Research article

Motorcyclists' beliefs of compliance with the Malaysian school zone speed limit (SZSL)

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ABSTRACT

Many road crashes that occur in school zones involve child pedestrians. Research has identified three contributing factors to road crashes, namely child behaviour, driver behaviour, and the environment. This study aims to identify critical beliefs that influence motorcyclist's intention to comply with the Malaysian school zone speed limit (SZSL). 159 Malaysian motorcyclists who have travel experience in school zones during school hours and non-school hours were recruited by using purposive sampling. Participants responded to a survey distributed by enumerators in public places and house-to-house survey conducted in Kedah, Malaysia. Step-by-step correlation and regression analysis were used to identify the motorcyclists' critical beliefs. The results identified that motorcyclists' beliefs of the community expectation for them to comply and that complying with the speed limit in school zones may reduce risk of crashes with school children were the critical beliefs. In addition, the observation of many motorcyclists in the school zone was also identified as critical beliefs influencing motorcyclists' intention to comply with the SZSL. The practical relevance of this study is to combine a public awareness campaign and safety education for the motorcyclists together with an enforcement method to reinforce motorcyclists' compliance with the SZSL. Additionally, to increase the awareness level among motorcyclists, traffic control devices, such as flashing lights and yellow lines could be implemented.

1. Introduction

Pedestrians are vulnerable road users to the extent that they have a limited chance to survive a crash, especially if the vehicle speed (of the crash vehicle) is >30 km/h [1]. The risk is higher if the pedestrian is a child, [2]. In Malaysia, school zones are among the most common locations for road crashes that involve schoolchildren. In 2015, for instance, 286 crashes occurred in Malaysian school zones. Among these crashes, a total of 60 schoolchildren aged between 7 and 20 years were injured and 18 schoolchildren have died [2]. Although the pedestrian injury and death in children of age 20 and below has decreased as compared to that in 2011, the figure is still high, presenting a challenge to protect child pedestrians; consequently, to address this problem, the local and federal governments have identified child pedestrians safety and mobility as high priorities. Therefore, investments are constantly allocated through different safety improvement programmes.

The development of a cost-effective safety improvement programme requires research and modelling to guide decision makers. In the past decade, although considerable research efforts were directed towards addressing road safety issues of child pedestrian crashes, there appeared to be very little research in regard to other road users' behaviour in school zones, such as car drivers and motorcyclists. This lack of studies may be due to the evidence that suggested that child pedestrian crashes most often occurred because of child behaviour [3,4]. However, some studies indicated that road-users violation of speed limit did occur in school zones. For instance, studies have found that drivers are likely to drive >10 km/h above the posted speed limit in school zones [5–7]. Studies have also shown that children face a high level risk in school zones. As an example, a study on 50 school zones found 760 examples of conflict between schoolchildren and motorised vehicles [8]. These conflicts were vehicles braking, decelerating or swerving to avoid hitting children who were crossing the road. This has raised questions about factors that may influence road users' behaviour in school zones. Furthermore, it is important to note that the studies mentioned above were engineering-based, and thus did not provide an understanding of the behaviours of road users who do not comply with the SZSL. This represents a gap in current knowledge.

1.1. Malaysia and school zones

Malaysia has two typical school sessions. A schoolchildren cohort attends school for the morning session which starts at 7.30 am and ends at 1.00 pm, while a second schoolchildren cohort attends the afternoon

session which starts at 1.00 pm and continues until 6.30 pm. The peak times for schoolchildren to be exposed in school zones are at 6.45 am to 7.45 am, when the first cohort of schoolchildren arrives, then at 12.00noon to 2.00 pm when the first cohort leaves and the second cohort arrives, and finally, at 6.00 pm to 7.00 pm when the second schoolchildren cohort leave. Between these times, there are also schoolchildren who go to and and return from school for extra classes and co-curricular activities. There are many interactions between schoolchildren and vehicles in the morning (6.45 am to 7.45 am) and at noon (12.00noon- 2.00 pm), increasing the risk of child pedestrian crashes.

Many schools in Malaysia are located on a major road (single or dual carriageway) and/or highway where the average posted speed limit ranges from 70 km/h to 90 km/h. Regardless of these different settings, the speed limit for school zones, which is set at 30 km/h by the road authority, is permanent (i.e. this speed reduction applies 24 h a day, every day of the year). In addition, the minimum requirements for the warning signs are the same (i.e. "Children Crossing" signs, 30 km/h speed limit signs, and "School Zone" signs). To raise further awareness of the speed limit reduction among drivers and motorcyclists who drive or ride through a school zone, some school zones have signalised crossing facilities and traffic calming measures, such as speed hump and transverse bars. Furthermore, some schools have other facilities to help schoolchildren handle the traffic when crossing the road, such as zebra crossings, pedestrian bridges, and traffic wardens. However, these facilities do not protect children who fail to use them or from drivers who choose to speed through school zones. Therefore, crashes still occur in school zones due to inappropriate schoolchildren behaviour, and drivers' failure to notice the presence of school zones or children within the school zones.

In addition, to improve children's traffic safety-related knowledge and behaviour, the Road Safety Education Programme (RSEP) in Malaysian schools was commenced in 2007 for the primary-aged children. By the end of 2010, primary schoolchildrenwould receive a minimum of eight lessons on road safety education. The training and education of RSEP for secondary-aged children were commenced in 2011. RSEP is a lifelong process to teach safe traffic habits to young children, so that such habits will become part of the culture and practice in their daily lives. Safety education programmes may improve children's knowledge in dealing with the traffic (i.e. road crossing behaviour) [9]. However, there are still many available options to improve road safety for schoolchildren.

Given the community's concerns and countermeasures that have been put in place, research evidence suggests that drivers and motorcyclists are not complying with the SZSL. Furthermore, the rate of child pedestrian crashes in Malaysian school zones, and greater noncompliance levels with the SZSL, or even when a vulnerable group is involved, have suggested a better understanding of the reasons for noncompliance with the SZSL is required.

1.2. Beliefs and intentional behaviour

In order to understand a motorcyclist's behaviour, the present study uses the Theory of Planned Behaviour (TPB), which has been widely applied in social behavioural research including road safety-related behaviour [10–12]. The TPB is a simple model of relationship that links beliefs and behaviour [13]. The basic explanation is that TPB suggests that behaviour is a function of salient beliefs relevant to behaviour. Three kinds of salient beliefs in the TPB are: behavioural beliefs are assumed to influence attitudes towards behaviour; normative beliefs constitute the underlying determinants of subjective norms; and control beliefs provide the basis for perceptions of behavioural control. The behavioural, normative and control beliefs people hold about their behaviour performance are influenced by a range of cultural, personal and situational factors [13]. For instance, they may be affected by the surroundings, social environment and exposure to information and experience.

Therefore, in relation to the current study, it is suggested that behavioural, normative and control beliefs may influence intention to comply with the SZSL among motorcyclists.

To date, there has been minimal research that linkedroad users' beliefs with intention to comply with speed limit, specifically in the school zone context [14]. In comparison with a previous study [14] in the context of car drivers and which employed a qualitative method, the current study focuses on motorcyclists and the belief study employs a quantitative method. This study is aimed to identify critical beliefs that influence motorcyclists' intention to comply with the SZSL; thus, addressing the gap in current knowledge.

2. Methods

2.1. Participants, research setting, study period and procedure

Participants were recruited based on their experience and involvement in related research topics, and those with opinions that interest the researcher [15]. In particular, people who have travel experience in school zones during school hours and non-school hours may have valuable information relevant to this study. Purposive sampling can be used to identify suitable participants to represent the group [15]. Therefore, 159 motorcyclists of various ages who had driven through a school zone were recruited for the survey. The sample was drawn from motorcyclists at Kubang Pasu, Kedah in 2015.

Data collection was assisted by trained enumerators. The enumerators were briefed, about the research before they started, including a brief explanation of the research purpose, incentives offered, and ways to participate. Anonymity and confidentiality assurances were also provided in the survey form. Approached individuals were given the option to either participate by answering the questionnaire or do not respond at all. Data collection was performed by both house-to-house visits and in public areas, such as public halls. Before data collection, the survey was piloted and minor amendments were made based on the feedback received. All questions were in Bahasa Melayu. In this paper, back-to-back translation was used to ensure that the sentences are similar in meaning.

2.2. Ethics

The research has been approved by Research and Innovation Management Centre (RIMC) Universiti Utara Malaysia.

2.3. Instrument

A cross-sectional paper and pencil were used as the survey instrument to sought motorcyclists' response on items related to behavioural, normative and control beliefs. The questionnaire used guidelines provided by Ajzen [16], the founder of the Theory of Planned Behaviour (TPB).

The survey was divided into two sections. In Section 1, respondents were asked about general demographic questions, including age, gender and riding experience. Section 2 consisted of questions related to behavioural, normative and control beliefs.

The following measures were operationalised in relation to compliance with the speed limit in school zones. The general beliefs questions consisted of outcome beliefs, normative beliefs, and control beliefs, which were based on the results of Study 1. All beliefs questions were assessed by using a 7-point scale, ranging from 1 (extremely unlikely) to 7 (extremely likely). Examples of the questions are as follows.

2.3.1. Behavioural beliefs

"How likely is it that the following outcomes would result if you were complying with the speed limit in school zones in the next month?" This question was followed by six statements of outcome beliefs, such as "I would be helping to keep the school children safe".

2.3.2. Normative beliefs

"How likely is it that each of the following people, or groups of people, would think that you should comply with the speed limit in school zones in the next month?" This question was followed by seven significant statements that may influence the respondents' complying behaviours, such as "My parents".

2.3.3. Control beliefs

"How likely would it be that each of the following factors would stop/encourage you from complying with the speed limit in school zones in the next month?" This question was followed by 18 statements related to situations that may influence the respondent's complying behaviour in school zones, such as "The need to be somewhere urgently" and "Seeing a police vehicle or police officer".

2.3.4. Intention

Four items were used to measure the intention to comply with the speed limit in school zones in the next month. Each item was rated on a 7-point unipolar scale. The four items were: "To what extent do you plan to comply with the speed limit in school zones in the next month?" (not at all/definitely will); "How willing would you be to comply with the speed limit in school zones in the next month?" (not at all/very willing); "Do you intend to comply with the speed limit in school zones in the next month?" (not at all/definitely will); and "How likely you will comply with the speed limit in school zones in the next month?" (not at all/very likely). The means that the items serve as a measure of intention.

In this study, the phrase "Complying with the school zones speed limit" refers to any occasion during which the respondents are travelling at or below the speed limit of 30 km/h in a school zone on a school day (i.e. when school is in session, before classes start and after school sessions finish). This definition was presented after the general demographic questions.

2.4. Data analysis

All data were analysed by using the Statistical Package for the Social Sciences (SPSS) Version 22.0. Prior to analysis, the data were screened for entry accuracy and missing values. As such, a visual inspection of the data was conducted. From 159 questionnaires, 8 cases were removed from analysis because they were missing >80% of total responses and were considered to be inadequate sources of information. Therefore, only 151 questionnaires were used in the analysis.

To identify the critical beliefs underpinning motorcyclists' intention to comply with the SZSL, the von Haeften and colleagues' guidelines were used [17]. This approach is a three-step analysis. First, the Pearson correlations were calculated to identify the behavioural, normative, and control beliefs which were significantly correlated with intention. After that, only those beliefs found to be significantly correlated with intention were entered into the initial series of regressions. Note that a separate regression was conducted for each belief type (i.e. behavioural beliefs, normative beliefs, control-barrier beliefs, and control-facilitator beliefs). Beliefs were found to significantly contribute to the prediction of intention in the second step were entered into one final regression analysis to predict intention.

3. Results

3.1. Participants' profile

Based on Table 1, out of 151 participants, 55% were males, and 45% were females. Meanwhile, 48% of the participants were under 26 years old. There was satisfactory representation of drivers who hold a motorcycle driving license (76%), while 24% of the participants did not have a driving license. Most of the participants had riding experience in <16 years (71%). This study had focused on those who have ridden

through a school zone; thus, all participants had ridden at least once through a school zone during the school day.

3.2. Correlation and regression analysis

The means and standard deviations of the beliefs and the correlation coefficients with intention are reported in Table 2. The beliefs that were significantly correlated with intention were then entered into the initial series of beliefs-based regression analysis. Table 2 only shows the beliefs that are significantly correlated with intention to comply with the SZSL. Out of six behavioural beliefs items, only three, as stated in Table 2, were significant, and thus were entered into the Step 2 of regression analysis.

Table 1
Demographic distribution of participants.

	Frequency	%
Gender		
- Male	83	55
- Female	68	45
Age		
- <16 years old	2	1
- 16–20 years old	43	28
- 21–25 years old	28	19
- 26–35 years old	31	21
- 36–45 years old	24	16
- > 45 years old	23	15
Driving licensed		
- Yes	115	76
- No	36	24
Years of experience riding a motorcycle		
- <5 years	30	20
- 5–10 years	60	40
- 11–15 years	16	11
- 16–25 years	25	17
- > 25 years	15	10

Table 2
Means and standard deviations of the individual behavioural beliefs, normative beliefs, control beliefs and correlations with intention to comply with the SZSL.

	M	SD	r
Intention to comply with SZSL	5.46	1.31	
Behavioural beliefs			
I would be helping to keep the school children safe.	5.87	1.51	0.39**
I would feel more safe than if I was riding at >30 km/h.	5.13	2.22	0.24**
It would reduce the chances of me having a crash involving a school child or children.	5.74	1.73	0.40**
Normative beliefs			
Parent	5.34	2.23	0.21*
Husband/Wife	4.24	2.84	0.22**
Friends	4.91	2.19	0.34**
Other motorcyclists	4.78	2.17	0.39**
Other family members	5.33	2.13	0.34**
General public	4.86	2.26	0.45**
Control beliefs (Barriers to compliance)			
Seeing that there are not any school children in the school zone.	4.07	2.10	0.17*
Control beliefs (Facilitators of compliance)			
Knowing it is a school day.	5.51	1.91	0.21**
Seeing flashing lights in operation.	4.83	1.89	0.24**
Seeing school children on the foot path in the school zone area.	5.41	1.91	0.27**
Seeing a crossing supervisor.	5.05	2.09	0.14*
Seeing adult pedestrians on the foot path in the school zone area.	5.08	2.03	0.21**
Seeing many motorcyclists in the school zone.	5.53	2.03	0.33**

Note: Significance level p < 0.05*, p < 0.01**.

In terms of normative beliefs, with the exception of the normative belief of 'fiancé/special boyfriend or girlfriend', which was not a significant predictor, all six beliefs examined were significant in the initial normative beliefs regression analysis and therefore, entered into the subsequent regression model. For control beliefs, one barrier to compliance and six facilitators to compliance with SZSL were significantly correlated with intention to comply with the SZSL and therefore, were entered into the subsequent regression model.

In Step 2, multiple regression analysis was conducted for each correlated belief (i.e. behavioural beliefs, normative beliefs and control beliefs which were facilitators of compliance). Only four beliefs were identified to significantly influence the intention to comply with the SZSL among motorcyclists. Which are: I would be helping to keep the school children safe (β: 0.21, $p < 0.05$); It would reduce the chances of me having a crash involving a school child or children (β: 0.24, $p < 0.05$); General public (β: 0.35, $p < 0.05$); and Seeing many motorcyclists in the school zone (β: 0.25, $p < 0.05$).

All of these significant five key beliefs, including "Seeing that there are not any school children in the school zone" (i.e. 5 beliefs) identified in this initial round of regressions were subsequently entered into the final regression analysis (Table 3). This final step was to identify the critical beliefs for potential future interventions.

As shown in Table 3, within the Step 3 regression model, three of the five beliefs contributed significantly to the prediction of intention to comply with SZSL, with this final model explaining 33% (adjusted R^2 = 0.30) of the variance in intention to comply with SZSL. The three predictors included behavioural, normative and control beliefs. In particular, these were the behavioural beliefs of 'It would reduce the chances of me having a crash which involve a schoolchild or schoolchildren' (β = 0.20, $p < 0.05$); General public (β = 0.36, $p < 0.05$) as a significant normative referent group; and the barriers/facilitators of 'Seeing many motorcyclists in the school zones' (β = 0.18, $p = 0.05$) as the significant critical beliefs predicting the intention to comply with the SZSL.

4. Discussion

This study was based on a well-established social psychological model (i.e. TPB) to identify critical beliefs that may influence motorcyclists' intention to comply with the SZSL and provide some recommendations to develop countermeasures that could help reduce the risk of pedestrian and motorcyclist crashes in a school zone.

Overall, this study has identified that behavioural, normative and control beliefs have influenced motorcyclists' intention to comply with the SZSL. These three beliefs are particularly important for the motorcyclists since they determine their behaviour towards compliance with the SZSL such that these beliefs may increase motorcyclists intention to comply with the SZSL. In particular, the results showed that behavioural beliefs of "It would reduce the chances of me having a crash that involve schoolchildren"; normative beliefs about "General public"; and the control beliefs about "Seeing many motorcyclists in the school zones" are critical beliefs that independently contribute to the prediction of intention to comply with the SZSL, with the beliefs explaining 33% of the variance. These three beliefs may increase motorcyclists'

intention to comply with the SZSL. Findings suggested that besides the concern of getting involved in crashes with schoolchildren, the motorcyclists are also widely concerned about the general public perception of their behaviour in school zones (i.e. speeding in school zones). Additionally, the presence of many motorcyclists in the school zones suggests that motorcyclists may require more visible and noticeable school zones to facilitate their compliance with the SZSL in Malaysia. Given that school zones had a much higher absolute risk of child-pedestrian crashes than other areas [5], these findings are as expected. Further, these findings also are in line with previous research related to intention to comply with SZSL among car drivers [18]. Therefore, the present study provides valuable understanding of motorcyclists' beliefs of intention to comply with SZSL.

The present study have a few limitations in the methodological aspects that warrant careful consideration. First, the use of self-report measures to assess the motorcyclists' beliefs of intention to comply with the SZSL may not have been a reliable measure in use. It is possible that some participants overstated their answers by reporting high levels of positive belief compliance. There is a possibility that the researcher missed prospective participants because they did not realise that they had gone through a school zone. However, the possibility is rather small because the participants were local residents who were generally knowledgeable about the local area. Furthermore, it is important to note that the belief items were constructed based on the guidelines provided [16] and the research was ensured that all participants understood the anonymity of the questionnaire. In addition, the sample of this survey was considered as moderate; thus, the results may not be generalised to all motorcyclists across Malaysia. While this is not a unique case, it still warrants the need for replication of results, which in turn can provide more general explanations.

5. Conclusion

The present study provides some insights into motorcyclists' beliefs about compliance with the SZSL. Based on the results, it is recommended that motorcyclist intervention should focus on reinforcing positive beliefs towards compliance with the SZSL, making motorcyclists more likely to have the intention to perform the behaviour. Furthermore, these motorcyclists believed that the general public would approve their compliance behaviour. Thus, public promotion of road safety would be beneficial. Last but not least, the present research findings suggested the need to increase the school zones visibility with the use of more noticeable traffic control devices, such as flashing lights, yellow lines, and so on. This intervention could improve motorcyclists' compliance, as it increases the visibility of school zones, thus strengthening motorcyclists' awareness as they approach or pass through a school zone.

Most importantly, the present findings provide a firm basis for future research direction towards efforts to inform strategies to improve complying behaviours among road users, especially motorcyclists in school zones.

Table 3
Regression analysis to identify the critical belief-based targets.

Items	R^2	β
	0.33	
I would be helping to keep the school children safe		0.05
It would reduce the chances of me having a crash involving a school child or children		0.20*
General public		0.36*
Seeing that there are not any school children in the school zone		0.05
Seeing many motorcyclists in the school zone		0.18*

Note: Significance level $p < 0.05$*.

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