

Human Risk Factors and Road Accident Causation among Motorcyclists in Malaysia: A Review Article

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Abstract

Road traffic accidents involving motorcyclists have increased steadily over the years in Malaysia. The causation of road traffic accidents is normally related to individual and environment factors. Therefore, this review aims to identify human risk factors for road traffic accidents among motorcyclists in Malaysia. We conducted a systematic review on the following electronic databases: Scopus, Wiley Online Library, Emerald, Web of Science, Google Scholar and Malaysian Institute of Road Safety Research (MIROS) from 1970-2017. A total of 1369 titles were identified and following the screening and review processes (i.e. title screening, abstract screening and full text reviewed), only four studies were included. Results showed that motorcyclists' traffic violation behavior is the main risk factor that contributes to road traffic accidents. This review paper helps to provide an understanding of the role of human factor contributing to road traffic accidents in Malaysia. It is suggested that an effective road safety campaigns could help in reducing the number of road traffic accidents in the future. More studies are needed to provide a better insight on the risk factors that lead to road traffic accidents.

Keywords

Accident causation, human factors, traffic violation, motorcyclists, Malaysia

1. Introduction

Road accident has become an alarming problem in Malaysia. Statistics by the Malaysian Road Transport Department, recorded a drastic increment of 31,860 cases in 2016 with a total accident of 521,466 cases as compared to 489,606 cases in 2015 (Gan, 2017; Official Portal of Road Transport Department Malaysia, 2017). Road accident involving motorcyclists are among the highest death contributors in the country, and this figure did not show any declining sign for the past years and predicted to be increasing in the near future (Abdul Manan, 2014; Abdul Manan & Várhelyi, 2015; Jamaluddin, Ho, Shabadin, Megat Johari, & Ameer Batcha, 2015; Kee, Shamsul, & Goh, 2009). Statistically, Malaysia is among the ASEAN countries with the highest road fatalities based on the overall population (Sultan, Ngadiman, & Kadir, 2016). The highest road fatalities are recorded in 2016 with 7,152 deaths with a severe increment of 6.65% compared to the previous year (Gan, 2017). For every death, the government is facing RM1.2 million losses from the economic contribution of human productivity (Lee, 2015). In 2016, Malaysia has recorded an estimation of RM9.2 billion lost due to the road accidents with a significant increment of RM581.3 million compared to 2015 (Gan, 2017).

2. Literature Review

There are several factors that contribute toward road accidents, and human factors alone contribute approximately 80% of the road crash (Lee, 2015). Human factors that lead toward road accident are referring to

human error and violation behavior. Human error is the unintentional action that made by drivers that subsequently may lead to road accident. Slips and lapses are examples of unintentional mistakes, whereby drivers unintentionally turns on the viper indicator rather than the turning indicator, consequently distract their driving. Meanwhile, violation behavior is referring to drivers' intentional failures by purposely violating traffic rule and regulations.

It is evident that traffic violation behavior predict the occurrence of serious traffic conflicts and road accidents (Abdul Manan, 2014). Several researchers defined traffic violation as driver's behavior of not following traffic regulations such as not wearing seat-belt/helmet, driving over the speed limit, drink-drive, texting and reading text while driving, running over the red light, tailgating and overtaking dangerously (Cristea & Gheorghiu, 2016; Fruhen & Flin, 2015; Wishart, Somoray, & Rowland, 2017). In addition to the above, serious traffic conflicts can also be considered as traffic violation behaviors. Serious traffic conflict refers to the interaction breakdown between two vehicles measured by the gap between the time to accident and the conflicting speed (Abdul Manan, 2014). The time gap will be measured through observation to determine whether drivers are in a serious traffic conflict or otherwise (Abdul Manan, 2014). For example, researchers monitor motorcyclists' faster speed and shorter time gap before entering the primary road from the access point, in order to identify whether such behavior put them in a serious traffic conflict or otherwise (Abdul Manan, 2014). This risky behavior will eventually lead to accident causation. Inconsiderate motorcyclists will jeopardize not only their lives but also other road users.

Apart from that, a violation of the speed limit also been reported as one of the major road accident contributors in Malaysia (Jamaluddin et al., 2015). Similar findings have also been recorded in several European countries like France, United Kingdom (UK) and Norway (Bjornskau, Naevestad, & Akhtar, 2012; Brewster, Elliott, & Kelly, 2015; Cestac, Paran, & Delhomme, 2011; Eyssartier, Meineri, & Gueguen, 2017). Another reason that leads to road accident causation is related to drink-driving among young drivers. It was reported that drink-drive is one of the road accident predictors in the Middle East country like Israel (Elias, Bord, Baron-Epel, Gesser-Edelsburg, & Shiftan, 2017). In addition, fatigue driving is also being considered as road violation behavior according to the Finnish Road Traffic Act (Radun & Radun, 2009). Another study conducted on the commercial bus accident in Malaysia, found that fatigue is among the critical antecedences in road accident causation (Oluwole, Abdul Rani, & Rohani, 2015). Tight working schedule and poor working condition deteriorate workers mental and physical state and subsequently influence their alertness to drive with vigilance.

It is notable that human risk factors indeed play an important role in predicting road accident. Therefore, it is the aim of this review to identify human risk factors that related to road accident causation among motorcyclists in Malaysia from the perspective of human violation behavior.

3. Methodology

A systematic review of the literature was conducted using the following electronic databases: Scopus, Wiley Online Library, Emerald, Web of Science, Google Scholar and Malaysian Institute of Road Safety Research (MIROS). Search terms used to search the relevant articles were: "road accident", "traffic crash", "violation", "offence" and "Malaysia". The search was restricted to studies which were conducted in Malaysia but were not restricted by language and date. Table 1 shows the detailed search strategy according to the electronic databases. After performed the search of literature, all the studies were exported into EndNote X7 reference management software. Next, the titles and abstracts of potentially relevant studies were screened independently by two review authors. To assist the process of screening the relevant studies, inclusion and exclusion criteria have been developed.

Eligibility criteria

Two review authors independently assessed each of the studies based on the following eligibility criteria:

1. Type of research: observational and cross-sectional studies
2. Target person/sample: motorcyclists who either have involved in road accidents or not.
3. Research setting: Malaysia
4. Outcomes: any traffic violation behavior that either led to serious traffic conflict and road accident or potentially regards as accident causation.

Exclusion criteria for this review were:

1. Type of literature: meta-analysis and systematic review paper, thesis and dissertation
2. Research focus: studies that focus on the technical and environmental aspects

After the screening and reviewing process, the final selection of the related studies was decided based on the consensus between the two review authors. Figure 1 shows the PRISMA flow diagram for the search strategy.

Table 1. Search strategies according to the related databased

Databases	Timespan	Search fields	Language	Returns
Scopus	1971 – 2017	All field	English	276
Wiley Online Library	All year	All field	English	359
Emerald	1970 – 2017	All field	English	399
Web of Science	All year	All field	English	74
Google Scholar	All year	All field	English	182
MIROS	All year	All publication	English	79

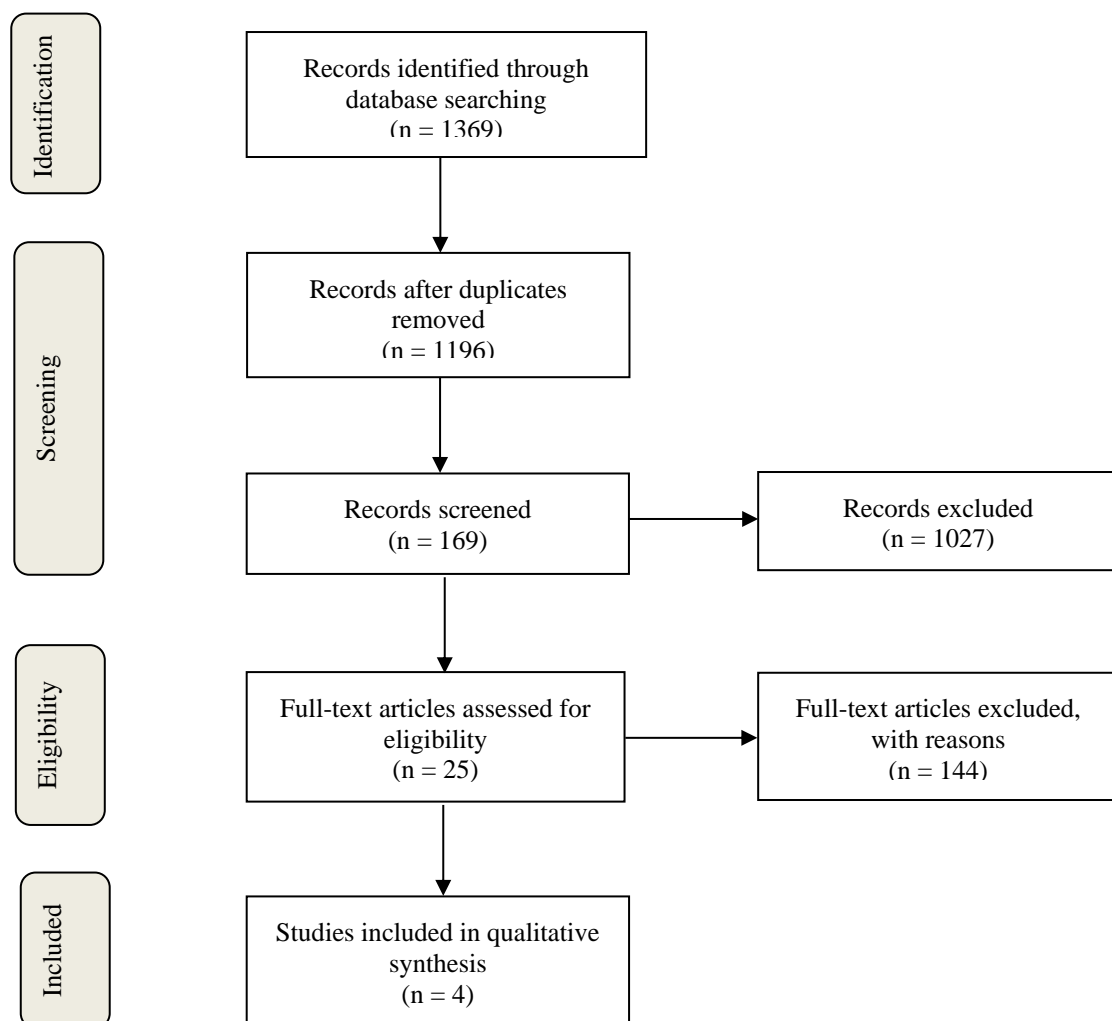


Figure 1. PRISMA flow diagram of the included and excluded studies

4. Results

4.1 Results of the search

A total of 1369 findings have been yielded from the database search. From the overall findings, 173 duplicate articles were excluded. Next, two review authors screened titles of the remaining 1196 findings and excluded any irrelevant studies. A total of 1027 titles were excluded in this process which left only 169 related titles. In the abstract screening process, a total of 144 abstracts were excluded and only 25 related abstracts remained. Out of the 25 full texts, four articles that fulfilled the inclusion criteria were included in this review.

4.2 Type of Study

Two studies evaluate motorcyclist traffic violation that lead toward serious traffic conflict through observation (Abdul Manan, 2014; Abdul Manan & Várhelyi, 2015). The other two studies evaluate motorcyclists' traffic violation behavior that leads toward road accident causation through cross-sectional study (Abdul Sukor, Zakaria, & Peng, 2016; Oxley et al., 2013).

4.3 Outcomes

The outcomes measures were the use of mobile phone while riding (Oxley et al., 2013), not turn on turning indicator (Abdul Manan, 2014; Abdul Manan & Várhelyi, 2015), fail to stop at the stop line (Abdul Manan & Várhelyi, 2015), do not aware of the approaching vehicles (Abdul Manan & Várhelyi, 2015; Abdul Sukor et al., 2016), enter the primary road with shorter time gap (Abdul Manan, 2014), aggressive and reckless driving (Abdul Sukor et al., 2016) as well as exit the access point in a sharp angle (Abdul Manan & Várhelyi, 2015).

4.4 Excluded studies

A total number of 21 studies were excluded from this review due to several reasons. Six studies were excluded because of the different research focus (technical and environmental aspects) (Ambak, Daniel, Mamat, Prasetijo, & Rohani, 2016; Ambak, Ismail, Abdullah, & Borhan, 2010; Kee et al., 2009; Kulanthayan, Raha, Law, & Radin Umar, 2004; Sullman, Stephens, & Yong, 2014, 2015), five studies used a secondary data that were extracted from the MIROS database, police database and other academic databases (Nik, Baharuddin, & Mohamad, 2015; Oxley, Ravi, Yuen, Hoareau, & Hashim, 2013; Ramli et al., 2014; Sambasivam, Karuppiah, Tamrin, Subramaniam, & Naeini, 2014; Sapuan, Razali, & Zamzuri, 2016), four studies used different research sample such as car drivers and truck drivers (Nik Mahdi, Bachok, Mohamed, & Shafei, 2014; Rahman, Zulkifli, Subramaniam, & Law, 2005; Sabir & Isha, 2016; Syed Shazali, Selvam, & Bujang, 2014), another four studies provided only the descriptive findings such as the motorcyclists' demographic information (Abu Bakar, Osman, & Liew, 2016; Ibrahim, Md Nor, Mohamad, & Mohd Yusoff, 2012; Jamaluddin et al., 2015; Pang et al., 2000), one study was a conceptual paper (Sultan et al., 2016) and finally one study discussed the comparison between motorcyclists accidents between in Malaysia and Singapore (Khan et al., 2015).

4.5 The Relationship between Human Risk Factors and Road Accident Causation among Motorcyclists

Traffic violation behavior which lead toward serious traffic conflict

A study conducted by Abdul Manan (2014) which aimed to examine the consequence of motorcyclists' behavior based on the incidence of serious traffic conflict to enter the primary road from the access points. Eight sites located in Arau, Kodiang, Kuala Selangor, Banting, Morib and Meru districts are chosen for this study. A total of 350 observations are selected from 800 observations that are recorded via video recording for 24 hours. The results show that 71% - 74% of the serious traffic conflicts occur due to motorcyclists' behavior such as did not switch on the turning indicator and entering the primary road with a shorter time gap.

Another study is conducted by Abdul Manan and Várhelyi (2015), aimed to observe motorcyclists' behavioral factors that lead to serious traffic conflict when entering the primary road. Motorcyclists' involvement in hazardous situation is measured using the Swedish Traffic Conflict Technique (TCT). Study sites are chosen based on several criteria like the access point with a simple T-junction and access point with a straight section of a primary road. Six observations are selected and coded by the researchers. The results indicate that several motorcyclist conducted hazardous traffic behavior including approaching the stop line of the access point in a high speed, not stopping at the stopping line, stopping beyond the stop line, failure to scan the road for cars, failure to use the turning indicators, enclosing in front of an approaching vehicle or squeeze in between two consecutive vehicles, exiting an access point with a sharp angle and failure to have no any eye contact with the drivers/riders approaching on the primary road.

Table 2. Human risk factors that cause road accident

Study	Subject	Method	Result
Abdul Manan (2014)	350 motorcyclists	Observation	<ul style="list-style-type: none"> - 71% - 74% of the serious traffic conflict caused by the motorcyclists' behavior:- a) Entering the primary road with shorter gap between one vehicle (time gap less than 4 second) and between two vehicles (time gap less than 4 second) b) Not turn on turning indicator
Abdul Manan and Várhelyi (2015)	6 motorcyclists	Observation	<ul style="list-style-type: none"> - Approaching the stop line of the access point with high speed - Do not stop at the stop line - Stop beyond the stop line - Do not scan the road for cars - Do not turn on the turning indicator - Enter in front of an approaching vehicle or squeeze in between two consecutive vehicles - Exit the access point in a sharp angle - Have no eye contact with drivers/riders approaching on the primary road
Oxley et al. (2013)	1750 motorcyclists	Telephone survey	<ul style="list-style-type: none"> - Use hand phone to check message while riding - Texting while riding
Abdul Sukor et al. (2016)	138 motorcyclists	Questionnaire	<p>Motorcyclists' behavior :-</p> <ul style="list-style-type: none"> - Aggressive behavior (28%) - Violation of traffic rules (27%) - Reckless driving (21%) - Not paying attention to other road users (24%) <p>Other road users' behavior :-</p> <ul style="list-style-type: none"> - Not paying attention to motorcyclists (26%) - Reckless driving (25%) - Aggressive behavior (25%) - Violation of traffic rules (24%)

Traffic violation behavior which lead toward the occurrence of road accident

A study conducted by Oxley et al. (2013) is aimed to identify the contributing factors involved in motorcycle commuter crashes. This study is undertaken using a telephone survey of 1,004 motorcyclists who were involved in crashes for the last 2 years (case group) and 746 motorcyclists who do not involved in crash in the last 2 years (control group). The findings showed that the use of mobile phone to check messages and texting while riding are among the contributing factors that cause motorcycle commuter crashes.

Another study conducted by Abdul Sukor et al. (2016), aimed to explore motorcyclist' risk perceptions of a road accident. A total of 138 motorcyclists who commute to work in Penang, Malaysia involved in this study. Results reveal that there are two main factors that lead toward road accident risk perception. The first factor is the motorcyclist' behavior themselves and the second factor is the other road users' behavior. For the first factor, motorcyclist' aggressive behavior (28%), violation of traffic rules (27%), not paying attention to other road users (24%) and motorcyclists' reckless driving (21%) are considered as the risks contributing factors of road accidents. As for the second factor, the risks that are causing road accidents are referring to other road users' behavior of not paying attention to motorcyclists (26%), reckless driving (25%), aggressive behavior (25%) and violation of traffic rules (24%). Table 2 shows the detailed information regarding the selected studies.

5. Discussion and Conclusion

Human factors are indeed played a significant role in explaining the occurrence of traffic accidents. Although there are other contributors such as the technical and environmental aspects, it was evident that human factors alone contribute 80% of the road accident causation in Malaysia (Lee, 2015). As compared to drivers unintentional mistake of slip and lapse, the intentional traffic violation behavior is more significant and becoming the leading factor that cause road accident in Malaysia. As can be seen from the findings, motorcyclists committed some traffic violation behaviors like over speeding, tail tailing, dangerous overtake, run over red light, drink and drive, taking drug, disobey the traffic signage, not stop at the stop line, use of mobile phone while driving and eating while driving. This violation behavior is among the highly risky behavior that can lead toward road accident causation. In addition, motorcyclists and drivers who fail to use helmet and seat belt will eventually put them in the severe traffic accident (Ambak et al., 2010). This review includes data which was gathered from an observation and by interviewing road accident victims. It therefore provides a clear understanding of the risk factors of road accidents' causation among motorcyclist. The data was gathered from the firsthand experience of road accident victims and in a natural setting.

This review paper has several limitations, as the focus of the study is only investigates the accident risk factors among motorcyclists. Therefore, future studies should also address the accident risk factors among other road users such as the car drivers, truck drivers and bus drivers. Moreover, the other limitation is, there is only one cross-sectional study that used respondents of actual road accident victims. Thus, the data gathered might not be comprehensive and conclusive because it involves the general public's perception rather than real experience. It is recommended that, future study should engage actual accident victims. Apart from that, it is also highly recommended for the future study to investigate other factors such as the role of attitude in explaining the road accident causation.

As a conclusion, this review has provided a summary of human risk factors that can contribute toward road accidents among motorcyclists in Malaysia. Motorcyclists' violation behaviour emerged as the main risk factors that contribute toward road accident. This information provided crucial use data for the local authorities such as the Malaysia Road Transport Ministry, Polices Department, MIROS and other related parties to develop the most suitable education and road accident prevention plan in the future. Apart from that, based on this review, it can also be identified that there is a limited number of studies about accidents involving motorcyclists' in Malaysia. Therefore, this review paper will help to provide to date discussion regarding motorcyclists' road accidents risk factors and add a new source of literature to the body of knowledge.

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