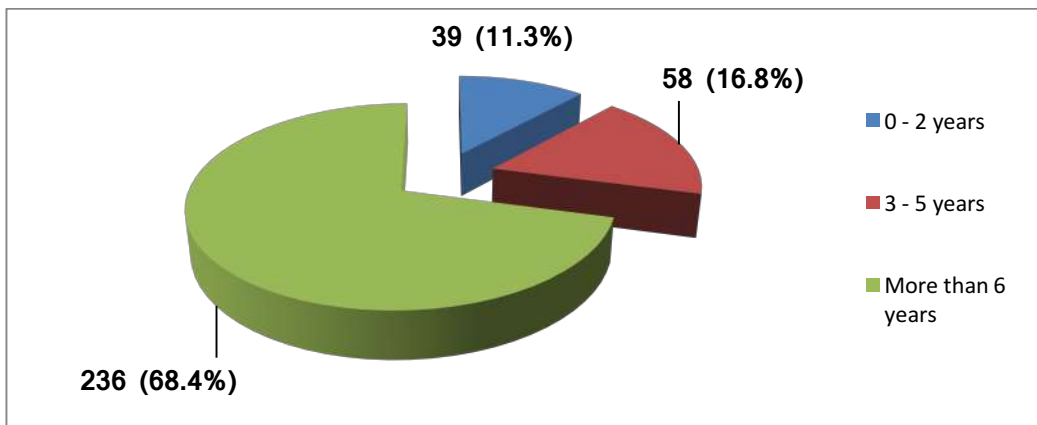


Figure 9 Riding experience of respondents

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The engine capacity distribution of motorcycles ridden by respondents is displayed in Figure 10. A large majority of the respondents (71.3%) rode motorcycles with engine capacities ranging from 101cc – 250cc. 15.7% of the respondents rode motorcycles of 100cc and below, only 1.2% motorcycles with engine capacities of 251cc – 500c, while 4.3% motorcycles with engine capacities of 501cc and above.

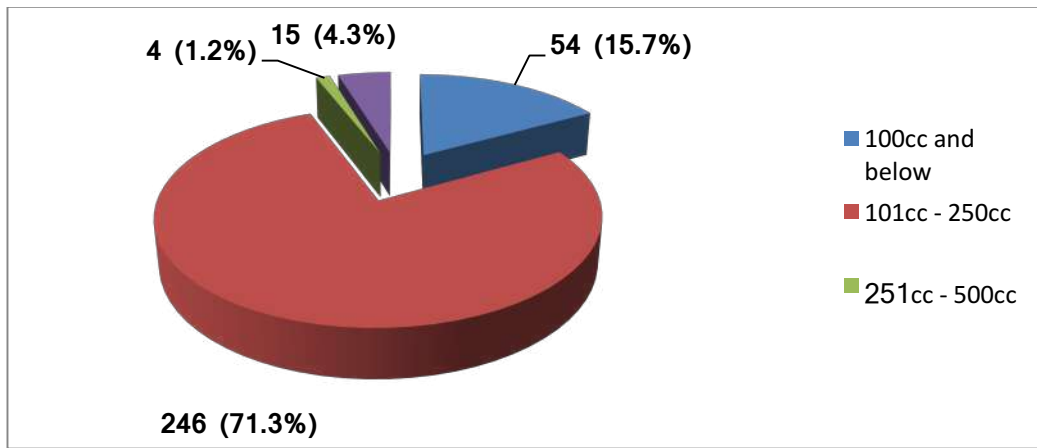


Figure 10 Engine capacities of motorcycles ridden by respondents

Figure 11 Shows the number of summonses received by the respondents within the 12 months immediately prior to data collection, as reported by the respondents themselves. 78.3% of the respondents had not been issued with a summons within the past 12 months while 15.4% reported that they received at least one to three summonses, 4.6% received four to six summonses while 1.7% of the respondents received more than seven summonses within the past 12 months. The mean of the number of summons received was 1.30, which shows that the possibility of one respondent being issued a summons in 12 months is at least once.

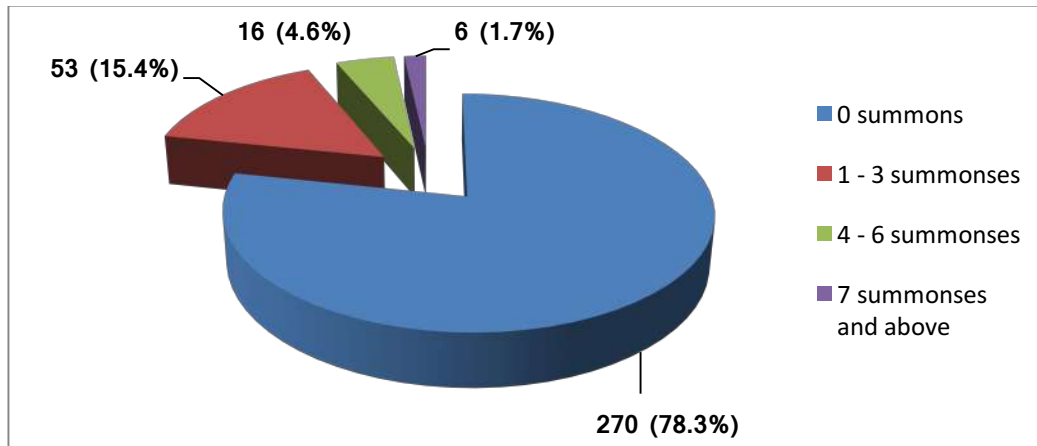


Figure 11 Number of summonses received by respondents within the past 12 months

4.3 Demographic Connections

Several statistical analyses were conducted to find out if there were any relationships between demographic variables.

4.3.1 Demographic Connections with Number of Summonses

Several statistical analyses were conducted to find out the connections between demographic variables with the number of summonses received by motorcyclists. It was found that male motorcyclists in Selangor were more likely to be summonsed as compared to female motorcyclists (OR= 8.35, CI=1.40, 7.32). A Chi-square test for independence further indicated that there was a significant association between gender and experienced of being summonsed, $\chi^2 (1, n = 345) = 7.45, p = .006$. However, there was no significant difference between single and married motorcyclists in terms of summonses received.

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Age and riding experience were found not to be significantly correlated with the number of summonses received. On the other hand, a significant relationship was found between engine capacity with the number of summonses received ($r=0.122$).

4.3.2 Demographic Connections with Crash Involvement

The number of summonses received by the motorcyclists and their crash involvement were analysed and a significant relationship was found between the two variables. This shows that motorcyclists who have received at least one summons are more likely to be involved in a road crash (OR= 10.06, CI=0.20, 0.69).

However, there were no significant differences between the gender and marital status of the motorcyclists and their crash involvement. A Chi-square test for independence indicated there was no significant association between gender and crash involvement, $\chi^2 (1, n = 345) = 0.06, p = .811, \phi = -.023$. Thus, the likelihood for males and females of being involved in road crashes is the same.

The crash involvement of the motorcyclists by demographic variables is shown in Table 9 below.

Table 9 Crash involvement by demographic variables

	Yes	No
Gender		
Male	42	229
Female	10	64
Age group		
35 and below	43	212
36 and above	9	81
Riding experience		
0 - 2 years	8	31
3 - 5 years	7	51
6 years and more	34	202
Engine capacity		

100cc and below	7	47
101cc – 250cc	40	206
251cc – 500cc	0	4
501cc and above	0	15
Marital status		
Single	26	138
Married	25	153

4.4 Riding Behaviour Connections

Several statistical analyses were conducted to find out the relationship between riding behaviours, number of summonses and crash involvement.

4.4.1 Relationship between Riding Behaviours and Number of Summonses

Pearson’s correlation test was run on the number of summonses received and the five components of the MRBQ to test the relationship strengths. The results are displayed in Table 10 below. There is a positive correlation between the number of summons and safety violations ($r = 0.117$) and speeding behaviour ($r = 0.141$).

Table 10 Correlations between number of summonses received and the components of riding behaviour

	r	p
Safety violations	0.117*	0.36
Traffic errors	0.095	0.092
Speeding	0.141*	0.010
Safety equipment	0.028	0.606
Precaution	0.023	0.669

*For all of the correlation coefficients: $p < 0.01$

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This is because there are several specific riding behaviours under “Safety Violations” which can earn motorcyclists a traffic summons such as riding without a helmet or wearing a helmet without fastening it properly, carrying a passenger who is not wearing a helmet; talking, typing or reading text messages on a mobile phone while riding and crossing a junction while the traffic light is red. However, the speeding behaviour of motorcyclists is harder to capture during enforcement activities.

Since speeding behaviour is a part of risky riding behaviour, it correlates well with crash risk. This is why the majority of motorcyclists (63.0%) do not survive fatal accidents even though they were wearing helmets (RMP, 2012).

There were also positive relationships among the various components of riding behaviours themselves as shown in Table 11. There is a strong correlation between safety violations and traffic errors ($r = 0.689$), speeding ($r = 0.665$) and the precaution behaviour ($r = 0.233$). There was also a positive correlation between traffic errors with speeding ($r = 0.732$) and precaution behaviour ($r = 0.261$). Meanwhile, the speeding behaviour also correlated positively with the precaution behaviour ($r = 0.325$) whereas the precaution behaviour showed a positive relationship with the safety equipment behaviour ($r = 0.218$). This shows that although the motorcyclists tend to exceed the speed limit, they are still cautious of their riding behaviour. In addition, they are also aware of the riding risks and thus take caution by wearing safety equipment while riding.

Table 11 Correlations among the components of riding behaviour

		Safety violations	Traffic errors	Speeding	Safety equipment	Precaution
Safety violations	Pearson Correlation	1	.689*	.665*	.061	.233*
	Sig. (2-tailed)		.000	.000	.280	.000
	N	324	300	311	318	322
Traffic errors	Pearson Correlation	.689*	1	.732*	.078	.261*
	Sig. (2-tailed)	.000		.000	.173	.000
	N	300	317	308	310	315

Speeding	Pearson Correlation	.665*	.732*	1	.064	.325*
	Sig. (2-tailed)	.000	.000		.253	.000
	N	311	308	331	324	329
Safety equipment	Pearson Correlation	.061	.078	.064	1	.218*
	Sig. (2-tailed)	.280	.173	.253		.000
	N	318	310	324	337	337
Precaution	Pearson Correlation	.233*	.261*	.325*	.218*	1
	Sig. (2-tailed)	.000	.000	.000	.000	
	N	322	315	329	337	343

*For all of the correlation coefficients: $p < 0.01$

From these results, the motorcyclists with a high crash risk are mostly those who have been issued with at least one traffic summons within the past 12 months and are also those who frequently report a riding behaviour of safety violations or speeding.

4.4.2 Relationship between Riding Behaviours and Crash Involvement

Table 12 shows the mean difference between crash involvements of the motorcyclists by riding behaviour. However, there were no significant differences between crash involvements of the motorcyclists by riding behaviour ($p < 0.01$).

Table 12 Mean differences between crash involvements by riding behaviours

Variables	Yes Mean (SD)	No Mean (SD)	Mean diff. (95% CI)	t-statistic (df)	P value
Safety violations	39.42 (16.55)	38.39 (17.70)	1.03 (-4.37, 6.42)	322	0.71
Traffic errors	33.16 (10.39)	30.59 (11.86)	2.57 (-0.96, 6.10)	315	0.15

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Speeding	22.22 (10.09)	19.63 (9.15)	2.59 (-0.22, 5.39)	329	0.71
Safety equipment	19.02 (8.90)	17.33 (7.89)	1.69 (-0.74, 4.11)	335	0.17
Precaution	10.46 (3.40)	9.98 (4.44)	0.48 (-0.80, 1.75)	341	0.46

5. Conclusion and Recommendations

Riding behaviour is an interesting field to explore, not only because of the very high road crash statistics involving motorcyclists in Malaysia, but also because behaviour varies from one (1) culture to another. As the results of this study indicated, the most frequently reported riding behaviour is safety violations, which also showed a positive correlation with the number of summons received by the motorcyclists besides speeding behaviour, thereby increasing the crash risk of the motorcyclists especially those who are repeat offenders. Thus, there is room for improvement in the riding curriculum for motorcyclists and also in the enforcement area in order to curb the number of offences conducted by motorcyclists and therefore reducing the risk of being involved in road accidents.

Based on the findings of the Malaysian MRBQ, one serious issue is the frequent occurrence of non-helmet or improper helmet wearing among respondents and their pillion. Stricter enforcement activities will be able to enhance the wearing rate as shown in the results of a MIROS study on the effectiveness of enforcement activities in increasing helmet wearing compliance among Malaysian motorcyclists (Jamilah et al., 2011) which found that helmet use increased along the Kajang – Semenyih route during periods of enforcement activities compared to when there were no enforcement activities

It is imperative to focus on the importance of proper helmet wearing as 57.7% of fatalities among Malaysian motorcyclist casualties were due to head injury (RMP, 2012). In a study in selected areas in Selangor, Rabihah et al. (2013) observed that although most of the motorcyclists were wearing helmets they did not fasten the straps. This indicates that motorcyclists still do not understand the philosophy behind helmet wearing (Rabihah et al., 2013). Therefore, apart from enhancement in the enforcement

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approach, advocacy and education programs are also highly needed to insight the motorcyclist on how proper helmet wearing could save their life.

Another finding of this study also highlights the specific riding behaviours associated with speeding. Thus, there is a need to plan and enhance the current enforcement strategies in order to reduce and ultimately eliminate the speeding behaviour of motorcyclists and thereby reducing their risk of crashes.

A positive finding of this study was that Malaysian motorcyclists are aware of the need to be conspicuous on the roads, and are thus putting more effort into this by wearing brighter/fluorescent clothes or by wearing bright/fluorescent strips on their clothes. Thus, it is recommended that the relevant agencies or bodies improve current awareness campaigns to further raise motorcyclists' consciousness about their conspicuity on the roads. The garment and personal protective equipment industry could also play a role by designing cheaper, more attractive clothing which is bright or fluorescent for riders to wear. In addition, this study could also set a good foundation for further research to find out behavioural changes among Malaysian motorcyclists regarding conspicuity on the road.

It is also recommended that this study to repeated with other target groups in order to learn more about the riding behaviour of specific groups, for example, the riding behaviour of youth, or the riding behaviour of the Malaysian "Mat Rempit", the riding behaviour of those working as delivery boys whose job requires them to ride a motorcycle, and so on. This study should also be carried out nationwide to acquire more robust and representative self-reports of frequently conducted riding behaviours among Malaysian motorcyclists with better sampling approach to address the limitation of this study. When a deeper insight into the riding behaviour of each target group can be obtained, it is hoped that the crash rate of Malaysian motorcyclists will decline as they ride more safely and other road users are also aware and cautious of their presence on the roads.

Another recommendation of this study is for a manual or handbook to be published on the process of localising the MRBQ and for further guidance in culturally validating other questionnaires for future research.

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Appendix A

Malay Version of the MRBQ

Section C

- C1 Semasa berbaris untuk masuk ke simpang kiri ke jalan besar, anda terlalu menumpukan perhatian terhadap lalu lintas utama sehingga anda hampir melanggar kenderaan yang beratur di hadapan anda.
- C2 Gagal menyedari kehadiran pejalan kaki yang sedang melintas, semasa anda memasuki simpang dari jalan utama.
- C3 Memandu melebihi had laju semasa menunggang di kawasan perumahan.
- C4 Tidak menyedari papan tanda “Beri Laluan” dan nyaris melanggar kenderaan yang memiliki laluan.
- C5 Cuba memotong kenderaan lain tanpa menyedari yang pemandunya sudah memberikan lampu isyarat ke kanan.
- C6 Memecut setelah lampu isyarat bertukar menjadi hijau dengan tujuan mendahului kenderaan di sebelah anda.
- C7 Menunggang terlalu hampir dengan kenderaan di hadapan sehinggakan jarak tersebut tidak selamat untuk berhenti jika ada kecemasan.
- C8 Menunggang melebihi had kelajuan di atas jalan raya.
- C9 Menunggang di antara dua lorong sewaktu lalulintas sedang bergerak laju.
- C10 Mengambil selekoh dengan laju sehingga anda sendiri cemas.
- C11 Menunggang melebihi had kelajuan di atas jalan kampung/pedalaman.
- C12 Menunggang ketika anda syak yang kandungan alkohol dalam badan anda melebihi paras yang dibenarkan.
- C13 Semasa menunggang dengan kelajuan yang sama dengan lalulintas di sekeliling anda, anda sukar untuk berhenti dengan selamat setelah lampu isyarat bertukar merah.
- C14 Anda leka atau lalai sehingga anda lambat menyedari yang pemandu di hadapan sedang memperlahankan kenderaan, dan anda terpaksa membrek secara mengejut untuk mengelakkan pelanggaran.
- C15 Mengambil selekoh ke jalan utama di hadapan kenderaan lain yang tidak anda sedari sebelum itu, ataupun kenderaan yang bergerak lebih laju dari yang anda sangka.

- C16 Tidak mempedulikan had laju ketika menunggang sewaktu larut malam atau awal pagi.
- C17 Tidak menyedari kehadiran pejalan kaki yang melintas di lintasan pejalan kaki, ataupun lintasan berlampu isyarat ketika lampu baru sahaja bertukar merah.
- C18 Lambat menyedari pejalan kaki yang melintas dari sebalik kereta yang diletakkan di bahu jalan.
- C19 Gagal menyedari atau mengagak yang kenderaan lain akan memintas di hadapan anda, dan menghadapi kesukaran berhenti.
- C20 Berlumba dengan pemandu atau penunggang lain.
- C21 Melakukan, atau cuba melakukan, 'wheelie'.
- C22 Secara tidak sengaja memecut dengan terlalu laju dari keadaan berhenti, sehingga tayar bergeser di permukaan jalan raya.
- C23 Secara sengaja memecut dengan terlalu laju dari keadaan berhenti, sehingga tayar bergeser di permukaan jalan raya.
- C24 Bergerak dengan terlalu cepat setelah berhenti, sehingga tayar hadapan terjungkit.
- C25 Memecut sehabis-habisan di atas jalan kampung/pedalaman.
- C26 Mengambil selekoh dengan begitu laju sehingga anda merasakan yang anda hampir terbabas.
- C27 Menukar gear ketika mengambil selekoh.
- C28 Tergelincir di atas jalan yang basah atau penutup pemetungan.
- C29 Makan jalan semasa mengambil selekoh.
- C30 Sukar mengawal motosikal ketika ia dipandu laju (contohnya hendal yang bergegar).
- C31 Membrek atau mengurangkan kelajuan ketika mengambil selekoh.
- C32 Melintas simpang semasa lampu isyarat sedang merah.
- C33 Menunggang di lorong atau lalu lintas yang berlawanan.
- C34 Menunggang di atas laluan pejalan kaki.
- C35 Bercakap di telefon bimbit semasa menunggang.
- C36 Menaip SMS semasa menunggang.
- C37 Membaca SMS semasa menunggang.
- C38 Merokok semasa menunggang.
- C39 Membawa lebih dari seorang pembonceng.
- C40 Melanggar kenderaan lain sehingga menyebabkan kerosakan dan lari dari tempat kejadian.
- C41 Menunggang motosikal yang tidak berada dalam keadaan sempurna.
- C42 Menunggang tanpa memakai topi keledar.
- C43 Membawa pembonceng yang tidak memakai topi keledar.

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- C44 Menghadapi kesukaran mengawal motosikal anda apabila ada pemandu di hadapan membuka pintu keretanya secara tiba-tiba.

Section D

- D1 Menggunakan sut perlindungan kulit *one-piece*?
- D2 Menggunakan jaket perlindungan (kulit ataupun bukan kulit)?
- D3 Menggunakan seluar perlindungan (kulit ataupun bukan kulit)?
- D4 Menggunakan perlindungan badan (pad siku, bahu, lutut dan sebagainya)?
- D5 Menggunakan but perlindungan?
- D6 Menggunakan sarung tangan?
- D7 Memakai pakaian cerah/*fluorescent*?
- D8 Memakai jaluran cerah/*fluorescent* pada pakaian anda?
- D9 Menggunakan lampu rendah semasa menunggang?
- D10 Menghadapi masalah dimana visor/*goggle* anda berkabut?
- D11 Memakai helmet tanpa mengikat talinya?

Soal selidik tamat. Terima kasih.

Appendix B

Principal components analysis of the MRBQ items and mean and standard deviation statistics for composite scales

Table 13 Principal components analysis of the MRBQ items and mean and standard deviation statistics for composite scales

	Factor				
	1	2	3	4	5
	Safety Violations	Traffic Errors	Speeding	Safety Equipment	Precaution
C1: Semasa berbaris untuk masuk ke simpang kiri ke jalan besar, anda terlalu menumpukan perhatian terhadap lalulintas utama sehingga anda hampir melanggar kenderaan yang beratur di hadapan anda.	.15	.61	.28	-.02	-.03
C2: Gagal menyedari kehadiran pejalan kaki yang sedang melintas, semasa anda memasuki simpang dari jalan utama.	.04	.73	.12	-.02	-.18
C3: Memandu melebihi had laju semasa menunggang di kawasan perumahan.	.25	.20	.58	-.10	.00
C4: Tidak menyedari papan tanda "Beri Laluan" dan nyaris melanggar kenderaan yang memiliki laluan.	.18	.64	.30	-.03	-.19
C5: Cuba memotong kenderaan lain tanpa menyedari yang pemandunya sudah memberikan lampu isyarat ke kanan.	.10	.52	.55	-.03	-.08
C6: Memecut setelah lampu isyarat kembali hijau dengan tujuan mendahului kenderaan di sebelah anda.	.13	.33	.67	.01	.09
C7: Menunggang terlalu hampir dengan kenderaan di hadapan sehinggakan jarak tersebut tidak	.24	.32	.62	.00	.01

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selamat untuk berhenti jika ada kecemasan.					
C8: Menunggang melebihi had kelajuan di atas jalan raya.	.22	.31	.71	-.01	.24
C9: Menunggang di antara dua lorong sewaktu lalulintas sedang bergerak laju.	.30	.35	.62	.06	.04
C10: Mengambil selekoh dengan laju sehingga anda sendiri cemas.	.30	.37	.61	.11	.06
C11: Menunggang melebihi had kelajuan di atas jalan kampung/pedalaman.	.33	.29	.70	-.01	.02
C12: Menunggang ketika anda syak yang kandungan alkohol dalam badan anda melebihi paras yang dibenarkan.	.35	.19	.29	.06	-.42
C13: Semasa menunggang dengan kelajuan yang sama dengan lalulintas di sekeliling anda, anda sukar untuk berhenti dengan selamat setelah lampu isyarat merah bertukar merah.	.22	.55	.40	-.05	.00
C14: Anda leka atau lalai sehingga anda lambat menyedari yang pemandu di hadapan sedang memperlahankan kenderaan, dan anda terpaksa membrek mengejut untuk mengelakkan perlanggaran.	.30	.52	.40	-.03	.14
C15: Mengambil selekoh ke jalan utama di hadapan kenderaan lain yang tidak anda sedari sebelum itu, ataupun kenderaan yang bergerak lebih laju dari yang anda sangka.	.26	.65	.32	-.01	.12
C16: Tidak mempedulikan had laju ketika menunggang sewaktu larut malam atau awal pagi.	.18	.32	.64	-.02	.21
C17: Tidak menyedari kehadiran pejalan kaki yang melintas di lintasan pejalan kaki, ataupun lintasan berlampu isyarat ketika lampu baru sahaja bertukar merah.	.20	.63	.38	.01	-.16
C18: Lambat menyedari pejalan kaki yang melintas dari sebalik kereta yang diletakkan di bahu jalan.	.16	.67	.31	.05	.10
C19: Gagal menyedari atau mengagak yang kenderaan lain akan memintas di	.21	.58	.42	-.05	.00

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hadapan anda, dan menghadapi kesukaran berhenti.					
C20: Berlumba dengan pemandu atau penunggang lain.	.49	.26	.46	.06	-.02
C21: Melakukan, atau cuba melakukan, 'wheelie'.	.56	.35	.14	.16	-.25
C22: Secara tidak sengaja bergerak dengan terlalu laju dari keadaan berhenti, sehingga tayar bergeser di permukaan jalanraya.	.61	.28	.37	.10	-.14
C23: Secara sengaja bergerak dengan terlalu laju dari keadaan berhenti, sehingga tayar bergeser di permukaan jalanraya.	.72	.12	.11	.02	.02
C24: Bergerak dengan terlalu cepat setelah berhenti, sehingga tayar hadapan terjungkit.	.58	.31	.27	.07	-.31
C25: Memecut sehabis-habisan di atas jalan kampung/pedalaman.	.63	.30	.31	-.02	-.12
C26: Mengambil selekoh dengan begitu laju sehingga anda merasakan yang anda hampir terbabas.	.49	.45	.33	.08	.09
C27: Menukar gear ketika mengambil selekoh.	.26	.28	.21	.08	.34
C28: Tergelincir di atas jalan yang basah atau penutup pembedahan.	.27	.56	.10	.19	.05
C29: Makan jalan semasa mengambil selekoh.	.37	.52	-.06	.04	.33
C30: Sukar mengawal motosikal ketika ia dipandu laju (contohnya hendal yang berpegar).	.47	.49	.20	.09	.06
C31: Membrek atau mengurangkan pecutan ketika mengambil selekoh.	.02	.08	.26	.12	.49
C32: Melintas simpang semasa lampu isyarat sedang merah.	.39	.25	.37	.00	.08
C33: Menunggang di lorong atau lalulintas yang berlawanan.	.61	.33	-.03	-.03	.20
C34: Menunggang di atas laluan pejalan kaki.	.66	.28	.24	.00	-.02
C35: Bercakap di telefon bimbit semasa menunggang.	.55	.22	.36	.00	.08
C36: Menaip SMS semasa menunggang.	.61	-.08	.03	-.09	.23

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C37: Membaca SMS semasa menunggang.	.52	.18	.45	-.09	.04
C38: Merokok semasa menunggang.	.38	.18	.23	.05	.15
C39: Membawa lebih dari seorang pembonceng.	.48	.17	.30	.07	-.05
C40: Melanggar kenderaan lainsehingga menyebabkan kerosakandan lari dari tempat kejadian.	.48	.26	.02	.00	-.26
C41: Menunggang motosikal yang tidak berada dalam keadaan sempurna.	.45	.04	.26	.04	-.03
C42: Menunggang tanpa memakai topi keledar.	.55	.04	.56	-.02	.20
C43: Membawa pembonceng yang tidak memakai topi keledar.	.58	.07	.55	-.01	.10
C44: Menghadapi kesukaran mengawal motosikal anda apabila ada pemandu di hadapan membuka pintu keretanya secara tiba-tiba.	.17	.56	.15	.10	.06
D1: Menggunakan sut perlindungan kulit one-piece?	.01	.01	.05	.72	-.10
D2: Menggunakan jaket perlindungan (kulit ataupun bukan kulit)?	-.10	.12	.01	.69	.20
D3: Menggunakan seluar perlindungan (kulit ataupun bukan kulit)?	-.01	.05	.02	.77	.01
D4: Menggunakan perlindungan badan (pad siku, bahu, lutut dan sebagainya)?	.04	.00	-.01	.74	-.12
D5: Menggunakan but perlindungan?	.00	.04	.05	.79	-.09
D6: Menggunakan sarung tangan?	.11	.04	-.01	.68	.15
D7: Memakai pakaian cerah/fluorescent?	.03	-.05	.00	.54	.38
D8: Memakai jaluran cerah/fluorescent pada pakaian anda?	.06	.02	-.15	.56	.23
D9: Menggunakan lampu rendah semasa menunggang?	.00	.00	.15	.14	.55
D10: Menghadapi masalah dimana visor/goggle anda berkabut?	.13	.42	.18	.16	.22
D11: Memakai helmet tanpa mengikat talinya?	.34	.28	.33	.06	-.14
Mean	38.50	30.87	20.20	17.73	10.18
S.D.	17.18	11.37	9.46	8.06	4.35



Research Report

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