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Exploring psychological factors of mobile phone use while riding among motorcyclists in Vietnam

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Abstract

Mobile phone use while riding is one of the five most common risky behaviors of motorcycle riders in Vietnam. This study investigated motorcyclist's mobile phone use while riding intention and behavior based on the extended Theory of Planned Behavior (TPB) framework. Based on this framework, attitude, subjective norm, perceived behavioral control, habits, and health motivation underlying the rider's mobile phone use while riding intentions and behavior were included in a questionnaire and captured by direct and indirect measurements. Small-displacement motorcycle riders (N = 291) completed the extended TPB based questionnaire. An exploratory factor analysis technique identified the selected factors (e.g., attitude, habit, etc.). Moreover, Structural Equation Modeling results showed moderate to good fits to the observed data. Therefore, the results supported the utilization of extended TPB framework in identifying factors of mobile phone use while riding intention and behavior. Specifically, negative attitude, perceived behavioral control, and mobile phone use while riding habit related to the intention to use a mobile phone while riding of small-displacement motorcyclists. Meanwhile, habit and behavioral intention related to the behavior to use a mobile phone while riding of small-displacement motorcycle riders. Especially, the correlation between behavioral intention and self-reported behavior was very strong. This finding embraced previous research indicating that intention was a major motivational component of behavior. Based on the results, safety intervention implications for small-displacement motorcycle riders were discussed.

Keywords: Mobile phone use, motorcycle riding, small-displacement motorcycles, extended theory of planned behavior, structural equation modeling.

1. Introduction

Distracted driving and riding is a problem that affects road traffic safety worldwide. Driver distraction can be described as "the diversion of attention away from activities critical for safe driving/riding toward a competing activity" (M. A. Regan et al., 2008). Mobile phone use while driving is one of the common causes of distraction, increasing the likelihood of crashes and the risk of motor vehicle crashes (Hill et al., 2019; Shaaban et al., 2018) because this behavior has been shown to restrict driver's movements, distract their attention from the road, and impair their reaction time (French & Gumus, 2018). A systematic review of previous studies by Lipovac et al. (2017) indicated that using a hands-free mobile phone while driving does not provide greater safety as compared to the use of hand-held mobile phones while driving. For this reason, many countries around the world, such as Denmark, France, United Kingdom, Italy, Norway, Sweden, Spain, Australia, Japan, introduced driving laws with high enforcement to restrict mobile phone use while driving in both hand-held and hands-free modes (WHO, 2015). Also, in Vietnam, mobile phone use while riding is one of the five most common risky behaviors of motorcycle riders (NTSC, 2019). The road traffic crash related to mobile phone use while driving behavior of drivers is accounted for around 5% of total serious accidents, in which the majority of traffic crashes are caused by motorcycle riders (NTSC, 2016b). In recent years, although the Government and the Ministry of Transport have issued and implemented many measures to reduce the mobile phone use while riding behavior for motorcyclists (i.e., raising the level of sanctions, public awareness campaigns, and education), however, the efficiency is still not high (Anh Tuan et al., 2018). The representation of motorcycles in the accident statistics can be partly explained by the fact that the motorcycle is the preferred mode for traveling that accounts for above 85% of vehicle fleet share (NTSC, 2016a). Motorcycles in Vietnam are mainly of the small-displacement types (50cc - 175cc), with the most common being 100cc - 125cc, accounting for 90% (Chu et al., 2016). The rate of large-displacement motorcycles (≥175cc) is low, accounting for about 0.05% of total motorcycles in Vietnam (C67, 2016). Therefore, more investigation into the problem of the mobile phone use while riding behavior for small-displacement motorcyclists in Vietnam is called for, in order to identify contributing factors and possible mitigation strategies.

1.1 Studies on mobile phone use while riding a motorcycle in Vietnam

The research on Mobile Phone Use While Riding (MPUR) in Vietnam is scant, although there have been some studies that were executed on the topic. For example, a field study on the actual of MPUR at nine typical cross-sections in Binh Duong Province and Ho Chi Minh City revealed that about six motorcycle riders per one thousand motorcyclists use mobile phones while riding, and the primary using mode are hand-held calling and texting (Anh Tuan et al., 2018). The study results on the MPUR among university students in Vietnam revealed that nearly 81% of university students in Hanoi and Ho Chi Minh City reported using a mobile phone while riding a motorcycle (Truong et al., 2017). More frequent use of a mobile phone for texting or searching for information while riding is associated with a higher chance of being involved in a crash/fall (Truong et al., 2019). These studies have mainly focused on studying the relationship between MPUR behavior and the possible occurrence of traffic crashes. Meanwhile, there has not been any in-depth research to determine the psychological factors that contribute to the MPUR. Meanwhile, the identification of such factors is a first step to the exploration of the most appropriate and potential countermeasures to counteract distracted riding of motorcyclists.

1.2 Factors associated with mobile phone use while driving and riding behavior

In the past decades, comprehensive researches contributed a considerable deal of knowledge about factors related to Mobile Phone Use While Driving (MPUD) behavior. These researches showed that driver characteristics (e.g., gender, age, occupation) and psychological factors (i.e., attitudes, beliefs) are linked to MPUD behavior (Korpinen & Pääkkönen, 2012; Oviedo-Trespalacios et al., 2017; Shaaban et al., 2018; R. Zhou et al., 2016). For example, the study by Korpinen and Pääkkönen (2012) on accidents connected to the use of mobile phones revealed that younger drivers and male drivers are more likely to take part in road accidents in situations when they use the mobile phone while driving for the conversation. The findings from a study on the mobile phone use while driving among young drivers in Qatar revealed that young drivers who had a crash history resulting from the MPUD behavior tend to use their mobile phone while driving less than those who did not have a mobile phone-related crash (Shaaban et al., 2018). Previous researches have confirmed the role of attitudes and beliefs in the prediction of mobile phone distracted driving behavior. Zhou et al. (2016) studied the contribution of compensatory beliefs to the MPUD behavior of drivers. The study results provided strong support for the contribution of compensatory beliefs in predicting mobile phone usage in the context of driving. In the study on risk factors of MPUD behavior, Oviedo-Trespalacios et al. (2017) concluded that attitudes were significant predictors on the MPUD behaviors of motorists.

Though mobile phone usage while driving a car has been a subject of much research, mobile phone use while riding a motorcycle has only been executed in recent studies (Pérez-Núñez et al., 2014; Phommachanh et al., 2017). For example, Pérez-Núñez et al. (2014) studied MPUD in three Mexican cities to quantify the prevalence of this behavior among motorcyclists and to identify associated factors. The result revealed that the MPUD behavior was higher among motorcyclists who were not wearing a helmet and among motorcyclists traveling on 1-lane roads. Phommachanh et al. (2017) studied the MPUR behavior of student motorcyclists in Laos. The results revealed that MPUR was associated with motorcycle riders have a longer riding period, and riding more frequently in a week. However, these studies were mainly executed in large-displacement motorcycles, while less attention has been given to the MPUR behavior of small-displacement motorcyclists. Indeed, only a couple of studies have targeted the distracted riding behavior of small-displacement motorcycle riders (Truong et al., 2016, 2018). For example, Truong et al. (2016), conducted a cross-sectional observation survey on the MPUR among small-displacement motorcyclists and e-bike riders in Hanoi. The result revealed that MPUR was associated with vehicle type, age, gender, riding alone, weather, day of the week, proximity to the city center, number of lanes, separate car lanes, red traffic light duration, and police presence. In another study, the author found that small-displacement motorcycle riders under the influence of alcohol were nearly twice as likely to call or text while riding (Truong et al., 2018). However, to our knowledge, there was no study investigating the relationship between psychological factors and MPUR to define the underlying reason for using mobile phones while riding of small-displacement motorcycle riders, especially in low-to-middle-income countries, such as Vietnam.

From literature review of the published studies, the three principal research methodologies (i.e., epidemiological, experimental and on-site study) were applied to examine the relation between MPUD and a risk of crash occurrence, define the frequency of MPUD, identify characteristics of persons inclined to use mobile phones more often while driving, define impacts of using various modes of mobile phones while driving on driving performance (‘‘hands-free”, ‘‘hand-held” or “texting”), and explore factors predicting MPUD behavior (Lipovac et al., 2017). In epidemiological studies, behavioral sciences models applied to examine characteristics of persons inclined to use mobile phones more often while driving and explore psychological factors that influence decision-making, or an intention to whether to use a mobile phone while driving. Behavioral models have the potential to enhance efforts to reduce unintentional injuries and to provide a potential framework to understand in the prediction of behavioral intention (Ambak et al., 2010). A literature review on the mobile phone use while driving of Lipovac et al., (2017) revealed that there much research on this domain applied well known behavioral models (i.e., the theory of planned behavior) to study the psychological and behavioral of car drivers. Meanwhile, there is a lack of studies applying psychological and behavioral theories to investigate the distracted riding behavior of motorcycle riders, especially small-displacement motorcycle riders in low-to-middle-income countries.

1.3 Theory of planned behavior and its application to risk-taking behavior

The Theory of Planned Behavior (TPB) is a robust and widely used behavioral decision theory that has been used across multiple contexts to explain a wide range of behaviors and received excellent empirical support (Fishbein & Ajzen, 2011; McEachan et al., 2011). The TPB states that human behavior is governed by behavioral intentions. People are expected to carry out their intentions when the opportunity arises (Fishbein & Ajzen, 2011). This behavioral intention stems from three underlying factors: attitude (AT), subjective norm (SN), and perceived behavioral control (PBC). Corresponding to the theory, the three factors (i.e., attitudes, subjective norms, and perceived behavioral controls) are formed from three kinds of belief considerations. Attitude toward the behavior is a person's overall evaluation of the behavior (Francis et al., 2004). Attitudes are produced from behavioral beliefs (i.e., beliefs about the outcomes of their behaviors weighted by the corresponding outcome evaluation), including either positive or negative evaluations of these outcomes (R. Zhou et al., 2012). Subjective norms are a person's own estimate of the social pressure to perform or not perform the target behavior (Francis et al., 2004). Subjective norms are produced from normative beliefs (i.e., beliefs about whether referents who may be in some way essential to the person, think that one should perform his/ her target behavior weighted by the motivation to comply with that referent). Perceived behavioral control is the extent to which a person feels able to enact the behavior (Francis et al., 2004). Perceived behavioral controls are produced from control beliefs (i.e., beliefs about control factors that facilitate/impede MPUR behavior weighted by the perceived power of those factors). PBC has both direct and mediated effects (by behavioral intention) on behavior and refers to the person's perception of control on engaging in that behavior (Ajzen, 1985, 1991; Conner & Sparks, 2005).

The Theory of Planned Behavior has been successfully applied in road traffic safety domains to study drivers/riders' risky behaviors. Castanier et al. (2013) found that TPB was a predictor of road violation intentions and behaviors, with both additive and interactive effects. Studies have revealed that TPB factors adequately explain traffic offenses such as drink-driving (Moan & Rise, 2011; Zhu et al., 2010), red-light running (Palat & Delhomme, 2012; Satiennam et al., 2018; Yao Lin et al., n.d.), speeding (Conner et al., 2007; Elliott et al., 2004; Parker, 1998; Stead et al., 2005) and MPUD (Prat et al., 2015; Sullman et al., 2018; R. Zhou et al., 2012). In MPUD studies, authors used the TPB to examine psychological factors that influence decision-making, or an intention to use a mobile phone while driving. For example, Zhou et al. (2012) applied TPB to predict car drivers' answering intentions and compensatory decisions while driving in China. The result revealed that answering intention and perceived behavioral risk and control consistently predicted most of the variance (handheld and hands-free) for compensatory perception limits. To understand the psychological predictors of texting while driving among Spanish university students, Prat et al. (2015) used TPB to investigate these predictors. The findings revealed that attitude and perceived behavioral control significantly predicted the intention to send and read text messages while driving of car drivers. Sullman et al. (2018) used TPB to predict intentions to text and call while driving of Ukrainian car drivers, and the study result showed that the positive attitude and perceived behavioral control of drivers were significantly and positively associated with MPUD intention.

1.4 The extended theory of planned behavior

To strengthen its exploratory power, the TPB's constructs have been subject to significant adaptation and extension. Regarding psychological flow theory, Chen and Chen (2011) argued that "intrinsic motivations might better explain and/or predict the risky behavior". Kumphong et al. (2018) revealed that the health motivation factor is positively and significantly correlated with behavioral intention, and this factor can determine the value that someone gives to health and safety. Health motivation was suggested by Becker (1974) as a further important component of the HBM. Health motivation is a multidimensional subsystem which involves the processes of choice, need for competence, and self-determination in one's health (Cox, 1982). Thus, the health motivation factor was taken into account to construct the extended TPB to explore the intrinsic motivation of MPUR among small-displacement motorcycle riders. Besides health motivation, habit is another important concept that can be added to strengthen the exploratory power of the TBP. The concept associated with this extension is that driving behaviors are not only 'planned' and 'reasoned' but are also habitual, in the sense that they can be performed independently of intentions (Lheureux et al., 2016). A habit of an individual is a set of behaviors started under conscious control, which, after sufficient and suitable repeats, is taken up in a more or less unconscious fashion (Verplanken, 2006). Lheureux et al.

(2016) argued that the addition of the habit factor systematically enhances the explained variance of the analysis model, even in the presence of all the TPB constructs. Several traffic safety studies added an individual's habit factor in the TPB to exam influences on behavioral intention and behavior in risk-taking behaviors of car drivers. The results converge massively in favor of including the concept of habit as a direct predictor of behaviors (De Pelsmacker & Janssens, 2007; Tseng et al., 2013). For example, De Pelsmacker and Janssens (2007) revealed from a study on the effect of norms, attitudes, and habits on speeding behavior that habit formation influences the intention towards speeding and self-reported speeding. Tseng et al. (2013) revealed that an offender' driving behavior after a lifetime license revocation was significantly correlated to the previous driving habit of the driver. To the best of our knowledge, the extended TPB theory has not been used to investigate the underlying beliefs, intentions, and behavior of small-displacement motorcycle riders on the MPUR behavior.

1.5 Research aim

Considering the current rate of MPUR behavior and MPUR-related crashes in Vietnam, and the lack of available information concerning the underlying factors that contribute to this behavior, more research is called for. This study, therefore, aims to examine significant predictors that contribute to the MPUR intention and behavior of small-displacement motorcycle riders in line with the extended TPB framework. Both direct and indirect measurement techniques were employed to develop the model that explains small-displacement motorcycle riders' MPUR intention and self-reported behavior.

2. Methodology

2.1 Questionnaire and survey

Survey questions

The data package for exploring psychological factors of mobile phone use while riding among motorcyclists in Vietnam was collected by means of a one-to-one interview survey. A carefully designed questionnaire was the first step to ensure that the data were reliable and valid for further analysis under the feedback and suggestions of experienced researchers and experts from the Asia Injury Prevention Foundation and Vietnam's National Traffic Safety Committee. The survey contained questions related to the demographics, riding history, mobile phone use while riding behavior, psychological factors, and mitigation strategies. The demographics section captured the information related to the participants' gender, age, occupation, income, and vehicle trips per day. The survey included stated and revealed preference questions with observed and latent variables. The revealed preference questions contained the riding history section, which investigates the riding experience and exposure, namely, the riding frequency, years of riding experience, traffic law understanding, information on traffic accidents involved in the last two years. Furthermore, in revealed preference questions, the motorcycle riders were asked whether they used mobile phones while riding in the last two years and the frequency they used. Participants were asked about their MPUR habits, including the principles of mobile phone using, the way of using a mobile phone while riding, and how they operate their vehicles while using mobile phones in different mobile phone modes (calling, texting, and other activities with their phones). To investigate the participants' revealed preference, they were asked about their motivation, psychology, and health belief effects of MPUR. Finally, participants were asked to express their opinion regarding the effectiveness of some innovative countermeasures in dealing with MPUR behavior of small-displacement motorcycle riders in Vietnam.

Procedure and participants

The previous publications suggested that the sample size number for Structural Equation Modeling (SEM) models could be meaningfully from 100 to 300. The simple SEM models, the number of sample sizes, is from 100 to 150 (Ding et al., 1995; Tabachnick & Fidell, 2001). In complex SEM models, the proposed number of sample size is N = 200-300 (Boomsma & Hoogland, 2001; Kline, 2005). Simulation studies show that with customarily distributed indicator variables and no missing data, a reasonable sample size for a simple confirmatory factor analysis model is about N = 150 (Muthén & Muthén, 2002). Besides, the sample size is considered in light of the number of observed variables (Wang & Wang, 2019). Bentler and Chou (1987) suggested a ratio as low as 5 cases per variable would be sufficient when latent variables have multiple indicators. A widely accepted rule-of-thumb is 10 observations per observed variable (Nunnally & Bernstein, 1967).

The study was conducted based on a one-to-one interview research method in downtown, urban, and suburban areas of Ho Chi Minh City and Binh Duong Province, Vietnam, in September 2017. Motorcycle riders were randomly invited to participate in the interview at gasoline stations, supermarkets, shopping centers, bookshops, amusement parks, and leisure centers. The author firstly introduced the primary purpose of the survey and then collected demographics and riding history of motorcycle riders. Finally, the author interviewed motorcycle riders on their mobile phone use while riding, psychological factors, and mitigation strategies. Participants received a gift coupon of 50 thousand VNĐ (2.2 USD) for thirty minutes of participation. Prior to the formal survey for this study, a pilot study with 15 persons (5% of total questionnaires) was carried out to ensure that each item in the questionnaire was clearly described, easily understood, and representative for the study goal. Out of the 300 questionnaires conducted, nine missed answers on more than 3% of the questions or failed to answer the questions. After the data cleaning, the remaining data from 291 small-displacement motorcycle riders (193 men and 98 women) were ready for further data analysis. Their ages ranged from 18 to 55 years, with a mean age of 29 years. Among the participants, 68 small-displacement motorcycle riders (23%) reported road accident experience within the past two years, 24 traffic accidents caused by MPUR behavior.

Table 1: The Demographics of the Respondents

#	Item	Variable	N	%
1	Gender	Male	193	66.32%
		Female	98	33.68%
2	Age	18-25	131	45.02%
		26-55	160	54.98%
3	Occupation	Office Staff	59	20.27%
		Student	104	35.74%
		State Official	17	5.84%
		Engineer	55	18.90%
		Manager	18	6.19%
		Business	17	5.84%
		Other	21	7.22%
4	Income	<3 million (VNĐ)	92	31.62%
		3- <5 million (VNĐ)	24	8.25%
		5- <10 million (VNĐ)	91	31.27%
		10- <18 million (VNĐ)	50	17.18%
		≥18 million (VNĐ)	34	11.68%

Exchange rate in 2017: 1 USD = 22,710 VNĐ

2.2 Measures

For each construct, the internal consistency of the items should be evaluated for the reliability of the survey data. Cronbach's alpha (α) correlation test was performed and conducted in the software SPSS (version 25). In general, Cronbach's alpha value ranges between 0 and 1. The closer it is to 1, the higher the internal consistency of the items in the construct (H. Zhou et al., 2016).

Attitude (AT)

Attitudes were assessed indirectly by using a belief-based measure, which is obtained by calculating the product of the belief and the corresponding outcome evaluation. Respondents were presented with eight behavioral beliefs in two groups of questions, include MPUR motivation, which was: "saving time", "do not need to call back (loss of money)", "do not miss the important calls", "express the politeness and respect to other people" and MPUR impediment, which was: "using a mobile phone while riding will cause distracted riders, this may lead to property damage when the crash occurs, and motorcycle riders may pay for their vehicle repairs and may compensate for other road users", "using a mobile phone while riding will cause distracted the rider, and this may lead to fatal accidents for the motorcycle rider and pillion passengers", "it is easy to be arrested and punished by the traffic police", "feeling guilty or repentant when it can cause danger to other road users". The responses ranged from strongly disagree (1) to strongly agree (5) on a 5-point scale.

Furthermore, an outcome evaluation of each belief was provided: "saving time is a good thing", "saving money is a good thing", "do not miss the important calls is a good thing", "keep the relationship and be respected by other people is a good thing", "pay for vehicle repairs or compensation is a bad thing", "it is awful to have an injury or fatality accident related to the phone use behavior", "it is terrible if be arrested and punished by the traffic police", "feeling guilty or repentant on the phone use behavior is a good thing". The responses were from strongly disagree (-2) to strongly agree (2) (Cronbach's alpha (α) is 0.823).

Subjective norm (SN)

Normative belief was constructed indirectly by eight items related to the reaction or counteraction of participant's relationship and other people when they use their mobile phone while riding, which were: "the traffic police will immediately punish the risky behavior", "parents/ spouse will worry and reprimand", "boyfriend/ girlfriend (if any) will be very angry with this behavior", "your children (if any) will have a bad image about this behavior", "your close friends will not support to this behavior", "your colleagues will have a bad thinking about you", "the pillion passengers will prevent you doing this behavior", "the other traffic users will have a bad thinking on you", scored from strongly disagree (1) to strongly agree (5).

As to the motivation to comply with normative beliefs, participants were asked to evaluate the influence of the other people to participant's risky behavior (MPUR): "traffic police", "parents/ spouse", "boyfriend/ girlfriend", "your children", "close friends", "colleagues", "pillion passengers", "other road users", scored from absolutely no effect (-2) to high effect (2). The product of the normative belief and the motivation to comply was calculated (Cronbach's alpha (α) of 0.866).

Perceived behavioral control (PBC)

Perceived behavioral control was measured indirectly by five control belief items of the question "when will you use the mobile phone while riding?", which were: "hear the bell of the incoming calls or messages", "when seeing no traffic police", "less vehicle on the road", "I feel the road I am riding is safe", "I can confidently control the steering wheel when using a mobile phone while riding". The responses ranged from strongly disagree (1) to strongly agree (5) on a 5-point scale.

The influence of control beliefs were based on the question "When using your cellphone while riding, do you feel calm or lose your temper when you encounter the following situations?" with five cases, which were: "when hearing the loud sound from the other vehicles' horn", "traffic police suddenly appear", "riding on a crowded road, and there is vehicle suddenly appear in the distance of 10-15m or a vehicle suddenly move out from a minor road with a distance of 10-15m.", "riding into the slippery road or rugged road (with potholes) or riding into the curves that reduce your vision by trees and houses", "riding under the influence of alcohol". The responses were from totally lost temper (-2) to feel calm (2) (Cronbach's alpha (α) is 0.772).

MPUR habit (H)

MPUR habit was measured directly by two items, which were: "your mobile phone use habit while riding for incoming calls", and "your mobile phone use habit while riding for other purposes (listen to music, search route, find destination)". The responses were rated from 3-point scales, from always using a mobile phone while riding (1) to never use a phone when riding (3) (Cronbach's alpha (α) of 0.924.

Health motivation (HM)

Health motivation was measured directly by two items, which were: "my life and health are more important than any other benefit or pleasure", and "the behavior of using a mobile phone while riding has a negative impact on my physical condition (makes me tired)", rated on a 5-point scale from strongly disagree (1) to strongly agree (5). Internal consistency was durable, with a Cronbach's alpha (α) of 0.947.

Behavioral intention (BI)

This construct was measured directly by four responses to the question "when you will have the behavior of mobile phone use while riding?", which were: "maybe today", "maybe next twelve months", "at any time when no traffic police", and "never use", rated on a 5-point scale from strongly disagree (1) to strongly agree (5). Internal consistency was strong, with a Cronbach's alpha (α) of 0.945.

Self-report behavior (B)

MPUR Behavior was measured directly via self-report. Participants were asked to indicate how often they had used a mobile phone while riding and their using purpose (calling, texting, and other purposes (*listening to music/surfing the Internet/ watching the time*)) during the twelve months before the interview. Self-report behavior was measured on a 5-rating scale ranging from 1 to 5 (every day, a few times per week, a few times per month, a few times per year, and never). Internal consistency with a Cronbach's alpha (α) of 0.772.

3. Results

3.1 Descriptive statistics

Table 2 presents the means and standard deviations of the scores for each item under study. It was deduced from the results that overall, the respondents use mobile phones while riding for calling (B1) (mean = 3.3471) a few times per month. For texting purposes (B2) (mean = 3.5258), they use the mobile phone while riding a few times per year. Their plan to use mobile phone while riding were unclear in the day of interview (BI1R) (mean = 3.3540), next 12 month (BI4R) (mean = 3.1718), At any time when have no traffic police on-road (BI5R) (mean = 3.3436), or never use mobile phone while riding (BI6) (mean = 3.2543). MPUR habit of participants is only answered important calls (H1&H2) (mean of calling = 2.1546 and mean of other purposes = 2.0550). Participants agreed that use mobile phones while riding would save time (AT1) (mean = 4.1306), save money (AT2) (mean = 4.0997). They strongly agreed that it is awful to have an injury or fatality accident related to the phone use behavior (AT6) (mean = 5.5052), and it is terrible if be arrested and punished by the traffic police (AT7) (mean = 4.2268), and they agreed for the feeling guilty or repentant when it can cause danger to other road users (AT8) (mean = 3.6392). Riders believed that their parents/spouses would worry and reprimand their risky behavior (SN2) (mean = 3.8247). They also think that their close friends (SN5) (mean = 1.1821), colleagues (SN6) (mean = 2.8007) and pillion passengers (SN7) (mean =1.9553) could change their MPUR behavior. The combining effects of the control beliefs and influence of control beliefs revealed that respondents' perceived behavioral control toward the MPUR behavior was positive. The respondents said that their life and health are more important than any other benefit or pleasure (HM1) (mean = 3.3471).

Table 2: Mean and standard deviation of the score for each item

	Mean	S.D.		Mean	S.D.		Mean	S.D.
Attitude			**Subjective norm**			**Perceived behavioral control**		
AT1	4.1306	4.2585	SN1	2.9553	3.9341	PBCi1R	0.7285	3.7072
AT2	4.0997	4.3320	SN2	3.8247	3.5185	PBCi2R	0.7079	3.4969
AT3	3.2371	4.4306	SN3	2.6323	3.4057	PBCi3R	0.4880	3.7254
AT4	3.2715	4.3278	SN4	1.9897	3.1737	PBCi4R	0.5017	4.1459
AT5	3.2474	4.3645	SN5	1.1821	2.9322	PBCi5R	1.2337	3.6190
AT6	5.5052	4.0483	SN6	2.8007	3.6485	**MPUR habit**		
AT7	4.2268	4.1577	SN7	1.9553	3.4383	H1	2.1546	0.7791
AT8	3.6392	4.1001	SN8	2.7251	3.4760	H3	2.0550	0.7546
Behavioral intention			**Behavior**			**Health motivation**		
BI1R	3.3540	1.1985	B1	3.3471	1.5380	HM1	3.3471	1.1476
BI4R	3.1718	1.2253	B2	3.5258	1.4051	HM2	3.3162	1.0874
BI5R	3.3436	1.2001	B3	3.3883	1.3710			
BI6	3.2543	1.2692						

3.2 Survey validation using Explanatory factor analysis

The Principal Axis Factoring (PAF) extraction with Promax (Oblique) rotation reflects the data structure more accurately than Principal Component Analysis (PCA) extraction with Varimax (Orthogonal) rotation (Anderson & Gerbing, 1988). PAF is preferred in SEM because it accounts for covariation, whereas PCA accounts for the total variance.

The Explanatory Factor Analysis (EFA) using PAF extraction with a Promax rotation was conducted during this study to validate the survey. It shows whether the survey succeeded in quantifying and measuring the factors affecting the riding behavior of small-displacement motorcycle riders and their mobile phone usage while riding. EFA identifies the number of unobserved constructs (latent variables) that produce the variability in the collected data. Several trials were conducted to obtain the final factors to avoid over factored variables and uninterpretable factors. The Kaiser-Meyer-Olkin value (KMO) was found to be 0.812, which is a measure of sample adequacy. A KMO value above 0.5 and under 1 is considered acceptable as it indicates that the data were well-factored. Extraction Sums of Squared Loadings (Cumulative %) is 65.268% (threshold value ≥ 50%), the result shows that the EFA model is acceptable. Initial Eigenvalues (Total) = 1.020 (threshold value ≥ 1), extracting 8 factors from 29 variables with the most meaningful information. Approx. Chi-Square = 5245.591 and Sig. value = .000 (threshold value <0.05), shows that factor analysis is appropriate.

Table 3 shows the obtained factors and loaded variables that have cut off greater than 0.4. The first construct expresses the behavioral intention of mobile phone usage while riding. The second and third constructs are the subjective norm and negative attitude of using mobile phones while riding. The fourth construct showed perceived behavioral control of small-displacement motorcycle riders on the MPUR behavior. The fifth construct was the self-report of small-displacement motorcycle riders on their MPUR behavior. The sixth showed positive attitude and health motivation of participants on the impact of mobile phone usage while riding. The final construct was the habit of using a mobile phone while riding of participants. The main objective of conducting the survey was to investigate psychological factors for mobile phone use while riding among small-displacement motorcycle riders in Vietnam. The eight obtained constructs from the EFA succeeded in explaining the main context of the survey.

Table 3: EFA results and the obtained constructs

Variable Question	**Factor Loading**							
	1	2	3	4	5	6	7	8
Factor #1 (Behavioral intention)								
Never use (BI6)	.946							
Maybe today (BI1R)	.921							
Maybe next 12 months (BI4R)	.864							
At any time when no traffic police on-road (BI5R)	.852							
Factor #2 (Subjective norm)								
Your children (if any) will have a bad image about this behavior (SN4)		.783						
Boyfriend/girlfriend (if any) will be angry with this behavior (SN3)		.761						
Parents/spouse (if married) will worry and reprimand (SN2)		.727						
The traffic police will immediately punish the risky behavior (SN1)		.674						
Your colleagues will have bad thinking about you (SN6)		.664						
Your close friends will not support this behavior (SN5)		.595						
Factor #3 (Negative attitude)								
Express the politeness and respect to other people (AT4)			.889					
Do not miss the important calls (AT3)			.855					
Do not need to call back (loss of money) (AT2)			.717					
Saving time (AT1)			.672					
Factor #4 (Perceived behavioral control)								
I can confidently control the steering wheel when using a mobile phone while riding (PBCi5R)				.696				
When seeing no traffic police (PBCi2R)				.655				
Hear the bell of the incoming calls or messages (PBCi1R)				.648				
I feel the road I am riding is safe (PBCi4R)				.635				
Less vehicle on the road (PBCi3R)				.536				
Factor #5 (Self-report behavior)								
Texting (Q10a2)					.892			
Calling (Q10a1)					.798			
Other purposes (Q10a3)					.764			
Factor #6 (Positive attitude)								
It is easy to be arrested and punished by the traffic police (AT7)						.799		
Causing distraction, can cause property damage, and must pay for vehicle repairs, compensation (AT5)						.776		
Causing distraction can lead to fatal accidents for rider and pillion passengers (AT6)						.667		
Factor #7 (Health motivation)								
For me, my life and health are more important than any other benefit or pleasure (HM1)							.949	
The behavior of using a mobile phone while riding harms my physical condition (makes me tired) (HM2)							.919	
Factor #8 (MPUR habit)								
Calling habit while riding (H1)								.986
Mobile phone use for other purposes habit while riding (H3)								.842

3.3 Model Specification

The SEM is conducted in this research using the AMOS software (version 24), which stands for analysis of moment structures. Confirmatory Factor Analysis (CFA) is the first step to conducting the SEM. It is mainly used to obtain an adequate measurement model. In the second step, the model path (SEM) is modified to investigate the direct relationships between the latent variables producing a causal model. SEM was utilized to test the hypothesized relationships between the predictors and behavioral intention, actual behavior.

In SEM, several fitness indexes that reflect how the fit of the model to the data. Holmes-Smith et al. (2006) and Hair et al. (2010) recommended the use of at least one fitness index from each category of model fit. There are three model fit categories, namely the Absolute fit, Incremental fit, and Parsimonious fit. In this study, the overall model fit was evaluated against several recommended fit indices (see Table 5). Whereas Chi-Square was used to evaluate the fit between the measurement models and the data, P-value in the Chi-Square test should be higher than 0.05 (N ≤ 200), and this value is not applicable for the large sample size (N > 200) (Wheaton et al., 1977). The Root Mean Square Error of Approximation (RMSEA) should be less than 0.08 (Browne & Cudeck, 1993). The Goodness-of-Fit Index (GFI) should be greater than 0.90 (Joreskog & Sorbom, 1984). The Adjusted Goodness of Fit (AGFI) should be greater than 0.09 (Tanaka & Huba, 1985). The Comparative Fit Index (CFI) should be greater than 0.90 (Peter M. Bentler, 1990). The Tucker Lewis Index (TLI) should be greater than 0.90 (Peter M. Bentler & Bonett, 1980), and the Normed Fit Index (NFI) should be greater than 0.90 (Bollen, 1989). Chi-Squared/ Degrees of Freedom (Chi-square/DF) should be less than 3 (Marsh & Hocevar, 1985).

Confirmatory factor analysis

CFA was employed in this stage to verify the factor structure. Figure 1 presents the results of CFA for the whole sample. The goodness-of-fit statistics related to the extended theory of planned behavior model revealed that the hypothesized model fits the data very well, as evidenced by the CMIN/DF = 1.765, RMSEA= 0.051, CFI = 0.947, TLI = 0.938, and NFI = 0.888 (see Table 4).

Table 4: Goodness of fit for CFA

Name of category	Criteria	Threshold	Result
Absolute fit	Chi-Square	P-value >0.05, (N/A for N>200)	-
	RMSEA	< 0.08	0.051
	GFI	> 0.90	0.874
Incremental fit	AGFI	> 0.90	0.841
	CFI	> 0.90	0.947
	TLI	> 0.90	0.938
	NFI	> 0.90	0.888
Parsimonious fit	Chi-square/DF (CMIN/DF)	< 3.00	1.765

Structural Equation Modeling

The SEM model was built to identify the contributions of standard and extended components in TPB to predict MPUR behavioral intention and behavior. Maximum likelihood estimation was applied by comparing the actual covariance matrices representing the relationships between variables and the estimated covariance matrices of the fitted model. The goodness-of-fit statistics related to the extended theory of planned behavior model revealed that the hypothesized model fits the data very well, as evidenced by the CMIN/DF = 1.701, RMSEA= 0.049, CFI = 0.970, TLI = 0.965, and NFI = 0.931 (see Table 5).

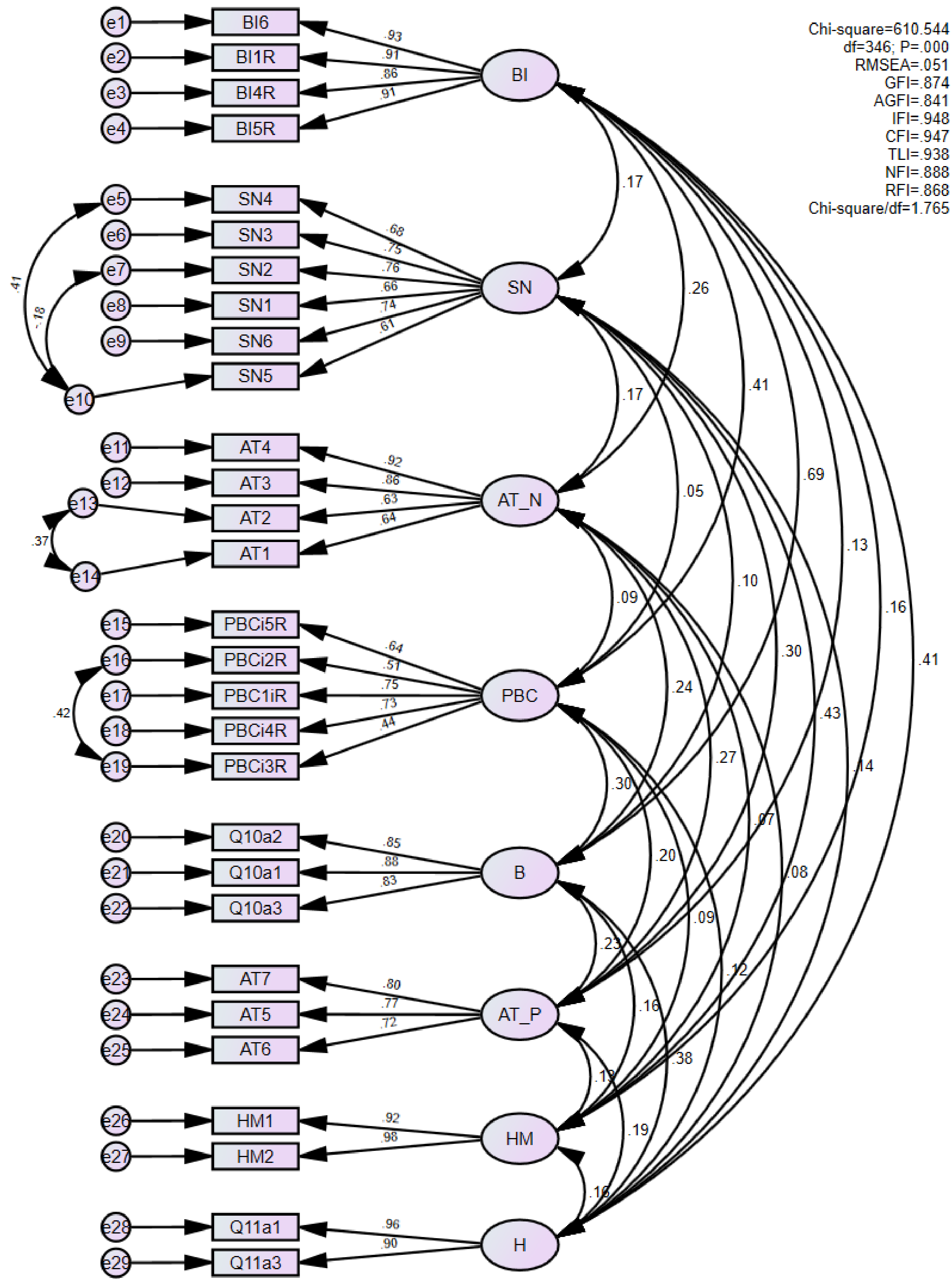

Figure 1: Confirmatory factor analysis of the extended TPB constructs

Table 5: Goodness of fit for SEM models

Name of category	Criteria	Threshold	Result
Absolute fit	Chi-Square	P-value > 0.05, (N/A for N>200)	-
	RMSEA	< 0.08	0.049
	GFI	> 0.90	0.915
Incremental fit	AGFI	> 0.09	0.891
	CFI	> 0.90	0.970
	TLI	> 0.90	0.965
	NFI	> 0.90	0.931
Parsimonious fit	Chi-square/DF (CMIN/DF)	< 3.00	1.701

Figure 2 shows the structural model with standardized path coefficients for small-displacement motorcycle riders. It showed that the items highly loaded on their respective constructs with values greater than 0.5 (except PBC3 = 0.44). It shows that the standardized direct effects on the behavioral intention are 0.21 for negative attitude (AT_N), 0.36 for perceived behavioral control (PBC), 0.08 for health motivation (HM), and 0.36 for MPUR habit (H). Health motivation was not a statistically significant factor for MPUR behavioral intention. The remaining variables (AT_N, H & PBC) were statistically significant, where PBC and H had great influences on MPUR intention. The result also shows that the standardized direct effects on the self-report behavior are 0.12 for MPUR habit, and 0.63 for behavioral intention (BI). These two constructs (H&BI) were statistically significant to self-report behavior.

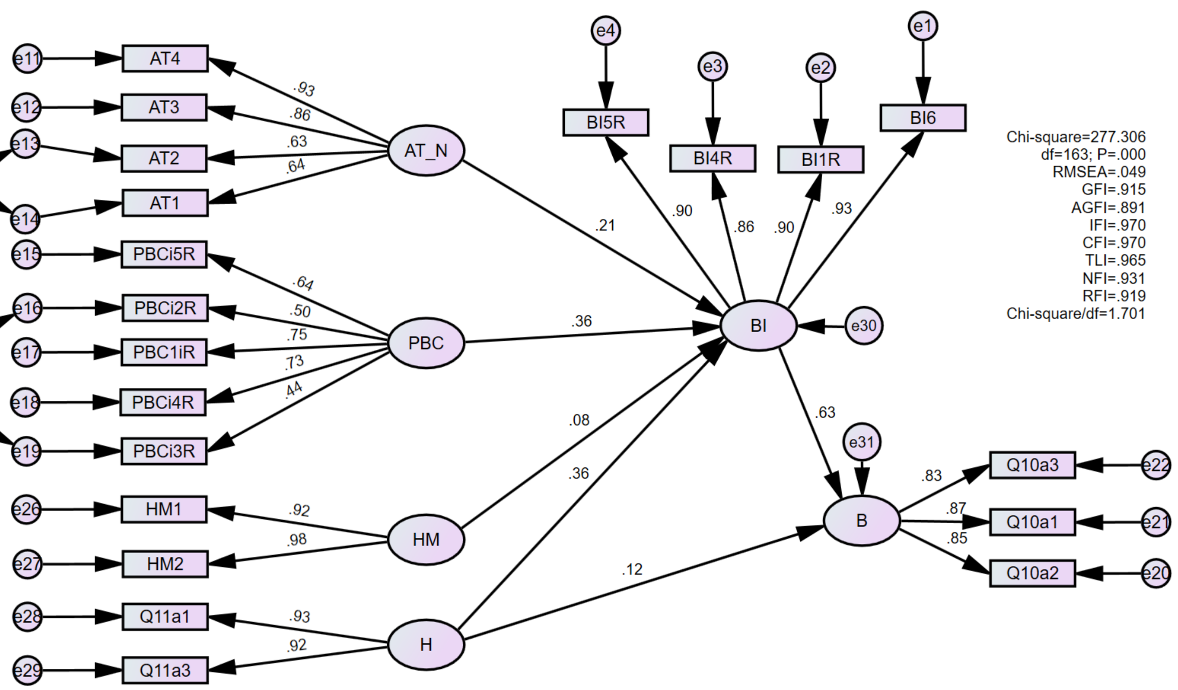

Figure 2: Structural equation model with health motivation & habit

Table 6 shows the unstandardized and standardized regression weights for each construct in the model. In the model, negative attitudes perceived behavioral control and MPUR habit were significant predictors of behavioral intention. The MPUR habit and behavioral intention were significant predictors of self-report behavior. Overall, 31.3% and 46.9%, respectively, of the intentions and behavior variance is explained by the extended TPB model. In summary, the MPUR habit, negative attitude, and perceived behavioral control were significant predictors of behavioral intention. The MPUR habit and behavioral intention were also significant predictors of self-report behavior in this model.

Table 6: Regression weights of the constructs

			Estimate	S.E.	C.R.	Std	P	R^2
BI	<---	HM	.089	.061	1.454	.077	.146	
BI	<---	ATN	.061	.016	3.863	.213	***	.313
BI	<---	PBC	.180	.033	5.449	.360	***	
BI	<---	H	.577	.090	6.376	.363	***	
B	<---	H	.196	.090	2.188	.120	.029	.469
B	<---	BI	.647	.061	10.615	.632	***	

S.E. = Standard error; C.R. = Critical ration; Std = Standardized coefficients; R^2 *= Squared multiple correlation; Significant code: *** =* $p < 0.001$

4. Discussion

4.1 Predictors of MPUR behavioral intention

The results revealed that MPUR habit, negative attitude, and perceived behavioral control related to small-displacement motorcycle rider's MPUR intention, as confirmed in the extended model. A negative attitude towards the behavior of using a mobile phone while riding was significant in the model, and the result revealed that small-displacement motorcycle riders are willing to take the violation while riding if this behavior is associated with meaningful benefits (e.g., saving time, saving money). This finding is consistent with the previous study that negative attitudes positively correlated with the MPUD behavioral intention of drivers (R. Zhou et al., 2012). The perceived behavioral control was significant affected MPUR intention. The positive relationship implies that the more perceived control of the behavior would contribute more to MPUR intention. This finding is consistent with previous studies that perceived behavioral control significantly correlated with risky behavioral intention (i.e., red-light riding, speeding) of motorcycle riders (Satiennam et al., 2018; Trinh & Le, 2018). The health motivation factor was not a significant predictor in the model. Possibly, this was caused by the fact that health motivation and MPUR habit both evaluated the influence of essential referents and therefore were highly correlated. Based on the results, MPUR habits appeared to be a stronger predictor than health motivation. Put differently, the habit of using a mobile phone while riding is probably more influential on MPUR behavioral intention of small-displacement motorcycle riders than their awareness of the importance of their health. This can be supported by a study from De Pelsmacker and Janssens (2007), which found that drivers' habit was one of the strongest influential factors to behavioral intention to speed in a sample of car drivers. Several studies confirmed that subjective norms were associated with risky riding behavioral intentions in developing countries (De Gruyter et al., 2017; Susilo et al., 2015). The study result on the association between social networks and mobile phone use among motorcyclists by De Gruyter et al. (2017) has revealed that subjective norms strongly associated with mobile phone use while riding a motorcycle. Susilo et al. (2015) also concluded that subjective norms significantly influenced the intention to disregard traffic regulations of motorcycle riders. Returning to the topic under study here, the subjective norm was not a significant predictor for the proposed model. In line with Brijs et al. (2014), we think the subjective norm itself without significant effects could mean that, even though respondents understand what important social referents figure out about the harms of MPUR, they are not persuaded to accept these points of view as interesting rules for their behavior. However, since this study was the first in its kind, follow-up research targeting factors of the intention to use of mobile phone while riding in Vietnam will be necessary to confirm these findings.

4.2 Predictors of self-report behavior

As expected, the correlation between intention and self-reported behavior was very strong, indicating that intention is a major motivational component of behavior. Small-displacement motorcycle riders that did not report an intention to use a mobile phone while riding soon (i.e., today, next week, next month) would also not report performing such kind of behavior in reality. Furthermore, MPUR habit related to self-reported MPUR behavior as well, as shown in the model. The significance of the effect of habit on behavior despite TPB constructs being taken into account indicates that habit has a distinct direct correlation with MPUR. This finding is in accordance with a previous study by Bayer and Campbell (2012), indicating that habits of car drivers influence sending and reading texts while riding. Still, behavioral intention to use the mobile phone while riding remained the most important direct predictor as it had a higher beta weight than the MPUR habit constructs. Therefore, MPUR behavior of small displacement motorcycles in Vietnam can both be intentional and habitual, with the emphasis on intentions. This result is in line with the results from a study carried out by Tseng et al. (2013), where the relation of behavioral intention to the actual driving behavior (offenders' driving frequency and annual mileage driven under administrative lifetime license revocation) was stronger than the habit and actual driving behavior relation. The results thus supported the use of MPUR habits together with behavioral intention to predict motorcyclist's MPUR behavior, as confirmed in the model. Again, follow-up research will be necessary to confirm the found factors of mobile phone use while riding in Vietnam.

4.3 Implications for the development of safety interventions

The study shows that negative attitude, perceived behavioral control, and habit are significant predictors of the intention to use a mobile phone while riding, whereas the habit has the highest influence. For deterring the problem of MPUR, it is essential to design interventions, particularly educational programs, aimed at intervening in the habitual use of mobile phone while riding a motorcycle. Such interventions should proactively boost new good habits for the riders so that they would be refrained from repeating the habit of MPUR. Previous studies confirmed that the application of strict law enforcement through increasing the level of punishment or monetary penalty could significantly reduce the behavior of repeating using a mobile phone while driving (Breen, 2009; M. Regan, 2007). However, in the absence of effective publicity programs, the enforcement countermeasures would become less positive, and the behavior rate would have risen to a similar level before the enforcements (McCartt & Geary, 2004). Key to the achievement of legislative measures is the capacity to sustain a significant level of enforcement and get the public well aware of the strict punishment and frequent patrol or detection. The enactment of the new legislation also must be accompanied by innovative public awareness campaigns and educational programs. In essence, these could help generate safe motorcycle riders via providing opportunities and tactics to form desirable habits for motorcycle riders, such as the habits of turning a mobile phone into a silence mode, placing a mobile phone at a hard-to-reach position prior to riding, planning breaks in your trip to contact family and friends in necessary cases, advising your family and friends not to call when you know you will ride, and mapping the route before riding. Publicity programs should educate the public about the actual risk of road crashes associated with MPUR habits and ways to avoid doing the behavior among the habitual MPUR riders (Isa et al., 2012; Luke et al., 2005). Sustained and targeted public awareness campaigns and education programs should also emphasize the harms of the negative attitude of MPUR (e.g., using a mobile phone while riding to express the politeness and respect to other people, or to avoid missing important calls), and enhance the perceived behavioral control of motorcycle riders (e.g., should not use a mobile phone while riding even there is a less vehicle on the road, or you are a skillful motorcycle rider) to change their MPUR intentions.

While the afore-mentioned interventions aim at the safer intention, it is also essential to set strategies for helping small-displacement motorcycle riders act on their harmless intentions or preventing motorcycle riders act on their risky intention. This study shows that MPUR habit and intention were significant predictors of the behavior of mobile phone use while riding, whereas MPUR intention has a higher weight. Therefore, interventions should be targeted at reducing MPUR exposure via engineering countermeasures. The application of technological measures to minimize riders' intention of usage of mobile phones is being employed and confirmed its effectiveness in some countries (e.g., America, Japan, Australia) (Albert et al., 2016; Oviedo-Trespalacios et al., 2019; WHO, 2011). For instance, some self-locking applications designed to prevent or limit the rider from using common features of the mobile phone while riding such as calling, typing, reading and prevention of various notifications (e.g., TxtBlocker, Live2Txt, PhonEnforcer) (Funkhouser & Sayer, 2013; Vegega et al., 2013).

4.4 Limitations of the study

Several potential limitations in terms of validity can be noted. First, the survey data are limited in terms of geographical spread. The data was collected in downtown, urban and suburban areas of Ho Chi Minh City and Binh Duong Province, while respondents living in rural areas were not included in the sample. Second, this study is based on self-report measures. The possibility for a social desirability bias in responses provided, cannot be totally excluded. Furthermore, crashes while riding a motorcycle may also be underreported since motorcycle riders who have been seriously injured or killed would not have been included in the survey. Last but not least, the primary target group of this study consists of small-displacement motorcycle riders. Psychological factors of large-displacement motorcyclists were not investigated in this study, preventing the possibility to compare the difference between the two motorcycle rider groups. To further investigate the psychological factors of mobile phone use while riding among motorcyclists in Vietnam, empirical data (e.g., data collection including rural areas, and with a large-displacement motorcycle rider group) should be conducted in addition to in-depth questionnaire surveys.

5. Conclusion

This study applied the extended TPB to study MPUR intention and behavior among small-displacement motorcycle riders in Vietnam. The results showed that MPUR habits, together with negative attitudes and perceived behavioral control are related to riders' MPUR intention and behavior.

The results have several theoretical and practical implications. They show that the extended TPB model allowed to gain more insight into underlying factors of MPUR (e.g., MPUR habit) that could be targeted when designing safety interventions. Confirming previous research, the results also reveal that behavioral intention has a strong correlation to behavior, especially when motorcycle riders report a strong MPUR habit. Considering all factors of intention, this study found that negative attitude, perceived behavioral control, MPUR habit may play an important role in shaping the intention of small-displacement motorcycle riders to use of a mobile phone while riding.

The findings provided further possible implications for designing interventions to change people's distracted riding behavior through law enforcement, social awareness campaigns, education programs, and innovative technology. In particular, the enhanced law enforcement and application of innovative technologies confirmed its potential for practice.

Last but not least, this study contributed to a broader scientific understanding and implication of combining different socio-cognitive models to explore MPUR intention and behavior among small-displacement motorcycle riders. In other words, rather than replicating socio-cognitive models, combining them to understand the underlying determinants of this phenomenon better, might be a suitable and 'scientifically accepted' approach to learn more about this road safety issue. These innovative scientific implications applied and proved useful in previous studies to explore the risky behaviors of motorcycle riders (Brijs et al., 2014; Satiennam et al., 2018; Trinh & Le, 2018). Furthermore, this study also provided knowledge and insight into motorcycle ridership in motorcycle dependent cities (i.e., Ho Chi Minh City and Binh Duong Province) of a developing country (i.e., Vietnam).

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