



The Open Psychology Journal

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RESEARCH ARTICLE

Traffic Risk Perception, Risky Road Use Behaviors among Vietnamese People

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Abstract:

Background:

The total number of (road) traffic accidents in Vietnam remains high and the death toll caused by these accidents also ranks second in Southeast Asia. Many studies elsewhere have shown a positive correlation between the traffic risk perception and the traffic risky behavior (henceforth, referred to as TRP and TRB, respectively, for short) However, this relationship has been relatively under-researched in the context of Vietnam. This study aimed to fulfill the above research gap by investigating the present status of TRP and TRB among Vietnamese people who used motorbikes and/or electric motorbikes for their daily travel as well as the association between these two variables.

Methods:

This was a cross-sectional quantitative study. Data were collected from a convenient sample of 373 people using motorbikes and electric motorbikes (102 males, 271 females; *M* age = 25.8) by means of an online questionnaire survey. This questionnaire survey was constructed based on the Risk Perception Scale on traffic risk developed by Ram *et al.* (2016) as well as an additional question that was to explore the risk behaviors of research participants during their traffic involvement for the last thirty days.

Results:

TRP indices were found to be higher for women than for men. Young males with extroverted characteristics had higher TRB than old females with introverted characteristics. However, no relationship existed between these two factors in the present study.

Conclusion:

As the finding of this study turned out to be inconsistent with those of previous research, more empirical studies are still welcome in this area.

Keywords: Traffic risk perception, Risky road-use behaviors, Vietnamese people, Risk perception scale, Traffic risky behavior, Death toll.

Article History

Received: November 16, 2019

Revised: March 09, 2020

Accepted: March 30, 2020

1. INTRODUCTION

1.1. Context

In Vietnam, motorbikes are one of the most popular means of transport. From 1990 to 2018, for example, the number of motorbikes in this country increased about 48 times, from more than 1.209.000 to nearly 58.170.000 units. Some big cities which have a high rate of using motorbikes up to 90% include

Hanoi and Ho Chi Minh City [1]. According to the latest statistics, almost 95% of the vehicle fleet in Vietnam is motorbikes, with an average of 7.500 motorbikes being registered every single day [2, 3], which together make this nation rank first among ASEAN countries regarding the quantity of motorized vehicles in use [4].

In 2018, a total of 18.736 traffic accidents occurred throughout the whole nation, including 9.166 collisions and 9.570 cases of other accident types, causing 8.248 deaths and 14.798 injuries. On average, there were 51 traffic accidents nationwide every single day, including 25 collisions and 26 cases of other accident forms, causing 23 deaths and 41 injuries

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[5]. Out of the total number of traffic accidents mentioned above, 60.25% was motorbike-related, 33.5% car-related and 6.25% related to other types of vehicles [6].

On a regional scale, the fatality rate caused by traffic accidents in Vietnam is also high. Specifically, according to the World Health Organization (WHO) report published in 2018, Vietnam ranked second in Southeast Asia in terms of roadside deaths, at a rate of 26.4 / 100.000 [7].

The number of traffic accidents in reality, however, might be far higher than the above officially-reported figures, because the practice of recording traffic accidents in Vietnam only tallies the accidents that involve great losses. With regards to the death toll, this counting practice takes into account the casualties right after the accidents, but not the cases occurring within 30 days after being hospitalized [8].

In Vietnam, studies on traffic involvement often focus on the following aspects: the cognition, attitude and behavior of traffic participants in general [9 - 13] or the effect of education programs on traffic safety [14]. Recently, there have been some research projects that give a closer look at traffic risky behaviors with a wide range of subtle topics, such as young people's traffic risky behaviors [15], using cellphones while driving [16]; tendency in wearing helmets when driving motorbikes [17]; or the relationship between phone using and risky behaviors while driving [16, 18]. However, research on Traffic Risk Perception (TRP), Traffic Risky Behavior (TRB) and their relationship is still limited in this context. The aim of the present study was to examine the current status of TRP, TRB among Vietnamese motorbike and/or electric motorbike users, as well as the link between these two variables.

1.2. The Association between Traffic Risk Perception and Traffic Risky Behaviors

1.2.1. Traffic Risk Perception

Traffic Risk Perception is defined as the driver's experience of potential traffic hazards, identified by information about traffic hazards in the traffic environment and their cognitive ability to prevent such hazards from being transformed into actual accidents [19] or subjective explanations of risks related to traffic situations. Prior research consistently shows that subjective assessments of traffic risks can increase the self-protective behavior in traffic among automobile drivers [20]. Subjective awareness of traffic risks involves two factors, which are the probability of an accident to happen and the negative consequences it might bring about [20,21]. In short, traffic risk perception is an individual's subjective assessment of the probability of a collision and/or an accident while in traffic and the consequences/problems (negative implications) an individual may experience as a result of that collision/accident.

1.2.2. Traffic Risky Behavior

Hsin-Li Chang and Tsu-Hung Yeh (2007) divided traffic risky behaviors into three categories. (i) The first category includes negligent behaviors such as driving at high speed, zigzagging in the segmented, narrow roads, driving without vehicle mirrors or turning without signals. (ii) Regarding the

second category, drivers are aware of dangerous or illegal behaviors, but still intentionally commit such violations as drinking and driving, speeding and driving through red lights. (iii) When it comes to the last category, risky behaviors can be associated with the negligence of motorbike examination or regular maintenance of vehicle's parts such as brakes, lights or tires [22]. Many researchers believe that some of the most common risky behaviors in traffic include drinking alcohol [23], not wearing helmets [24], using mobile phones [25] and crossing red lights [26].

According to Nguyen Van Luot and Phi Thi Thai Ha (2015), road TRBs are conscious, dangerous and risky behaviors while participating in traffic. These behaviors can threaten the physical and mental health and the life of the driver himself as well as that of the people around him [15]. This appears to be a comprehensive definition of TRB of road users, because it encompasses both physical and mental damage that road users may undergo as a result of their risky behaviours as well as the damage they may cause to others who share the same road. In this study, we use this concept to guide our research implementation.

1.2.3. The Association between Traffic Risk Perception and Traffic Risky Behaviors

Some psychologists suggest that people can choose to behave based on their own assessment of the risks and benefits of their behaviors, along with their beliefs in their ability to change or not change their behavior [27, 28]. The two most important components of TRP are threat perception and behavioral evaluation. Threat perception is related to awareness of probable behavior (perceived susceptibility) and its consequences (perceived severity) [27,28]. Behavioral evaluation assesses behaviors as well as the perceived merits and demerits related to that behavior that an individual might experience [27, 28]. In addition, there are many factors that can influence TRB, such as cultural background, education level, experience and beliefs in self-capacity [29]. Researchers regard traffic risk perception as an important concept in road traffic safety studies that aim to devise countermeasures for reducing the number of traffic accidents [30].

1.3. Literature Review

Traffic Risk Perception and Traffic Risky Behaviors are topics that have gained the attention of many scholars from far and wide, which can be synthesized into the following research lines/strands:

(i) The first strand focuses on the relationship between TRP and TRB. Studies in this area show that higher risk perception has a positive effect on speed limit [31]. It is because, as most researchers in this area claim, a feeling of risk at a given speed might prompt drivers to believe that speed is already too high and thus set a limit to their driving speed. TRP also has a direct effect on safe behavior during traffic participation. There is a significant correlation between drivers' risk perception and perception of driving tasks and these both perceptions affected drivers' road safety attitude [32]. Lanning *et al.* (2018) also confirmed the positive impact of risk perception and self-efficacy on drivers' driving behavior. These studies altogether

show that TRP and TRB have a close relationship [29]. Thus, studying of TRP and TRB may have an important role in reducing the traffic accident rate all over the world as well as in Vietnam.

(ii) Another research line concerns with the current status of common TRB among road users. Below are some key findings in this research line: Speeding is a common TRB [30, 33]; Excessive driving speed in different road situations is considered the most common reason for road crashes, regardless of drivers' ages and driving skills [34]. Research also shows that speeding is more likely to occur in urban areas or when drivers are under time pressure [33] in order to catch up with a pre-set meeting or appointment, for instance [35] or when they intend to pass a red light [26]. Using phones is also one of the widely studied risky behaviors. The use of phones while driving is also found to cause as many traffic accidents as in the case of drinking alcohol or speeding [36, 37]. It should be noted here that chatting with passengers in the car is different from talking on the phone while driving. In fact, there are many driving errors that occur while drivers are using mobile phones and driving at the same time [36]. Drinking alcohol and driving is also another common risky behavior among road users [38]. As informed by these studies, all the TRBs listed above are also selected as the foci of our present study.

(iii) The next research strand centers around different factors that affect TRP and TRB. These studies show that gender, age, experience, personality trait, culture, and income are among the most common influential factors [21, 39 - 41]. In terms of gender, young male motorists are more likely to have risky behaviors than their female counterparts [21, 42]. In terms of age, young people tend to have higher TRBs than senior drivers [26]. Lin Yao and Changxu Wu (2012) also pointed out that gender and experience are both closely related to traffic incidents that occur due to driver errors. In particular, men are more likely to have accidents than women, and people with driving licenses are less likely to have accidents than those without driving licenses [21]. Men tend to use phones while driving more often than women and younger people tend to use phones more often than their senior counterparts [43]. Recent research in Vietnam also shows similar results. For example, male traffic participants tend to have more risky behaviors than female counterparts [15], men show a higher level of so-called Excitement - Seeking than women, so their level of compliance with the traffic safety laws is also lower [44]. The driving experience also exerts a certain effect on the chance of having traffic accidents. Young driver groups, especially young women with little driving experience, are more likely to cause traffic accidents [22].

Character traits can also predict the TRP and the TRB [45]. An angry and unusual character is often indicative of serious violated behaviors, and all four mechanisms of anger, altruism, Excitement - Seeking and abnormality can predict common violated behaviors. A high score for Excitement - Seeking, normlessness and aggression is often found to be associated with both risk-taking attitudes (*i.e.*, negative attitudes towards traffic safety) and risky driving behaviors [46]. Research also indicates that driving speed is strongly related to a lower

Aversion to Risk Taking [45]. It means that Aversion to Risk Taking can be considered a mediator of the influence of key aspects of personality on the driving speed and the TRB in general. Ingunn Olea Lund, Torbjörn Rundmo (2009) concluded that there were differences between Norway and Ghana related to traffic risk perception, risk sensitivity and risk willingness. Some studies have shown that cultural factors and income also affect attitudes and perceptions of traffic risks, traffic risky behaviors [47 - 49].

(iv) The last research line aims to explore different measures to reduce TRB. Scholars consistently suggest that people should undertake pilot driving programs before being granted driving licenses [29] and that they should also be mandated to wear helmets while driving (electric) motorbikes [50]. A combination of education and propaganda programs is also found to have lasting effects on the attitude of road users and encourages them to comply with traffic laws. In other words, it is education, but not legal enforcement that has a better impact on road users' compliance with traffic safety laws [14]. In addition, adding new content to the driving training program can be another way to cultivate the proper traffic behavior among young drivers. For example, Machin and Sankey (2008) suggested that Self-awareness exercises may be included in driver education programs to help young drivers to gain better insight into their tendency to crave excitement and the possible consequences that this behavior may bring about for other drivers. Previous research consistently emphasizes on supporting young people to be aware of how personality traits influence their decisions. It is because such awareness is generally deemed to be more effective for reducing TRBs than merely telling young drivers to obey the rules [45].

In summary, there have been many research directions related to traffic behavior in the existing literature. In this paper, however, we only focus on the current status of the Traffic Risk Perception (TRP) and Traffic Risky Behavior (TRB) among Vietnamese motorbike and electric motorbike users as well as the relationship between these two variables (if any)

1.4. The Present Study

As seen from the above review, the issue of TRP, TRB and their relationship has been relatively well-researched in many contexts throughout the world. This, however, does not hold true for the case of Vietnam. In addition, through that review, we also recognized a paucity of empirical research into the link between the TRP and the TRB among motorbike and electric motorbike users. Therefore, our present study is expected to address this research gap. At the same time, this study might be a useful reference for stakeholders in their endeavors to reduce traffic risky behaviours and, thus, traffic accidents both inside and outside of the Vietnamese context.

The present study answers the following questions:

- (1) How do Vietnamese motorbike and electric motorbike users rate their TRP and TRB?
- (2) Is their rating outcome associated with their individual factors, including age, gender, occupation status, length of driving experience, and in/extroversion?

(3) Is there any relationship between their rated TRP and TRB levels?

2. METHODS

2.1. Research Sites and Participants

This was a cross-sectional study. Research participants were selected by means of convenience sampling. They were Vietnamese people who were studying and working in Hanoi, Hung Yen, Hue, Da Nang, Phu Yen and Ho Chi Minh City. An online questionnaire survey was posted on public forums related to the transport sector. During the posting period from May to July 2019, a total of 419 responses were received. Such data were first screened in order to remove irrelevant cases, which finally brought about a pool of 373 eligible responses. These responses were used as the primary data in the present study.

Among these 373 respondents, 72.7% were females. The average age of all respondents was 25.80 ($SD = 7.08$) Out of these research participants, 89.8% used a motorbike and 10.2% an electric motorbike. The average length of their driving experience was 7.00 years ($SD = 5.78$) 78.8% of these respondents lived in urban areas and 52.0% were either full-time or part-time employees.

2.2. Measures

The first scale we used was The Risk Perception Scale developed by Ram *et al.* (2016) We chose this scale, because it allowed respondents to be aware of the two aspects: (a) they themselves can be in danger while driving and (b) they can also put others in danger by their driving behaviours. Moreover, this scale has been employed by many previous studies (*e.g.*, Ma *et al.* (2009) or Ram *et al.* (2016)), thus its reliability and validity were verified [32, 51]. The Risk Perception Scale (Ram *et al.*, 2016) was developed based on that of Ma *et al.* (2009) This scale consisted of 6 items that would be rated on a five-point Likert scale from 1 for “strongly disagree” to 5 for “strongly agree”:

- (1) Others may be injured in a road accident
- (2) Others may be involved in a road accident
- (3) I may be injured in a road accident
- (4) Feel unsafe that I could be injured
- (5) I may be involved in a road accident
- (6) I feel unsafe that others could be injured by me

The final perception of traffic risk was gauged as the average score of all six items. A higher score meant a higher awareness of the traffic risks that a person had. In the study by Ma *et al.* (2009), Cronbach’s Alpha of the scale was 0.82. In the present study, Cronbach’s Alpha was 0.861, Skewness = -0.205 and Kurtosis = 0.601.

To measure the status/level of TRB as perceived by the research participants, a question on traffic risky behaviors was developed based on our own observations of the common risk behaviors among Vietnamese motorbike and electric motorbike users, as well as those reported by the National Traffic Safety

Committee in recent years [8], by Nguyen Van Luot *et al.* (2015), Truong *et al.* (2018), Truong *et al.* (2019) [15, 18, 52] and Ferguson (2003), and Cubranic (2013) [53, 54]. This question aimed to measure the risky behaviors of people participating in road traffic in their latest 30 days. This question went as follows: “In the last 30 days, how many times did you perform risky behaviors while participating in road traffic?” Risky behaviors include the following:

- (1) Texting
- (2) Checking message (*e.g.*, sms/facebook/zalo)
- (3) Answering a phone call
- (4) Making a phone call
- (5) Driving on the sidewalk
- (6) Driving in the opposite direction
- (7) Not wearing a helmet when riding a motorbike
- (8) Wearing a helmet that fails to guarantee your safety (*e.g.*, without a buckle or without quality assurance)
- (9) Using alcohol of any type;
- (10) Passing the traffic light even after it turns yellow
- (11) Driving in fatigue (after exercising or/and staying up all night long)

In response to this question, respondents reported their frequency of committing each of the behaviours as: “1 = No”, “2 = less than 3 times”, “3 = 3 to 6 times”, “4 = from 7 to 10 times”, “5 = more than 10 times”. The seriousness level of their traffic risky behaviors was the average scores of all 11 items above. The higher score they rated, the higher the risky behavior they had. The Cronbach’s Alpha of question was 0.637, Skewness = 0.821 and Kurtosis = 0.147.

In addition, some general information about the research participants was also collected, such as: gender, age, mean of transport, driving experience, occupation, living place, and personal character (*i.e.*, introvert or extrovert)

As the main purpose of this study was to examine the status/level of TRP and TBR among the target population as well as the relationship between these two variables, we defined Traffic Risk Perception as an independent variable and Traffic Risky Behavior as a dependent one.

2.3. Data Analysis

All the data was processed by a Statistical Package for the Social Sciences (SPSS version 23.0)

3. RESULTS

3.1. Traffic Risk Perception

Our first research question was concerned with the participants’ self-rating of their own TRP levels. Table 1 provides descriptive statistics for their rating outcome.

The data in Table 1 shows that in general, people’s awareness about the risks of participating in road traffic was quite high (Mean = 3.2901 out of the maximum score of 5.00 points) It should also be worth noting that 5/6 items in the

above survey were rated with a mean of 2.5 points or higher.

People tended to see higher risks on the part of others than on themselves. Specifically, items 1 and 2 were both rated with at least a mean of 3.7922 points, while that of all other items ranged somewhere between 2.4432 and 3.4129 points.

Table 2 shows the difference in the TRP rating outcome between subtle groups of the research participants divided by gender, age, transport mode, driving experience, living place, occupation and personality trait.

(1) There was a statistically significant difference in the levels of traffic risk perception between male and female groups. Specifically, the female group was more aware of the risks when participating in traffic than the male group: $t(178) = -2.963, p = 0.003$.

(2) The group with less than 5 years of driving experience was also found to be more aware of the risks than the group with at least 5 years of driving experience: $t(336) = 2.259, p = 0.025$.

3.2. Traffic Risky Behaviors

Table 3 presents the participants' rating outcome for their own TRB within the latest 30 days.

It is clear from the above table that the three most common types of risky behaviors among these respondents were

“driving on the sidewalk, “answering a phone call” and “driving in a tired state with a mean score of 1.9893, 1.8338 and 1.8016 out of 5.00 points, respectively.

Meanwhile, the least common risky behaviours were “texting”, “using alcohol of any type” and “driving in the opposite direction” with a mean score, also in that order, of 1.2842, 1.2574 and 1.1582 points.

Again, Table 4 presents the difference in the TRB rating outcome between subtle groups of the research participants divided by gender, age, transport mode, driving experience, living place, occupation and personality trait.

(1) There was a significant difference in the TRB levels among three age groups: $F(2,370) = 3.016, p = 0.050$. According to the results of the Tukey post hoc analyses for pairwise comparisons, those who were between 18 and 22 of age tended to have more traffic-risky behaviours than those whose age was above 30 ($p = 0.015$)

(2) The extrovert group was also found to have more risky behaviors than the introvert group: $t(284) = -2.095, p = 0.037$.

Regarding the final research question, this study found no relationship between the TRP and the TRB: $r = 0.006$ with $p > 0.05$. A more detailed statistical report is presented in Table 5 and 6.

Table 1. The status of traffic risk perception of research participants.

S.No	Items	N	Mean	SD	CI 95%	
					Lower	Upper
1.	Others may be injured in a road accident	373	3.8346	1.1731	3.7161	3.9516
2.	Others may be involved in a road accident	373	3.7922	1.1870	3.6705	3.9048
3.	I may be injured in a road accident	373	3.4129	1.3219	3.2834	3.5442
4.	Feel unsafe that I could be injured	373	3.3448	1.3524	3.2108	3.4898
5.	I may be involved in a road accident	373	2.9129	1.3553	2.7791	3.0456
6.	I feel unsafe that others could be injured by me	373	2.4432	1.3925	2.2960	2.5828
-	Risk Perception (total)	373	3.2901	.99785	3.1842	3.3922

Table 2. Relationship between traffic risk perception and other driver-related factors.

S.No	Criteria	Classification	N	Mean (SD)	F.t.df. sig.
1.	Gender	Male	102	3.040 (1.000)	$t(178) = -2.963, p = 0.003$
		Female	271	3.384 (0.981)	
2.	Age	Aged 18 – 22	156	3.350 (0.973)	$F(2, 370) = 0.524, p = 0.593$
		Aged 23 – 30	148	3.258 (0.991)	
		Aged > 30	69	3.221 (1.070)	
3.	Mean of Transport	Motorbike	38	3.111 (1.035)	$t(45) = 1.127, p = 0.266$
		Electric motorbike	335	3.310 (0.993)	
4.	Driving experience	1 – 5 years	149	3.429 (0.940)	$t(336) = 2.259, p = 0.025$
		> 5 years	223	3.196 (1.028)	
5.	Living place	Rural	79	3.192 (1.050)	$t(117) = -0.947, p = 0.346$
		Urban	294	3.316 (0.983)	
6.	Occupation	Student	179	3.369 (0.969)	$t(370) = 1.479, p = 0.140$
		Employee	194	3.216 (1.020)	
7.	Personal trait (self-report)	Introvert	231	3.251 (0.988)	$t(292) = -0.957, p = 0.339$
		Extrovert	142	3.353 (1.013)	

Table 3. Status of traffic risky behaviors of participants.

S.No	Items	N	Mean	SD	CI 95%	
					Lower	Upper
1.	Texting	373	1.2842	.6473	1.2225	1.3539
2.	Checking message (e.g., sms/facebook/zalo)	373	1.4263	.8119	1.3512	1.5121
3.	Answering a phone call	373	1.8338	.9005	1.7453	1.9276
4.	Making a phone call	373	1.6032	.8476	1.5201	1.6970
5.	Driving on the sidewalk	373	1.9893	1.0343	1.8901	2.1018
6.	Driving in the opposite direction	373	1.1582	.4327	1.1180	1.2038
7.	Not wearing a helmet when riding a motorbike	373	1.3485	.6930	1.2761	1.4182
8.	Wearing a helmet that fails to guarantee your safety (e.g., without a buckle or without quality assurance)	373	1.5416	1.1223	1.4316	1.6541
9.	Using alcohol of any type	373	1.2574	.5269	1.2038	1.3137
10.	Passing the traffic light even after it turns yellow	373	1.6810	.8598	1.5952	1.7774
11.	Driving in fatigue (after exercising or staying up all night long)	373	1.8016	.9148	1.7212	1.8954
-	Traffic Risky Behaviors (total)	373	1.5386	.3826	1.4984	1.5784

Table 4. Relationship between traffic risky behaviors and other driver-related factors.

S.No	Criteria	Classification	N	Mean (SD)	F.t.df. sig.
1.	Gender	Male	102	1.586(0.404)	$t(169) = 1.431. p = 0.154$
		Female	271	1.523(0.037)	
2.	Age	Aged 18 – 22 (1)	156	1.582 (0.385)	$F(2,370) = 3.016. p = 0.050$ $(1) > (3) p = 0.015$
		Aged 23 – 30 (2)	148	1.534 (0.388)	
		Aged > 30 (3)	69	1.448 (0.351)	
3.	Mean of Transport	Electric Motorbike	38	1.636(0.380)	$t(45) = -1.670. p = 0.102$
		Motorbike	335	1.529(0.382)	
4.	Driving experience	1 – 5 years	149	1.545(0.393)	$t(310) = 0.105. p = 0.916$
		> 5 years	223	1.536(0.378)	
5.	Living place	Rural	79	1.565(0.394)	$t(120) = 0.502. p = 0.617$
		Urban	294	1.533(0.380)	
6.	Occupation	Student	179	1.576(0.373)	$t(371) = 1.867. p = 0.063$
		Employee	194	1.503(0.388)	
7.	Personal trait	Introvert	231	1.505(0.370)	$t(284) = -2.095. p = 0.037$
		Extrovert	142	1.596 (0.398)	

Table 5. Model Summary^b.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	0.057 ^a	0.003	0.001	0.38252	0.003	1.211	1	371	0.272	1.494

a. Predictors: (Constant), Traffic Risk Perception

b. Dependent Variable: Traffic Risky Behavior

Table 6. Coefficients^a.

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% CI for B		Correlations			Collinearity Statistics		
	B	SE	Beta			Lower	Upper	Zero-order	Partial	Part	Tolerance	VIF	
1	(Constant)	1.466	0.069	-	21.346	0.000	1.331	1.601	-	-	-	-	-
	Traffic RiskPerception_	0.022	0.020	0.057	1.101	0.272	-0.017	0.061	0.057	0.057	0.057	1.000	1.000

a. Dependent Variable: Traffic Risky Behaviors

4. DISCUSSION

This study aimed to investigate the status of TRP and TRB among Vietnamese motorbike and electric motorbike users, as well as the relationship between these two factors. The key findings went as follows. Firstly, in general, people's awareness of traffic risks was quite high. Women were found to be more aware of those risks than men and they were also less likely to have traffic risky behaviors than their male counterparts. The three most common risky behaviors among the surveyed people were "driving on the sidewalk", "answering a phone call", and "driving in fatigue". The older drivers had fewer TRBs than the young ones. Risky behaviors were more common among extroverts than introverts. Unlike most of the previous studies, this study found no correlation between the TRP and the TRB.

Regarding Traffic Risk Perception, the results of our research echoed those of Ma *et al.* (2009) and Ram *et al.* (2016) Specifically, in a study by Ma *et al.* (2009), the mean score for TRP ranged from 2.44 to 3.71 out of the maximum score of 5 points. These figures, in fact, did not differ much from what we found in the present study (*i.e.*, between 2.44 and 3.83 points) [32, 51].

Our findings were also similar to those of previous studies in the regard that men were more likely to have risky behaviors than women [15, 42] while women were more aware of traffic-risky behaviors than men. The proportion of people using mobile phones while traveling in our study was as high as that in some previous studies [16, 18]. Young people were also found to have more TRBs than their senior counterparts [21, 41, 43]. As Machin and Sankey (2008) already reported in their study, we also found that people with an introverted personality had fewer risky behaviors than extroverts [45].

Previous studies have consistently shown a correlation between the TRP and the TRB [31, 32]. However, this does not hold true for the present study. Therefore, as Ma *et al.* (2009) once reported, risk perception did not have direct effects on risky driving behaviors, we can find to have indirect effects on risky driving behavior through other variables [51].

This research represented a fairly new research direction in Vietnam. In the past, studies conducted in Vietnam were only related to traffic behaviors and compliance with traffic laws [52 - 55]. The present study once again confirmed that gender and age, as well as personality characteristics, might have some relationship with TRP and TRB. This was useful information for managers and policymakers to propose measures and programs to raise people's awareness about traffic risks, which, in turn, were expected to contribute to the reduction and prevention of traffic risky behaviors.

However, our study also had several limitations. Firstly, this was a cross-sectional study, which allowed the research team to understand the problem at a certain point of time, but not over a longer stretch of time. Secondly, although our sample size was relatively large, it still failed to represent the entire Vietnamese population. In addition, in this study, we merely carried out the survey among people with internet access. Therefore, this result could not be generalized for a larger population. Thirdly, people's assessments of their own

TRP and TRB were done by means of self-report. There were no in-depth interviews to better understand their perceptions on this issue. Therefore, we still call for more empirical research in this area.

CONCLUSION

In short, our research showed that women were more aware of the risks while participating in traffic than men. Males were found to have more risky behaviors than their female counterparts. Senior drivers had fewer risky behaviors than younger ones. People with an extrovert personality tended to have more risky behaviors than those with an introvert personality. We, however, did not find any evidence for the link between TRP and TRB. Therefore, more studies are still needed in this area, especially the ones that give priority to the TRB as well as suggestions of relevant policies and/or programs to minimize TRB among road users in Vietnam.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Not applicable.

HUMAN AND ANIMAL RIGHTS

No animals/humans were used for studies that are the basis of this research.

CONSENT FOR PUBLICATION

Not applicable.

AVAILABILITY OF DATA AND MATERIALS

Not applicable.

FUNDING

None.

CONFLICT OF INTEREST

The authors declare no conflict of interest, financial or otherwise.

ACKNOWLEDGEMENTS

Declared none.

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