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MOTORCYCLE HELMET USE AND THE THEORY OF TRAFFIC PSYCHOLOGY FOR BEHAVIOR CHANGE IN LAO PDR

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ABSTRACT: Recently, there has been growing interest in motorcycle safety in ASEAN countries. Laos has a high death rate of motorcycle riders and the low helmet wearing rate remains a big problem. This study aims to reveal how the helmet-use-campaign activities affected behavior change and explain influential factors regarding the intentions to use helmet among student riders. The data was collected from 219 students and analyzed using the Structural Equation Model (SEM). The Theory of Planned Behavior (TPB) and the Transtheoretical Model (TTM) were used as a study framework. The TTM results indicated that the student riders' helmet use was increased, the processes of change positively and significantly correlated with the stages of change at 95% confidence level. Whereas the TPB model showed that the perceived behavioral control was significant with the helmet use intention. Riders's attitudes and perceived behavioral control were significant with the helmet use behavior. The findings are useful for the responsible authority for planning road safety in Lao PDR.

Keywords: Helmet, Motorcycle, Safety, Traffic injuries

1. INTRODUCTION

Motorcycles have been used for transportation and sport activities in ASEAN countries. The correlation between high fatality rates among motorcyclists and low helmet use rates indicates that the problem is severe [1-6].

Laos has a high death rate (a number of deaths per 100,000 population) from traffic accidents. That could be associated with the low helmet wearing rate and insufficient helmet law enforcement. The country also shows the highest rate of deaths from motorized 2-or 3-wheelers as shown in Fig. 1 and Fig. 2 [6].

Vientiane city is a big city consisting of many educational establishments, hospitals, department stores, and residences. Thus there is an extensive use of motorcycle transportation in the city. The average number of injuries on the road is 1,734 per year, the average number of severe injuries is 209 per year, and the average number deaths is 161 per year [7]. However, many riders still do not wear helmets while driving (the helmet wearing rate is 60% [5]). The city of Vientiane has been conducting a helmet use campaign and distributing 1,000 helmets to student riders since August 31, 2016 [8].

This study, therefore, aims to reveal how the helmet-use-campaign activities affected the helmet use behavior change among student riders by a psychological model including the Theory of Planned Behavior (TPB) and Transtheoretical Model (TTM).

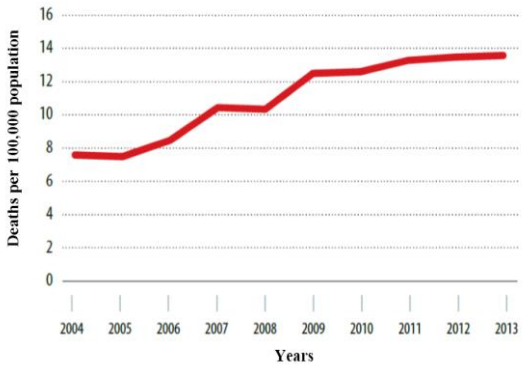

Fig. 1 Trends in reported road traffic deaths in Lao PDR. [6]

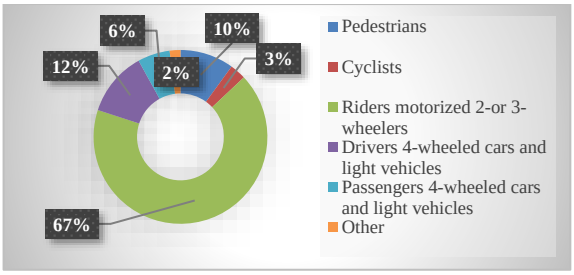

Fig. 2 Deaths by road user category in Lao PDR. [6]

2. METHODOLOGY

2.1 Data Collection by Observation

To determine the behavioral changes, this study applied the TTM to explain the intention of helmet use. Accordingly, this study proposed the following hypotheses (Fig. 3):

H_1: Processes of change variable is positively related to the stages of change.
H_2: Pros and cons variable is positively related to the stages of change.

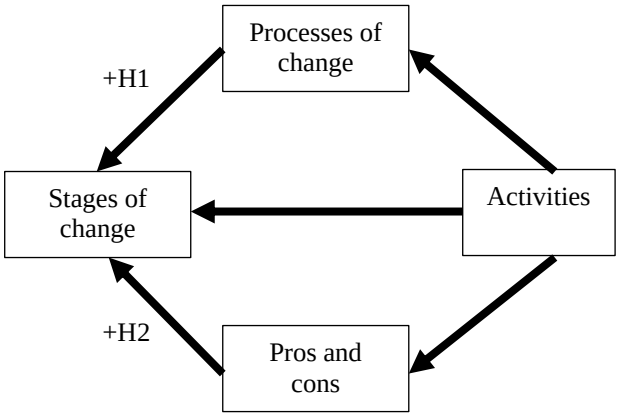

Fig. 3 Proposed study framework by TTM

In addition, this study applied the TPB to explain the intention of helmet use. Accordingly, this study proposed the following hypotheses (Fig. 4):

H_3: Attitude (ATT) variable is positively related to the intention of helmet use (IN).
H_4: Subjective norm (SN) variable is positively related to the intention of helmet use (IN).
H_5: Perceived behavioral control (PBC) variable is positively related to the intention of helmet use (IN).
H_6: Attitude (ATT) variable is positively related to the helmet use behavioral variable (B).
H_7: Subjective norm (SN) variable is positively related to the helmet use behavioral variable (B).
H_8: Intention (IN) variable is positively related to the helmet use behavioral variable (B).
H_9: Perceived behavioral control (PBC) variable is positively related to the helmet use behavioral variable (B).

The questionnaire measuring the items based on TTM and TPB was then developed. TTM was used for investigating the states of a chance as shown in Table 1. The items to measure the process of change and decisional balance are shown in Table 2 and Table 3, respectively. [9-10]. For the TPB items, direct measurements of intention, attitude, subjective norm and perceived behavioral control are shown in Table 4. [11-15].

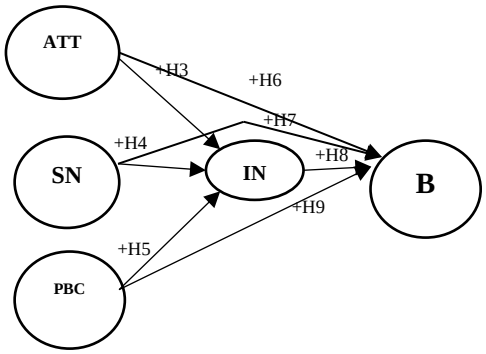

Fig. 4 Proposed study framework by TPB

Table 1 Stage of change concept

Stage of change	Wearing helmet
Precontemplation	Wearing a helmet is not an important behavior.
Contemplation	Wearing a helmet is an important behavior.
Preparation	Wearing a helmet is a behavior that I should do.
Action	I often wear a helmet.
Maintenance	I have been wearing a helmet for more than a year.

Table 2 Process of change concept and scale

The process of change concept	Scoring	M	SD
Experiential process			
PC1-The activities let me know and learn importance of helmet wearing.	1 = disagree : 4 = agree	3.50	0.54
PC2- The activities make me feel that not wearing helmet is a risk.	1 = disagree : 4 = agree	3.21	0.86
PC3- The activities make me realize that wearing helmet is an important thing for me.	1 = disagree : 4 = agree	3.60	0.60
PC4- The activities make me realize that wearing a helmet is an important thing to do in the society.	1 = disagree : 4 = agree	3.54	0.56
PC5- The activities make me realize that social norm is supporting wearing helmet.	1 = disagree : 4 = agree	3.47	0.57
Behavioral process			

PC6- The activities make me interested to wear helmet.	1 = disagree : 4 = agree	3.37	0.62
PC7- The activities make me remember to wear helmet when riding motorcycle.	1 = disagree : 4 = agree	3.51	0.57
PC8-The activities let me meet those who always wear helmet.	1 = disagree : 4 = agree	3.17	0.65
PC9-The activities support me to wear helmet.	1 = disagree : 4 = agree	3.43	0.61
PC10-The activities make me feel that wearing helmet is useful.	1 = disagree : 4 = agree	3.58	0.61

Table 3 Decisional balance item and scale

Decisional balance concept	Item	M	SD
Pros			
P1-Increase safety	1 = disagree : 5 = agree	4.73	0.59
P2-Reduce accident injury	1 = disagree : 5 = agree	4.68	0.64
P3-Sun/ dust/ insect protection	1 = disagree : 5 = agree	4.69	0.61
P4-Police enforcement	1 = disagree : 5 = agree	4.69	0.63
Cons			
C1-Reduce visibility	1 = disagree : 5 = agree	3.56	1.06
C2-Prevent hearing	1 = disagree : 5 = agree	3.60	1.04
C3-Hot and uncomfortable	1 = disagree : 5 = agree	3.06	1.34

Table 4 TPB item and scale

Items	Scoring	M	SD
Attitude (ATT)			
ATT1 Wearing a helmet would be	1 = bad : 5 = good	4.71	0.73
ATT2 Wearing a helmet would be	1 = unsafe: 5 = safe	4.72	0.73
ATT3 Wearing a helmet would be	1 = harmful : 5 = beneficial	4.62	0.81
ATT4 Wearing a helmet would be	1 = unlikely : 5 = likely	4.68	0.78
Subject norm (SN)			
SN1 Most of my friends wears a helmet when driving...	1 = disagree : 5 = agree	4.18	1.05
SN2 Most people wear a helmet when driving...	1 = disagree : 5 = agree	4.12	1.02
Perceived Behavioral Control (PBC)			
PBC1 I believe I have the ability to wear a helmet.	1 = disagree : 5 = agree	4.65	0.66
PBC2 I can wear a helmet even if the others do not.	1 = disagree : 5 = agree	4.50	0.84
PBC3 I can wear a helmet even if there is no police on the street.	1 = disagree : 5 = agree	4.48	0.90
PBC4 I am confident that I could wear a helmet.	1 = disagree : 5 = agree	4.52	0.74
Intention (IN)			
IN1 Next 3 months, I will wear a helmet when driving.....	1 = disagree : 5 = agree	4.46	1.05
IN2 Next 3 months, I want wear a helmet when driving...	1 = disagree : 5 = agree	4.56	0.86
IN3 Next 3 months, I intent wear a helmet when driving.....	1 = disagree : 5 = agree	4.39	1.03
Self-report behavioral (B)			
B How often do you wear a helmet when riding?	1 = never : 5 = always	4.39	0.82

The data collection was done in 2017, one year after the campaign had been conducted. The questionnaire survey was conducted with 219 student motorcyclists (80% males and 20% females) as shown in Fig. 5. Their average age was 21 years old. 51% had a driver's license, and the average riding experience was 7 years. The interesting points found were: the average of 1 time of the crash of participants, 27% had not experienced any accident, only 7% experienced property loss and damage, and 56% were involved in injuries whereas only 10% had severe injuries.

Fig. 5 Observation by questionnaire

2.2 Statistical Analysis

The analysis was divided into two parts according to the previous study [12]. The first part analyzed the correlation between TTM variables using Pearson Correlation at 95% confidence level. This included the stages of change, processes of change, and decisional balance variables. The second part applied factor analysis to construct the TPB-based latent variables (attitude (ATT), subjective (SN), perceived behavior control (PBC) and intention (IN)). Reliability of the latent variables was also determined by Cronbach's alpha value. The Structural Equation Modeling (SEM) was then used for intentions model construction. Overall, the model fit was evaluated against the number of recommended fit statistics and fit indices based on Hair et al. (2010) [16].

3. RESULTS AND DISCUSSION

3.1 Test of a TTM structure

Fig. 6 shows the distribution of the stage of change before and after the campaign was conducted. The proportion of stage 5 increased indicating that riders' helmet use was increased.

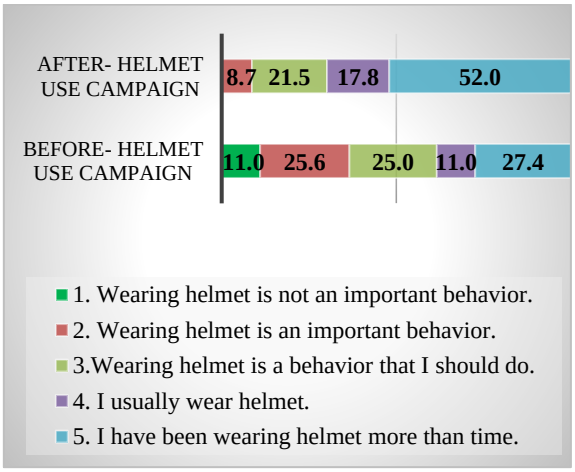

Fig. 6 Percentage changes in helmet wearing

Table 5 shows the correlation between the stages of change and processes of change at 0.1% and 5% level of significance, respectively. The results indicated that PC7 and PC8 positively and significantly correlated with the stages of change. These results imply that the activities to make the rider remember to wear a helmet (PC7) and the activities that allow the riders to meet other riders who always wear a helmet (PC8) are important for the behavioral change.

On the other hand, the correlations in the results between the stages of change and decisional balance as shown in Table 6 indicate that the decisional balance items were not significant with the stages of change variable.

Table 5 Correlations between the stages of change and processes of change

Processes of change items	Pearson Correlation	Sig.
PC1	0.070	0.304
PC2	-0.051	0.450
PC3	0.027	0.695
PC4	0.128	0.059
PC5	0.002	0.979
PC6	0.108	0.109
PC7	0.158*	0.019
PC8	0.169*	0.012
PC9	0.046	0.494
PC10	0.122	0.071

Note: ** $P < 0.001$; * $P < 0.05$

Table 6 Correlations between the stages of change and decisional balance

Decisional balance items	Pearson Correlation	Sig.
Pros		
P1	0.052	0.447
P2	0.056	0.406
P3	0.079	0.243
P4	0.042	0.539
Cons		
C1	-0.030	0.654
C2	0.037	0.588
C3	0.027	0.687

Note: ** $P < 0.001$; * $P < 0.05$

3.2 Validity of TPB-based measurement model

The results of reliability and validation estimation are presented in Table 7. They show that 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 ATT measure) of the respondents. As a result, these values indicate latent variables of TPB model, which are good reliable representative values to explain the model. Table 8 shows that all latent variables (ATT, SN and PBC) correlated with the INT variable at 0.1% level of significance.

Table 7 Exploratory factor analyses of model

		Factors			
		1	2	3	4
1. ATT	ATT1	0.863			
	ATT2	0.901			
	ATT3	0.864			
	ATT4	0.869			
2. SN	SN1		0.861		
	SN2		0.824		
3. PBC	PBC1			0.715	
	PBC2			0.745	
	PBC3			0.782	
	PBC4			0.700	
4. IN	IN1				0.799
	IN2				0.812
	IN3				0.801
Cronbach's α		0.914	0.675	0.767	0.756

Note: Factor loadings > 0.7; (KMO = 0.806, $p < 0.001$)

Table 8 Reliability scales and correlation matrix of TPB-based factors

Factors	No. of items	1. ATT	2. SN	3. PBC	4. IN
1.ATT	4	1			
2.SN	2	0.234*	1		
3.PBC	4	0.457**	0.476**	1	
4.IN	3	0.257*	0.196*	0.465**	1

Note: ** $P < 0.001$; * $P < 0.05$

3.3 Test of a structural TPB model

The results of the TPB model showed the adequate fit to the data ($\chi 2$= 115.785; df = 68; $\chi 2/ df$ = 1.70 ($\chi 2/ df \leq 3$); GFI = 0.929 (GFI > 0.900); CFI = 0.962 (CFI > 9.000); RMSEA = 0.057(RMSEA < 0.080)).

Fig. 7 shows the results of structural models with standardized path coefficients for TPB model. The TPB model fit could pass recommended fit indices. The TPB model could explain 22% of the variance for helmet use intentions and 31% of the variance for helmet use behaviors.

From the TPB model, PBC (β = 0.46) was found to positively and significantly correlate with IN. PBC was able to regulate behavior intention. In addition, the model indicated that ATT (β = 0.35) and PBC (β = 0.35) were found to positively and significantly correlate with B. Therefore, ATT and PBC positively effected the behavior (B).

Table 9 summarized the model's findings with the study hypothesis.

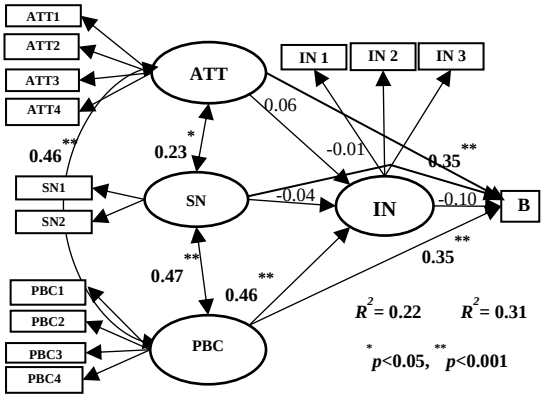

Fig. 7 Structure of model of motorcyclists' helmet use in the city

Table 9 SEM results of the model (N=219)

Paths	Coefficients (β)	*p*-value	Hypothesis supported
ATT → IN (+)	0.059	0.508	No
SN → IN (+)	-0.035	0.729	No
PBC → IN (+)	0.455**	0.000	Yes
ATT → B (+)	0.352**	0.000	Yes
SN → B (+)	-0.012	0.879	No
IN → B (+)	-0.100	0.214	No
PBC → B (+)	0.350**	0.000	Yes

Note: ** $P < 0.001$; * $P < 0.05$

The results of this study agree with the previous studies of helmet wearing behaviors among students in Khon Kaen City, Thailand [12] and students in Ho Chi Minh, Vietnam [11]. PBC influenced the intention to wear a helmet since PBC occurred from oneself or one's own decision [11-12]. In this study, the attitude affected helmet use at a statistically significant level. The TTM results are similar to those from the previous research [17]. When considering TTM to investigate helmet wearing behavior, it was possible that measures taken to encourage helmet use could increase motorcycle helmet use behavior [17].

It was interesting to note that ATT was significant with B and was similar to PC7, which was significant with the stages of change. From the PC7 statement, "The activities make me remember to wear a helmet when riding a motorcycle", it can be seen that the campaign changed motorcycle riders' attitudes. The results of TTM and TPB showed that ATT is the key factor that changes the helmet wearing behavior of Lao motorcyclists. If the attitude is positively changed, then their helmet wearing behavior will be improved.

4. CONCLUSIONS

This study aims to reveal how the helmet use campaign activities affected helmet use behavior change and explained influential factors on the intentions to use helmet among student riders. The TTM model results showed that after the helmet wearing campaign had been conducted, the helmet using behaviors improved. Besides, the important processes of change that affected behavioral change are the activities that make the rider remember to wear a helmet and the activities that allow the riders to meet other riders that always wear a helmet.

For TPB model, the results showed that perceived behavioral control was significant with the intention to wear a helmet, and the attitude and the perceived control were significant with helmet using behavior among the student riders. The results of this study will be presented to those involved in this area for road traffic planning and crash prevention. Some concrete transport measures developed based on these research outputs are suggested as follows:

1) Implement a city road safety action plan (100% Helmet use).

2) Set up the safe motorcycle rider measures in city areas.

3) Apply helmet law enforcement by 24-hr CCTV camera [18-21].

5. ACKNOWLEDGMENTS

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