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A conceptual framework on the role of road safety management intervention in overcoming road accident

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Abstract

Road accident is a critical problem faced by most countries around the world. Literature showed that human factors contribute the most with 80% of the road accidents in Malaysia. Traffic violation behaviour is one of the human factors leading to the road accident causation. To overcome the drivers' traffic violation behaviour and reduce the accident involvement statistics, the Malaysian government has implemented road safety management intervention of soft enforcement approaches (road safety campaign, education and training) and hard enforcement approaches (penalty, surveillance, fines and tickets). The objective of this paper is to investigate the effectiveness of road safety management intervention through the implementation of soft and hard enforcement approaches in overcoming the road accident involvement. Literatures demonstrated inconsistent findings on the effectiveness of the soft and hard enforcement approaches, which further suggest these variables as the moderators for this study. This study will be conducted on young drivers within the age of 18 to 25 years old who have been involved in road accident within the past 12 months. The research finding will provides the answer for accident involvement among young drivers and further confirms the effectiveness of road safety intervention in Malaysia.

Keywords
Road accident, traffic violation behavior, road safety management intervention

1. Introduction

Road accident is a critical issue faced by most countries around the globe including Malaysia. The number of road accident and road fatalities increases over the year and it has been reported that an average of 20 Malaysian died because of the road accident every day (Thiagarajan, 2017). This surprising statistics has placed Malaysia among the ASEAN countries with the highest road fatalities per overall population. This problem has been identified

as the third leading factor behind the death statistics in Malaysia. To prevent this problem from worsening, numerous efforts have been outlined by the government. Under the road safety management plan, the Malaysian government has established the Road Safety Plan 2014-2020 that mainly aims at reducing road fatality rate. The government exercised both soft enforcement approaches through the use of road safety campaign, educational and training program as well as the hard enforcement approaches through stricter punishments of penalty, surveillance camera, fines and tickets to achieve its objective. Apart from that, these efforts are crucial to ensure that the Malaysian road safety is at the par with the other developing and developed countries.

2. Literature Review

2.1. Accident Involvement

Road accident is defined as the collision or crash involving one or more vehicles that takes place in either highway or other public roads, thus causing light injury, permanent injury, vehicle breakdown or even death (Olusina & Ajanakum, 2017). Review on literature has shown that traffic crash involving young drivers within the age 17 to 25 years old was significantly higher than that of the mature and older drivers in western countries (Rowe et al., 2016). In Malaysia, the similar findings have also been emphasized by scholars as 46% of the fatal and non-fatal accidents are caused by the young drivers aged between 16 to 25 years old (Ramli et al., 2014). The young and novice drivers commit more traffic violations such as speeding, use of mobile phone while driving, tailgating, dangerous overtake, failure to follow traffic signage and drink-drive. These drivers perceived a higher level of risks when driving due to their lack of driving skills and experience. Moreover, they also seem to be "unnecessarily" confident on the road, which caused them to break numerous traffic offences.

2.2. Traffic Violation Behaviour

A study had shown that 80% of the road accidents in Malaysia occurred because of the human factors (Lee, 2015). These human factors are related to the human trait, attributes and psychological limitation contributing to the occurrence of road accidents. Traffic violation behaviour is the leading human factor of road accident causations in Malaysia. Traffic violation behaviour is the drivers' intentional failure to follow the traffic rules and regulation. Some of the traffic violation behaviours are speeding, use of mobile phone while driving, drink-drive, fail to follow traffic signage, run over red light, tailgating and dangerous overtake. A study conducted by Mohamed and Bromfield (2017) reported that drivers' traffic violation behaviour of speeding is one of the significant factors toward the accident causation involving young drivers in Saudi Arabia. Svenson, Eriksson, and Gonzalez (2012) further highlighted that drivers' poor judgement of overestimating their driving skill tend to drive faster but unable to reduce the speed and stop the car on time when sudden incidents happen including a child running over the road. As a result, this risky driving behaviour leads to road accident.

Apart from that, it has been reported that drivers' violation behaviour of using their phone while driving can cause distraction and increase the probability of traffic crash. In a qualitative study by La, Duong, Lee, and Meuleners (2017), it has been stressed that bus drivers' violation behaviour of consuming alcohol over the limit had caused the bus-related accident in Hanoi, Vietnam. Moreover, drivers who failed to follow the traffic signage and tailgating have been confirmed to lead to traffic crash. Similar finding has been obtained by Levulis, DeLucia, and Jupe (2015) reporting that drivers' mistake in estimating the right safe-close distance with the front vehicle has led to unexpected collision when the front vehicle suddenly break because of unforeseen matter. Subsequently, review on literature confirmed that daredevil riders who performed dangerous stunt are likely to put themselves and other road users in danger because of their selfish acts (Ramli et al., 2014). In overall, through the pertinent review on literature, it can be summarised that traffic violation behaviour like over-speed, illegal use of mobile phone while driving, tailgating, driving while intoxicated and failure to follow traffic signage committed by drivers are among the significant factors of road accident causation in most countries around the globe including Malaysia. Therefore, the hypothesis developed for this study is:

H1 : There is a significant relationship between traffic violation behaviour and accident involvement.

2.3. Road Safety Management Intervention

Road Safety Management (RSM) plays the role of formulating and implementing the nation road safety policies to overcome the road accident and road fatality problem. In a more specific definition, RSM is used by the government in defining its aim and road safety target, programming the best and suitable intervention plan, executing the intervention, evaluating the intervention and finally conducting research based on the outcomes. To overcome the alarming road accident issue in Malaysia, the government established the Road Safety Plan 2014-2020 that onlined five main strategic pillars namely Road Safety Management, Safer Mobility and Roads, Safer Vehicles, Safer Road Users and Post-Crash Management. To execute the Road Safety Plan 2014-2020, the Malaysian government has made several interventions, which include soft and hard enforcement approaches.

Soft enforcement approaches are used to deliver the road safety information and knowledge to the public. The government used the media of persuasive communication and education through the implementation of road safety campaign, road safety education program as well as road safety training program to educate the public to abide with the road safety rules and regulation (Olumide & Owoaje, 2016). The Malaysian Road Safety Department conducted several road safety programs and campaigns especially during the festival season (Hamid, 2017). The department is actively educating the public on the importance of road safety by distributing pamphlet, organising the safety campaign in universities and even changing the motorcyclists' old helmet to ensure that they are wearing the standard-compliance helmets and prevent them from fatal-related injuries (Hamid, 2017). Moreover, the Malaysian government has come out with several road safety slogans with a very meaningful message like "Hargailah nyawa anda" (Value your life) and "Biar lambat asalkan selamat" (It's okay to be slow as long as it's safe). All the slogans are usually advertised in the media social, television, radio, newspaper and the highway billboard.

Apart from the soft enforcement approach, the Malaysian government also implemented the hard enforcement approaches that emphasize on stricter methods to ensure that the public abide with the traffic rules and regulation. These approaches use the traffic ticket, fines, penalty demerit system and surveillance camera to discipline the public (Mphela, 2011). Recently, the government has introduced the Automated Awareness Safety System (AWAS) and Demerit Points System also known as "Kejara" (Tarmizi, 2017). AWAS is a system used to catch traffic offenders through the automated enforcement system (AES) camera. Currently, there are 28 AES cameras in Malaysia to monitor the drivers' traffic violation behaviour including speeding and the use of emergency lane (Tarmizi, 2017). The drivers caught by the AES cameras will be fined amounting RM300 and under the "Kejara" system, have their merit point deducted accordingly and finally, their driving license will be revoked once all the merit points have been deducted (Tarmizi, 2017).

2.3.1. The Role of Soft Enforcement Approach to Moderate the Relationship between Traffic Violation Behaviour and Accident Involvement

Scholars have consistently proved that traffic violation behaviour is the significant factor toward the occurrence of road accident (Mohamed & Bromfield, 2017). Thus, to cater this issue, the soft and hard enforcement approaches are used as the governmental intervention plan to practice road safety strategy and policies. Study by Auzoult, Lheureux, Hardy-Massard, Minary, and Charlois (2015) reported that social communication through campaign has positively overcome drivers' speeding behaviour and reduce the speeding related accident in France. In a review study by Yadav and Kobayashi (2015) also reported similar finding where the drink-drive campaign has effectively overcome the road accident. Besides, a meta-analysis study by Elvik (2016) summarized that the persuasive communication and message delivered through the road safety campaigns have successfully reduced road accident statistics. Apart from that, a thorough evaluation on the effectiveness of road safety campaign and advertisement in Spain within the period of 28 years (1980 - 2008) concluded that the success of this intervention was determined through the level of message hardness (Castillo-Manzano, Castro-Nuño, & Pedregal, 2012). The harder the message, the more effective the campaign with the result showing clear reduction in the road fatality rate (Castillo-Manzano et al., 2012).

However, not all soft enforcement interventions promise positive findings. van Schagen, Commandeur, Goldenbeld, and Stipdonk (2016) reported that more than 1/3 drivers in Netherland still violate the speed limit even though the government has actively publicized the anti-speeding campaign and it was reported that this campaign has failed to reduce the accident rate in the country. Similarly, Markl (2016) also stressed that driving under influence (DUI) educational program organized by the Slovene Road Safety Agency failed to overcome DUI problem among the young drivers in Slovenia. Meanwhile, Bhalla et al. (2013) through an observational study

reported that the China road traffic authorities have failed to overcome the speeding and drink-drive problems despite putting much effort on social road safety campaign.

In overall, scholars indeed reported various finding on the effectiveness of the soft enforcement approach, some of the intervention plans show a positive result but some of it failed to do so. Thus, to further address this issue, the effectiveness of soft enforcement intervention plan in overcoming the road accident issue will be further study within the Malaysia setting. Based on the definition of moderator as proposed by MacKinnon (2011), which suggest that a variable is being consider as a moderator when the variable can influence the strength or the final outcome of another variable (i.e. dependent variable). Therefore, the hypothesis developed for this study is:
H2a: Soft enforcement approach (i.e. road safety campaign, education and training) moderate the relationship between traffic violation behaviour and accident involvement.

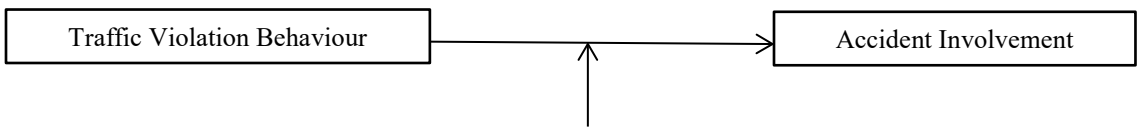
2.3.2. The Role of Hard Enforcement Approach to Moderate the Relationship between Traffic Violation Behaviour and Accident Involvement

As compared to soft enforcement approaches, hard enforcement approaches are more harsh and rigid in disciplining the aberrant drivers. Study by Alonso, Esteban, Calatayud, and Sanmart¨an (2013) reported that the penalty point system and the higher traffic fined imposed by the Spain government has successfully reduced the road fatality problems in the country. Luca (2015) reported similar finding on the effectiveness of traffic ticket issued by the North Carolina authorities on overcoming the aberrant drivers' behaviour and reducing the non-fatal injuries. Skubic, Johnson, Salvino, Vanhoy, and Hu (2013) revealed that the installation of speeding cameras in several experimental location in Phoenix, Arizona has significantly reduced the number of road accidents in that area compared to non-experimental area. The study further added that similar positive outcome was reported even though the speeding cameras were removed from the experimental location (Skubic et al., 2013). Moreover, study by Rosenbloom and Eldror (2013) reported that the success of road accident reduction in Israel was due to the application of the psychological theories of punishment to discipline the drivers in abiding the traffic rules and regulation. Similar application has been also implemented by Greece government through the stricter police enforcement all over the country and has positively reduced the road fatality rate (Yannis, Papadimitriou, & Antoniou, 2008). Apart from that, the US government reported a reduction of 1% in accidents related to drink-drive due to the strict and harsh regulations imposed by the government (Fell et al., 2014). In a review study by Wilson, Willis, Hendrikz, Le Brocque, and Bellamy (2010), it was summarized that the installation of speeding camera was the key safety measure that significantly reduced the road accident statistics in several countries like South Australia, Toronto and Vancouver (Canada), Germany, Denmark and Finland.

Nevertheless, not all hard enforcement approaches deliver positive outcomes. The speeding ticket issued by the Maryland authorities failed to cater the drivers' risky driving behaviour and reduce the number of road accident (Li et al., 2011). Similarly, the Botswana government reported that the nation was only able to achieve a little reduction in the number of road accident despite having a new regulation of a stricter penalties system, higher fined policy and even a longer jail term for traffic offenders (Mphela, 2011). Besides, the Malaysian authorities are also facing similar problem when the stricter regulation of higher fine seemed to be no longer a key solution to discipline the aberrant drivers (Singh, 2016). Most of the Malaysian citizen seem to be unfazed with the government harsh road safety measure and continue to violate the traffic rules and regulation (Singh, 2016).

In overall, the effectiveness of the hard enforcement approach seems to have various findings. Although in most countries, this method indicates a positive finding but in certain countries it failed to do so. Therefore, to further address this issue, the effectiveness of hard enforcement intervention plan in overcoming the road accident problem will be further study within the Malaysia setting. The hypothesis developed for this study is:
H3b: Hard enforcement approach (i.e. penalty, surveillance, fines and tickets) moderate the relationship between traffic violation behaviour and accident involvement.

2.4. Conceptual Framework



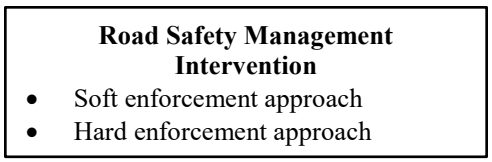


Figure 1. Proposed Conceptual Framework

The proposed conceptual framework as shown in Figure 1 consists of one independent variable of traffic violation behaviour, one moderator of road safety management intervention which being separated into soft enforcement approach and hard enforcement approach as one dependent variable of accident involvement.

2.5. Underpinning Theories

2.5.1. Fear Appeal Theory: The Drive Model

Fear Appeal Theory: The Drive Model is proposed by Hovland, Janis and Kelly in 1953, focus on delivering persuasive message to create fear among audience in order to persuade them from committing any unwanted or undesired outcome (Shen & Dillard, 2014). This model specifies that when the element fear is aroused, a person will try to avoid himself/herself from committing such behaviour. Nevertheless, if the element of fear is been delivered too much, the person will start to act defensively toward the message and denial the danger. Thus, the right propensity of fear element in delivering message is required in order to obtain the maximum outcome (Carey, McDermott, & Sarma, 2013; Shen & Dillard, 2014). This theory is applicable in explaining the proposed research framework through the implementation of soft enforcement approach (i.e. road safety campaign, education and training) executed by the Malaysian government. This theory will help to create fear among the drivers through the persuasive and emotional road safety messages. Persuaded drivers will avoid themselves from committing dangerous driving and abide with traffic regulations. Consequently, the number of accident involvement can be reduced.

2.5.2. Reinforcement Theory

Reinforcement Theory is proposed by Skinner in 1938 explaining on the development of behaviour through the influenced of its consequences (Wei & Yazdanifard, 2014). Individual behaviour can be changed using the element of reinforcement, punishment and extinction. Firstly, reinforcement can be either positive reinforcement or negative reinforcement. Positive reinforcement is a positive outcome (i.e. reward, benefit) given to the individual when he/she able to achieve the desired/targeted behaviour, whereas negative reinforcement is the negative outcome (i.e. unfavourable task) imposed to the individual in order to increase the probability toward performing the desired/targeted behaviour. Secondly, punishment is any negative consequences such as cut off salary imposed to the individual to avoid the unfavorable behaviour. Finally, extinction is a situation where positive reinforcement is given to the individual in order to encourage them to perform the desired behaviour and stop the undesired behaviour. Figure 2 shows the Reinforcement Theory.

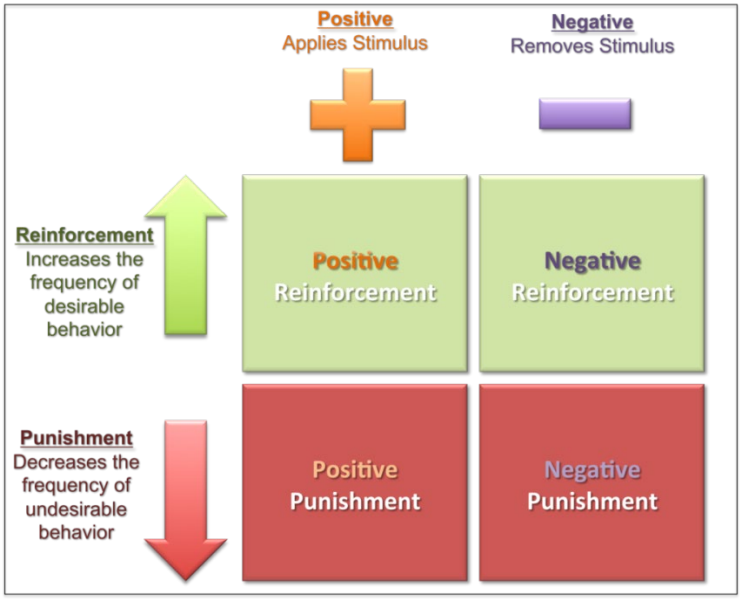


Figure 2. Reinforcement Theory

The Reinforcement Theory is applicable in explaining the proposed research framework through the implementation of hard enforcement approach (i.e. penalty, surveillance, fines and tickets). To promote safe driving, positive reinforcement of claim-free driving reward has been offered by the insurance company when drivers did not involve in any road accident, whereas, the concept of negative reinforcement can be applied through the element of fear toward financial lost, physical injury and probability of losing job due as the outcome of accident involvement. Next, the elements of punishment such as traffic ticket/summon and penalty is imposed to drivers when they broke the traffic rule and regulations. Finally, to extinguish drivers from drive dangerously, all the elements under the Reinforcement Theory need to be executed by the Malaysian authority.

3. Research Methodology

This study will apply the quantitative method through distribution of questionnaire toward young drivers who being categories within the age of 18 to 25 years old who have been involved in any road accident for the past 12 months, possessed a valid driving licence, with at least six month of driving experience and actively driving for the past six months (must drive at least 3-4 times a week). This study will only focus on young drivers who reside or lived in Selangor or Johor or Kuala Lumpur during the accident occurrence. The selection of young driver as the research sample is due to the fact that 46% of the fatal and non-fatal accident in Malaysia happened caused by the young drivers. Apart from that, only three states (i.e. Selangor, Johor and Kuala Lumpur) are chosen for this study because the Malaysian Ministry of Home Affair reported that these three states are among the states with the highest number of road accident cases for the past 10 consecutive years.

3. Conclusion and Discussion

This study will investigate the relationship between traffic violation behaviour and accident involvement. Apart from that, it also will examine the influence of road safety management intervention (soft enforcement and hard approaches) in reducing the accident involvement statistics. Pertinent review on literature confirmed that traffic violation behaviour has led to the occurrence of accidents. In order to overcome the drivers' traffic violation behaviour and reduce the accident involvement statistics, the road safety management intervention of soft and hard enforcement approaches have been implemented by the authorities. Soft enforcement approaches consist of road safety campaign, education and training, whereas hard enforcement approaches comprised penalty, surveillance camera, fines and tickets.

Literatures also showed that some of the soft and hard enforcement approaches were indeed effective in overcoming the drivers' traffic violation behaviour and reduce the accident involvement. Nevertheless, some of

these approaches failed to deliver positive outcome. As a result, inconsistent findings on the interventions made by the authorities to overcome drivers' risky driving behaviour and accident involvement have proved the role of soft and hard enforcement approaches as the moderators to moderate the relationship between traffic violation behaviour and accident involvement. The findings of this study can provide the reasons behind the occurrence of accident involving young drivers in Malaysia and further confirm whether or not the current road safety interventions imposed by the government really work in overcoming this issue. Based on these findings, the best fit of road safety measure can be regulated by the authorities to cater this problem.

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