A STUDY OF FACTORS AFFECTING WRONG-WAY RIDING BEHAVIORS AMONG MOTORCYCLISTS: THE CASE OF URBAN ARTERIAL ROAD IN KHON KAEN CITY, THAILAND

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ABSTRACT

The wrong-way riding behaviors are increasingly found in Thailand, which could result from personal habits or inappropriate road design. The aim of the present study was to explain variables affecting the wrong-way riding behaviors of motorcyclists on Mittraphap Road, Khon Kaen City, Thailand. Data was collected from 200 motorcyclists and analyzed using the Structural Equation Model (SEM) and the Theory of Planned Behavior (TPB), which is a traffic psychology module including Attitude (ATT), Subjective Norm (SN) and Perceived Behavioral Control (PBC). The results indicated that the wrong-way riding intention model and wrong-way riding behavior could explain 58% and 39% of the variance of intentions, respectively, where the most significant factor of intention (IN) was subjective norm (SN). The outcome of this study is useful for responsible agencies to determine the required traffic safety strategies in order to reduce motorcycle accidents in the area of Khon Kaen City.

Keywords: *Theory of Planned Behavior, Motorcycle accident, Subjective Norm, Perceived Behavioral Control, Student.*

1. INTRODUCTION

Thailand has the highest record in the world statistics of road accident deaths and a high rate of deaths from motorcycle accidents in the world [1]-[6]. Currently, the problem of road accidents is the main issue of interest for the government and private sectors because road accidents affect tourism, industry, economy, livelihood, etc.

Figure 1 demonstrates percentages of the causes of road accidents compiled by Royal Thai Police. The highest cause of road accidents found was excess of speed limit, sudden cut-in, or sudden stop from cut-in vehicle, approaching vehicle in front too closely, unskilled driver, not giving the right of way, drunk driving, driving on the wrong way, respectively. Driving on the wrong way was the 5th cause of accidents and traffic lights or signals violation; traffic sign violation (include wrong way riding, Red-light running etc.) was the 6th cause of accidents in Thailand [7].

From 2008 to 2012, a study was conducted in France on the crashes of passenger cars, motorcycles, trucks and buses from driving on the wrong way. It was found that most drivers in this case were men aged over 65, most of the accidents occurred from 06.00 P.M. to 06.00 A.M., and most drivers were drunk [8]. In addition, based on data from the United States and other nations found wrong way driving is notorious for its severity and more frequency [9]-[15].

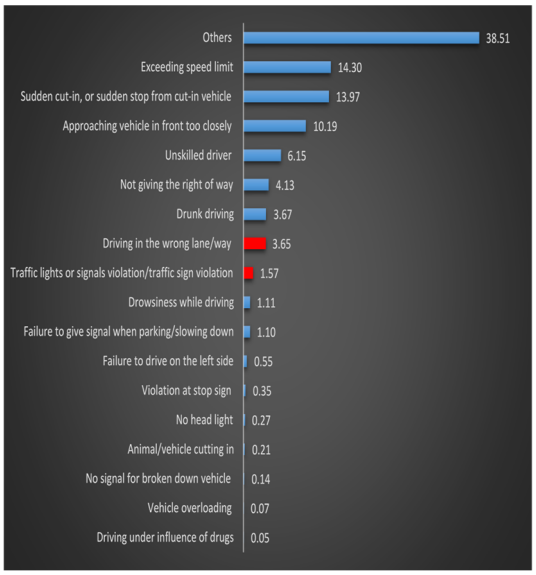

Figure 1 Percentages and means of the causes of road accidents in 2013-2015 [7]

In Thailand, motorcycles are popular among road users. However, most riders still adopt risky behaviors

during riding such as omission of helmet use, riding with high speeds, riding after drinking alcohol, and more [16], [17]. These issues have been studied by many researchers, especially in Thailand. However, studies on the behavior related to riding on the wrong side of the road are few although this behavior is becoming common and no concrete measure has been taken against it.

Khon Kaen city is the center of northeastern Thailand. It is a connection point from one city to another and also an important city of education, trade, health care, etc. The growth of the city has led to urban and road expansion, especially Mittraphap Road, which is the major road of the city as shown in Figure 2. One of the problems found related to traffic on this road is the wrong-way riding of motorcyclists as shown in Figure 3, a problem that can lead to dangerous collision. A study of speed on Mittraphap Road showed that the average speed of vehicle is 70 km/hr and that of motorcycle is 50 km/hr. If a motorcycle crashes from wrong-way riding, death is likely to result. One case can be quoted about this kind of accident: A motorcycle riding on the wrong way was crashed by a truck. The rider died on the spot as shown in Figure 4 [18]. This risk behavior is a new issue for Khon Kaen city authorities to take relevant action so that loss of life and asset will be reduced.

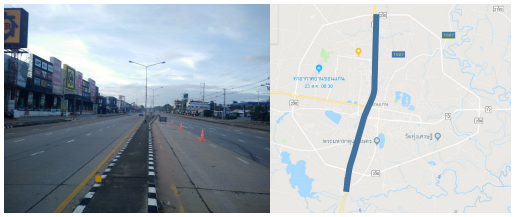

Figure 2 Mittraphap Road, Khon Kaen City, Thailand

Figure 3 Wrong-way riding of motorcyclists on Mittraphap Road, Khon Kaen City, Thailand

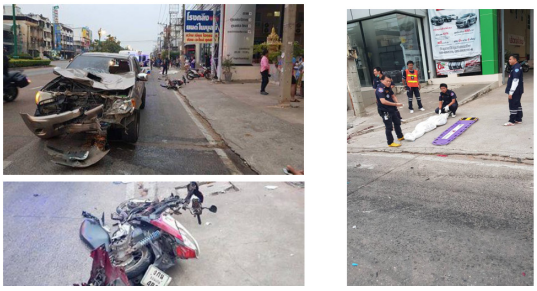

Figure 4 Example of accident case [18]

This study aims to investigate the influence of psychological factors, including attitudes, norms and perceived behavioral control of teen drivers' behavior of wrong-way riding on Mittraphap Road, Khon Kaen City, Thailand. The findings should provide practical information for more effective measures that lead to road safety.

2. METHODOLOGY

2.1. DATA COLLECTION

This article is based on the data collected from the sample group derived from the Purposive Sampling method as the study was carried out on the wrong-direction riding behaviors of teenage motorcyclists. The questionnaire informants comprised the teenagers who had experience in long-direction riding on Mittraphap Road in Khon Kaen City. The steps in the data collection were: 1) explaining the background of the research and the parts of the questionnaire, 2) the informants answered the questionnaire in 10-20 minutes, 3) the researcher collected the questionnaire and made certain that everything was accounted for.

2.2. QUESTIONNAIRE SURVEY

The Theory of Planned Behavior (TPB) clarifies the intention (IN) influenced by three factors including Attitude (ATT), Subject Norm (SN) and Perceived Behavioral Control (PBC) as shown in Figure 5. Attitude towards the behavior and Subject Norm would be determined by Behavioral belief; Normative belief and the Perceived Behavioral Control (PBC) was determined by Control belief – feeling difficult or easy to perform a behavior [19]-[21].

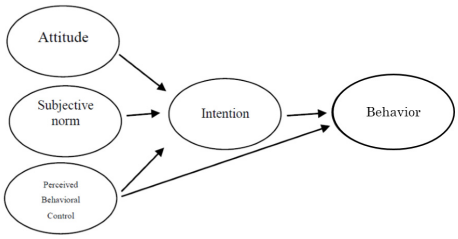

Figure 5 The Theory of Planned Behavior (TPB)

The questionnaire survey which examined direct measurements followed the principles of TPB [5], [22]. All questions were measured by a 5-point scale. Examples of TPB items: "Wearing a helmet is a benefit", "Most people wear a helmet when driving on campus", "For me, to wear a helmet is easy", "How often do you wear a helmet in KKU?" (Table 1).

Therefore, we employed the TPB to explain intention of wrong-way riding. Accordingly, we proposed the following hypotheses:

H1: Attitude (ATT) variable is positively related to the intention of wrong-way riding.

H2: Subjective Norm (SN) variable is positively related to the intention of wrong-way riding.

H3: Perceived Behavioral Control (PBC) variable is positively related to the intention of wrong-way riding.

H4: Intention (IN) variable is positively related to the wrong-way riding behavioral variable.

H5: Perceived Behavioral Control (PBC) variable is positively related to the wrong-way riding behavioral variable.

Based on the aforementioned literature review, the following explains our study models and hypotheses (Figure 6).

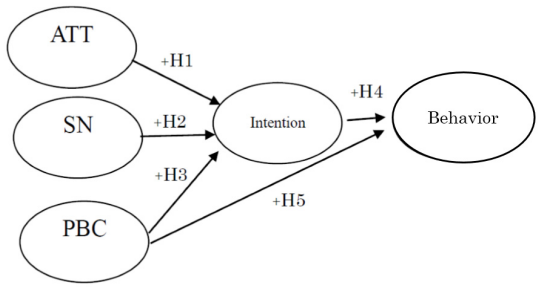

Figure 6 Proposed study framework

2.3. DATA ANALYSIS

The analysis was adapted from Kumphong et al. (2017) [22]. Overall, the model fit was evaluated against the number of recommended fit statistics and fit indices based on Hair et al. (2010) [23]. The factor analysis was applied on latent variables (Attitude (ATT), Subjective Norm (SN), Perceived Behavior Control (PBC) and Intention (IN)) from the questionnaire. Reliability of the latent variables was analyzed by Cronbach's α. All variables were analyzed based on TPB by Confirmatory Factor Analysis (CFA). The final part used the Structural Equation Modeling (SEM) to analyze all variables. Respondent's factors (ATT, SN and PBC) were positively related to the behavioral intention of wrong-way riding. IN and PBC were also positively related to the behavior of wrong-way riding [23].

3. RESULTS AND DISCUSSIONS

3.1. DEMOGRAPHIC DATA OF THE SAMPLE

The study of helmet wearing behavior change was done by the questionnaire survey from 200 student motorcyclists (60% male and 40% female), whose average age was 21 years old. 72% had a driver's license, and the average riding experience was 6 years. The interesting point founds were: the average of 1 time/year of a near-crash of participants, 45% had no experience of accident, only 8% experienced property loss and damage, and 44% were involved in minor injuries whereas only 3% had severe injuries (Table 2).

3.2. VALIDITY OF MEASUREMENT MODEL

The results of reliability and validation estimation were presented in Table 3. All values of reliability and validation followed a good rule of internal consistency and rule of thumb, suggesting adequate convergence. In other words, Cronbach's α, refers to consistent answers from identical group questions (e.g., Items for SN measure) of the respondents. The values threshold of 0.7 is acceptable. As a result, these values indicate latent variables of TPB model, which are good reliable representative values to explain the model. Table 4 shows that all latent variables (ATT and SN) correlated

with the IN variable at 0.1% level of significance.

3.3. TEST OF A STRUCTURAL MODEL

We present the indexes in Structural Equation Model and factors influencing the indexes with standardized path coefficients. The most often indicated number of recommended statistics and indices in Tables 5 and 6 are fitted for the SEM according to Hair et al. (2010) [23]. Therefore, the model fits in terms of the theoretical constructs and observation constructs. We carried out SEM for independent TPB and extended TPB models. Figure 7 shows the result of structural models with standardized path coefficients for TPB model. The TPB model fit could pass a number of recommended fit indices. TPB model could explain 58% of variance for wrong-way riding intentions and 39% of variance for wrong-way riding behavior. From the TPB model, ATT and SN were found to positively and significantly correlate with the helmet use intention (IN). SN was the most significant and highly influential factor. In addition, the TPB model indicated that IN positively and significantly correlated with the wrong-way riding behavior.

Table 1 Concepts and scales

Item	Scoring	M	SD
Attitude (ATT)			
ATT1 Wrong-way riding, it would be	1 = Bad : 5 = Good	1.45	0.933
ATT2 Wrong-way riding, it would be	1 = Harmful : 5 = Benefit	1.42	0.958
ATT3 Wrong-way riding, it would be	1 = unpleasant : 5 = Pleasant	1.41	0.946
ATT5 Wrong-way riding, it would be	1 = Unlikely : 5 = likely	1.44	0.944
Subject norm (SN)			
SN1 I think people who are important to me (Parent/friend/relative) would think I need....	1 = Disagree : 5 = Agree	1.51	0.908
SN2 I think these people are important to me (Parent/friend/relative) would think I should...	1 = Disagree : 5 = Agree	1.34	0.766
SN3 I think people who are important for me (Parent/friend/relative) would think I support	1 = Disagree : 5 = Agree	1.34	0.847
Perceived Behavioral Control (PBC)			
PBC1 Wrong-way riding, it would be	1 = Very hard : 5 = Very easy	3.13	1.468
PBC2 Wrong-way riding, it would be	1 = Impossible : 5 = Possible	3.57	1.362
PBC3 Wrong-way riding, it would be	1 = Unable to : 5 = Able to	3.09	1.533
Intention (IN)			
IN1 Next 3 months, I will wrong-way riding...	1 = Disagree : 5 = Agree	1.58	0.979
IN2 Next 3 months, I want wrong-way riding...	1 = Disagree : 5 = Agree	1.42	0.835
IN3 Next 3 months, I intent wrong-way riding...	1 = Disagree : 5 = Agree	1.42	0.846
Self-report behavioral (B)			
B How often you wrong-way riding...	1 = Never: 5 = Always	1.63	0.817

Table 2 Demographic Data of the Sample

Variables	Categories	Freq.	%
Gender	Male	121	60
	Female	79	40
You usually wear a	Yes	123	71
helmet	No	77	29
Have a rider license	Yes	145	72
	No	55	28
Accident severity	Never	90	45
(Maximum)	1. Property damage Only	15	8
	2.Slightly Injured	89	44
	3.Seriously Injured	6	3

Table 3 Exploratory factor analyses of model

TPB items		Factors			
		1	2	3	4
1. Attitude	ATT1	0.858			
(ATT)	ATT2	0.885			
	ATT3	0.920			
	ATT4	0.881			
2. Subject	SN1		0.787		
Norm (SN)	SN2		0.834		
	SN3		0.831		
3. Perceived	PBC1			0.775	
Behavioral	PBC2			0.868	
Control (PBC)	PBC3			0.830	
4. Intention	IN1				0.882
(IN)	IN2				0.838
	IN3				0.808

Note: Factor loadings > 0.7; (KMO = 0.866, p < 0.001)

The results were consistent with the findings of previous studies on wrong-way riding intentions in which the significant factor of Intention (IN) included Subject Norm (SN) and Attitude (ATT) for TPB model. Furthermore, we found that Perceived Behavioral Control (PBC) is non-significant to wrong-way riding intentions for TPB model.

Table 4 Reliability scales and correlation matrix TPB model

Factors	No. of items	α	1	2	3	4
1. ATT	4	0.95	1			
2. SN	3	0.90	0.528**	1		
3. PBC	3	0.77	0.190*	0.143	1	
4. IN	3	0.93	0.519**	0.744**	0.124	1

Note: ** Significant at 0.1% level; * Significant at 5% level; $\alpha > 0.7$

Table 5 Explanatory power and fit index of models.

Model fit	Recommended value	Model
χ^2		103.215
df		70
Chi-square/df	< 3.0	1.47
GFI	> 0.90	0.932
CFI	> 0.90	0.985
RMSEA	< 0.08	0.049

Table 6 SEM results of TPB model.

Paths	Coefficients (β)	Direct effect	Hypothesis Supported
Model			
ATT ⟶ IN (+)	0.18	0.179*	Yes
SN ⟶ IN (+)	0.65	0.653**	Yes
PBC ⟶ IN (+)	0.00	-0.003	No
IN ⟶ B (+)	0.63	0.625*	Yes
PBC ⟶ B (+)	0.02	0.016	No

Note: Factors influencing and standardized path coefficients; ** Significant at 0.1% level; * Significant at 5% level.

The results of this study agree with the previous studies of wrong-way riding behaviors among students in Ubon Ratchathani, Thailand and students in Khon Kaen, Thailand. SN influenced the intention of wrong-way riding [24-25]. In our study, the attitude factor affected wrong-way riding intention at a statistically significant level.

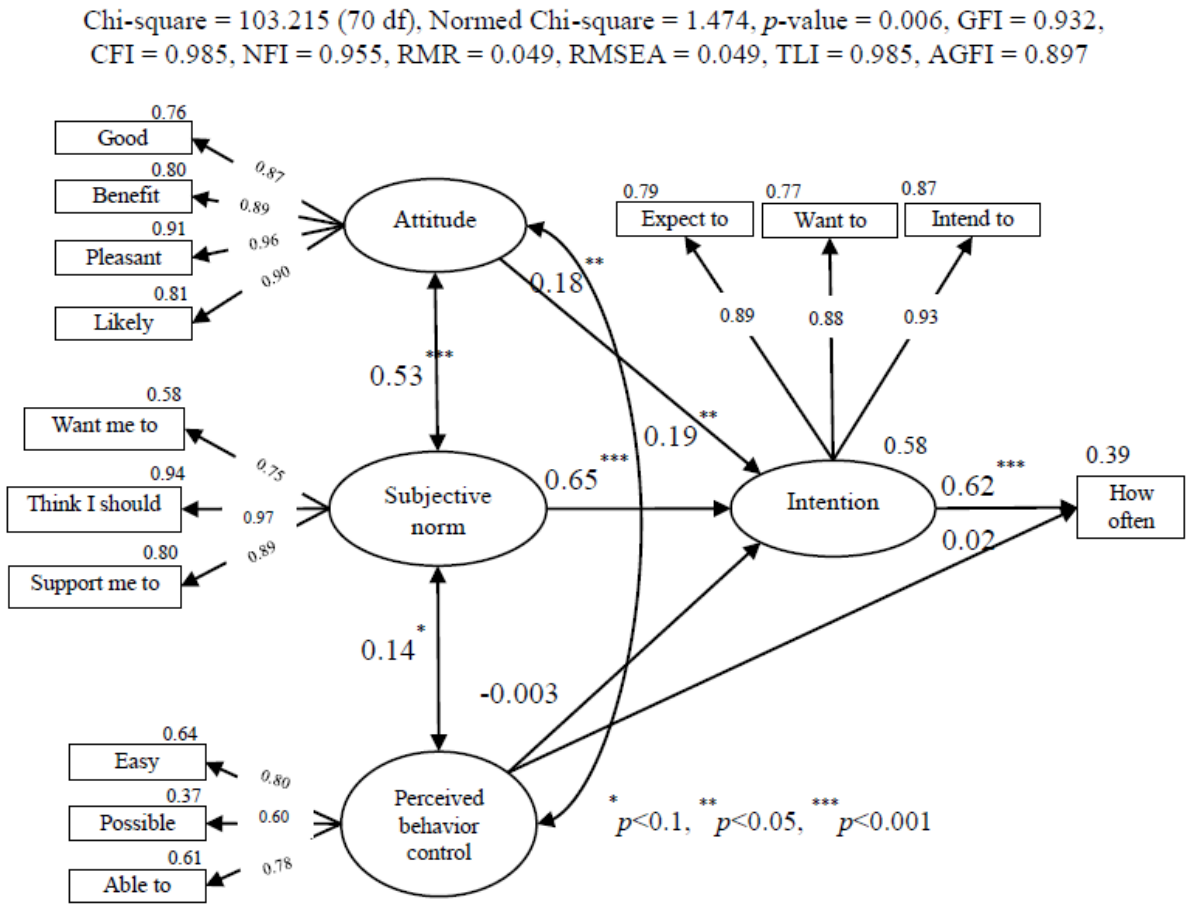

Figure 7 Structure of TPB model of wrong-way riding behavior

When we consider in detail the SN group, it was found that the motorcycle riders often think that their parents, friends or relatives are worried about them and do not want them to ride on the wrong way. In the SN group, the study found that the environment and surroundings of the riders and other people can dictate their wrong-way riding intention. In the ATT group, if riders adopt a better attitude, seeing that wrong-way riding is unsafe, then they will not intend to do it.

When considering studies that applied similar methodology but different behaviors such as a study on helmet wearing behavior of students in Khon Kaen, Thailand; it was found that PBC influenced students' intention to wear a helmet at the highest degree. This is consistent with a study conducted on students in the city of Ho Chi Minh, Vietnam [5], [22]. In addition, a study on the speed use behavior of motorcyclists in Khon Kaen shows that PBC influenced intention for speed use among motorcyclists [26]. From what has been discussed, SN was found to have the highest influence on intention to wrong-way riding. This differs from the study on helmet use and speed use of motorcyclists, in which PBC was found to have the highest influence.

4. CONCLUSIONS AND RECOMMENDATIONS

According to the TPB, this study examined psychological factors influencing the wrong-way riding behavior of motorcycle riders in a city under the framework of TPB. The results confirm the hypothesis (H1, H2 and H4) that the psychological factors of TPB, (SN) and ATT can explain behavior Intention (IN), and that PBC was non-significant in terms of IN factor. On the other hand, the study suggested that riders' acquaintances and social pressures are influential on their changing from the Subjective Norm (SN) and ATT. This suggestion is key to being in tune with norms. These findings suggest that changing the social attitude and norm for motorcycle riders about wrong-way riding in Mittraphap Road, Khon Kaen City can reduce the rate of fatality among

motorcyclists from accidents. The study result will be presented to Khon Kaen City authority for planning road safety in the city.

In the future, we will study the indirect factors in order to determine the factors important to traffic engineering such as the appropriate distance away from the U-turn for motorcycles.

5. ACKNOWLEDGEMENTS

This work is dedicated to and in good remembrance of my belated elder brother, Mr. Vutidach Kumphong, who passed away from a road accident.

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