Transport and Communications Science Journal

EXPLORING FACTORS ASSOCIATED WITH RIDING ATTITUDES OF MOTORCYCLISTS IN VIETNAM

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ARTICLE INFO

TYPE: Research Article
Received: 02/07/2022
Revised: 02/11/2022
Accepted: 17/11/2022
Published online: 15/01/2023
https://doi.org/10.47869/tcsj.74.1.8

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Abstract. The riding attitude of motorcyclists is an important key in the investigation and analysis of motorcyclists' behaviors in traffic flow. The main aims of this study are to explore factors associated with the riding attitudes of motorcyclists in Vietnam using a self-reported questionnaire with Exploratory Factor analysis (EFA) and Confirmatory Factor Analysis (CFA) approaches. This study was conducted from January to March 2019, surveying randomly selected motorcyclists at least the age of 16 years in Hanoi, the capital of Vietnam. A sample consisting of 716 motorcyclists was used to analyze EFA and CFA. The results presented 11 items that were confirmed to compose the Vietnamese motorcyclists' riding attitudes. Three factors, including attitude towards traffic flow, attitude towards rule obedience and speeding, and attitude towards fun riding were explored in this study. Besides, the study also showed that there were differences in riding attitudes among groups by age group, education level, riding experience, related to accidents in the last three years, and involvement in near-accidents in the last three years. The results of this study can inform the future study of the risky behaviors of Vietnamese motorcyclists.

Keywords. Motorcyclists, self-reported questionnaire, riding attitudes, Confirmatory Factor Analysis (CFA), Exploratory Factor Analysis (EFA)

1. INTRODUCTION

Motorcycles are the most frequent means of transportation in Vietnam and other South-East Asia countries due to their inexpensive cost and low fuel consumption [1, 2]. For example, in Hanoi City (Vietnam), as of 2020, there are more than 5.7 million motorcycles registered with over 700 units per 1,000 people [3], carrying over 80% of the trips in this city while public transport only meets about 10-12% of the traffic demand[4]. As the number of motorcycles on the road is growing, the number of motorcycle accidents and fatalities in these countries is also increasing. World Health Organization (WHO) [5] reported that almost half of all deaths on the world's roads are among road users with the least protection (i.e., motorcyclists, cyclists, and pedestrians). Of these, the majority of road traffic deaths are among motorcyclists in South-East Asia, accounting for 43% of all deaths. Vietnam as a country in the South-East Asia region has accidents involving motorcyclists accounting for over 66.7% of road traffic accidents, and human factors accounting for 71.6% [6]. In compassion to cars, a motorcycle is very vulnerable due to the lack of protection and the high level of interaction with surrounding vehicles, the risk of serious injury is significantly higher than the occupants of the cars with figures varying depending on the countries considered [7, 8]. For example, in urban areas of New Zealand, the injury risk of over 20-year-old motorcyclists is eight times higher than that for car drivers [9]. In France, the probability of a motorcycle accident is seven times greater than that of a car accident [10]. In the United States, per vehicle mile travelled, motorcyclist fatalities occur nearly 28 times more frequently than passenger car occupants in traffic accidents [11]. Hence, motorcycle safety is still a major issue around the world, notably in the South-East Asia region, including Hanoi (Vietnam).

Several previous studies found that motorcycle accidents have been associated with risky behaviors and riding attitude toward unsafe behavior (Parker et al., 1996 [12]; Parker et al. 1998 [13]; Assum, 1997 [14]; Eiksund, 2009 [15]; Forward, 2009 [16], etc.). In general, attitude is the thinking, emotion, and cognition that the rider must have in the riding process, and it can affect riding behavior [17]. For example, motorcyclists' attitudes towards speeding, closely following, road occupancy, dunk-riding, and so on can lead to changes in their riding behaviors. Attitudes can be a predisposition to behave positively or negatively towards an individual, group, event, or even an object [18]. Hence, the riding attitude of motorcyclists can predict their riding behavior tendencies and relates to motorcycle accidents.

The theory of reasoned action [19] and its extended version, namely the theory of planned behavior (TPB) [20] are dominant theories concerning the relationship between attitudes and behavior which have been tested in the traffic safety sector. Subsequently, many studies have explored factors related to riding attitudes as well as the relationship between riding attitudes and risky behaviors. For example, Ulleberg and Rundmo (2003) [21] developed a driving safety attitude scale with 18 items which were divided into 3 factors, and concluded that attitudes have an impact on the involvement of risky behaviors. Iversen and Rundmo (2004) [22] proposed a driving safety attitude scale with 3 factors of 18 items. Iversen (2004) [23] developed a risk behavior attitude scale with 20 items and showed that there was a high correlation between the attitude factors and riding behavior, and they were significant predictors of accident rates among drivers. Li et al. (2008) [24] used 4 factors (i.e., riding

attitude, drunk-riding attitude, traffic rule attitude, and speeding attitude) with 30 items to estimate the traffic safety attitude of motorcyclists. Chen (2009) [25] examined young drivers' safety attitudes in Taiwan. Zhang et al. (2017) [26] evaluated the reliability and validity of the driving safety attitude scale in Chinese drivers.

So far, researchers have paid less attention to the riding attitudes of motorcyclists compared to car drivers. Besides, little is known about the riding attitudes of motorcyclists in Vietnam and how it contributes to risky behaviors and traffic accidents. There were only a few studies that focused on certain behaviors of motorcyclists in Vietnam. For example, Trinh and Vo (2016) [27] used an integrated behavioral model of the theory of planned behavior and the health belief model to explain three risky behaviors (drunk driving, illegal changing direction, and speeding), but not focus on motorcyclists. Trinh and Le (2016) [28] examined the relationship between speeding and helmet-wearing among motorcyclists using the expanded theory of planned behavior. They indicated that the predictors had a significant impact on the intention to speed without helmet wearing. Furthermore, there was a direct link between intention and actual behavior. Truong et al. (2018) [29] explored the correlations between the use of a phone while riding and other risky behaviors of university students riding motorcycles. They found that the largest occurrence was calling while riding a motorcycle, whereas the lowest prevalence was reckless overtaking. Nguyen-Phuoc et al. (2020) [30] studied risky behaviors of app-based motorcycle taxi riders related to traffic accidents. They showed that the most common risky behavior was using a phone while riding, followed by failing to use turn signals, encroaching car lanes, exceeding the speed limit, running red lights, and carrying more than one passenger.

This study first explores the riding attitudes of motorcyclists, then we attempt to explain the relationship between the detected factors among riding attitudes. A self-reported questionnaire is used to explore the riding attitudes of motorcyclists. The detected factors are verified using exploratory factor analysis (EFA) and second-order confirmatory factor analysis (second-order CFA).

The rest of this study is organized as follows. Materials and methods are presented in Section 2. The results of this study are described in Section 3. Conclusions and future work are given in Section 4.

2. MATERIALS AND METHODS

2.1. Data Collection

To identify which factors of riding attitudes on the list appeared to have a significant influence on riding behaviors in mixed traffic flow like in Vietnam, this study used a self-reported questionnaire as a frequency assessment report of motorcyclists. The self-reported questionnaire consists of general demographics (e.g., gender, age, riding license) and questions related to the riding attitudes of Vietnamese motorcyclists based on related studies of riding attitudes.

The factors of questions related to attitudes towards unsafe behaviors include attitudes towards traffic flow (3 items), attitudes towards rule obedience and speeding (9 items), and attitudes towards fun-riding (3 items) based on previous studies (Chen, 2009 [25], Zhang et al., 2017 [26]), as shown in Appendix A. Quantitative items are assessed through a 5-point Likert-type scale from low to high (strongly disagree (1) to strongly agree (5)). The higher the score indicates the more positive attitudes towards unsafe behaviors.

We selected to interview motorcyclists in specific areas, such as registration locations, commercial centers, agencies, schools, etc. in Hanoi City, the capital of Vietnam. Respondents are those over the age of 16 years who are capable and experienced in riding with or without a riding license. If the interviewee does not agree, it is transferred to another person. Because the sample size is as large as possible and to avoid risks due to negligent errors during the investigation, the number of investigated samples is 750 samples. Data collection is implemented from January to March 2019.

2.2. Hypothesis testing

Regarding hypothesis, H1 of this study, the questionnaire is appropriately used to study the riding attitude of Vietnamese motorcyclists. Several goodness-of-fit statistics were tested for the hypothesis, as well as to judge the fit and validity of the measurement model. H2 of this study, there are significant differences among some demographic factors with riding attitudes. H3 of this study, there are significant differences between the respondents who are related to accidents (or near-accidents) and others in riding attitudes.

The goodness-of-fit index (GFI) and the root mean square error of approximation (RMSEA) are evaluated as absolute fit measures. The comparative fit index (CFI) [31] and incremental fit index (IFI) are taken as incremental fit indexes. Other indexes are used to test the hypothesis, such as the value of chi-square/df, and the Tucker-Lewis index (TLI). The criteria of goodness-of-fit statistics is required as follows [32, 33]: the value of chi-square/df < 5, $GFI \geq 0.8$, RMSEA < 0.08, $CFI \geq 0.9$, $TLI \geq 0.9$, $IFI \geq 0.9$.

To filter observed variables of the same group and eliminate some factors to fit with the model, we utilize exploratory factor analysis (EFA) to develop hypothesized measurement models before testing by confirmatory factor analysis. Second-order confirmatory factor analysis (second-order CFA) is utilized to create a model confirming the measurement of riding attitudes and to select variables and factors that could be used in a self-reported questionnaire. Moreover, to ensure reliability and convergence, the Average Variance Extracted (AVE) is not less than 0.5 [34] and the composite reliability index (CRI) is not less than 0.6 [35, 36]. Of these, the AVE measures the amount of variance attributed to the structure versus the amount due to measurement error while the CRI represents the consistency of the structures.

In this study, SPSS software [37] is used for descriptive statistics, including Exploratory Factor Analysis and reliability test of samples with Cronbach's Alpha coefficient to verify the

factorial structure of the self-report questionnaire. The items of the self-report questionnaire are factor analyzed using principal components analysis (PCA) and oblique rotation of varimax. Further, AMOS software [38] as the tool for the structural equation modeling (SEM) solution is utilized for Confirmatory factor analysis (CFA) with a multiple-item measurement model to evaluate uni-dimensionality for sets of measurement items and the identified the adequacy of the factorial structure. Besides, analysis of variance (ANOVA) and T-test are used to measure the relationships of demographic factors and accident (near-accident) on riding attitudes. The research process is shown in Figure 1.

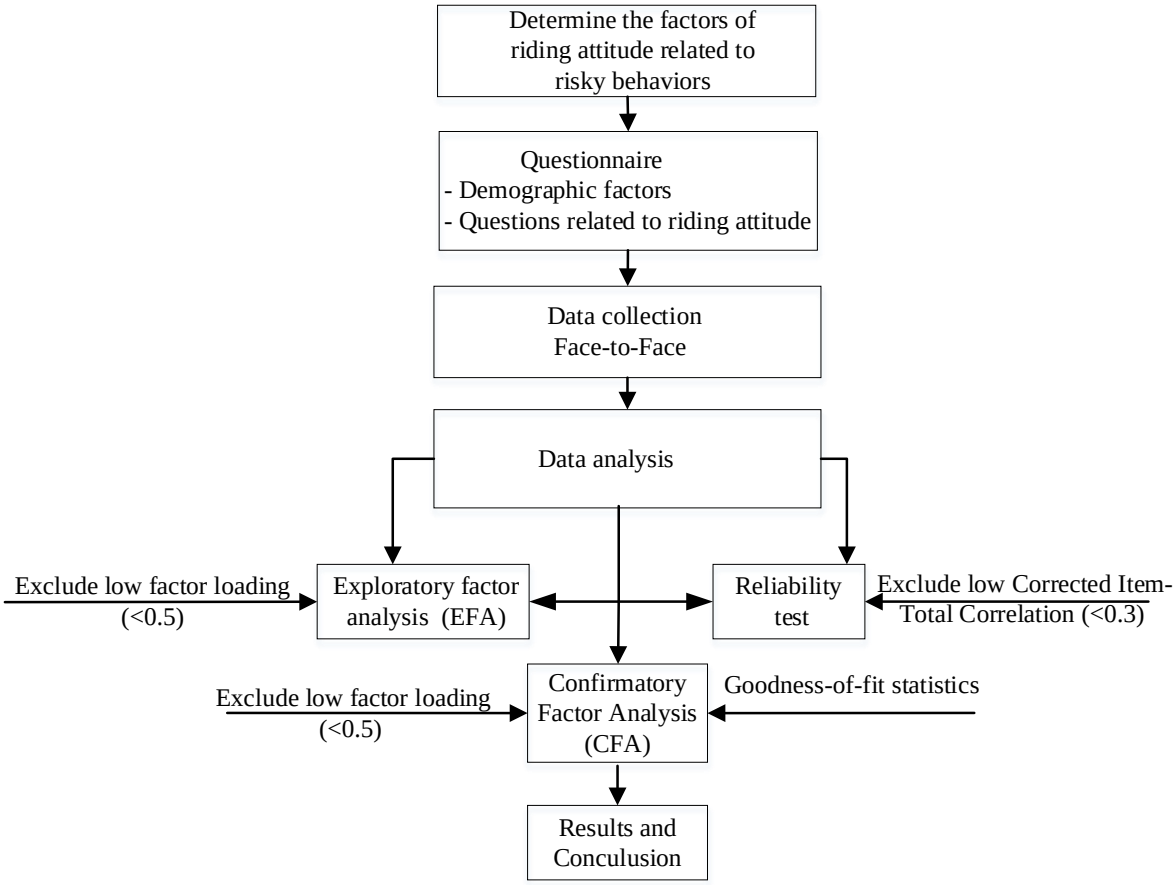

Figure 1. The research processes.

3. ANALYSIS RESULTS

3.1. Sample characteristics

Data with 716 valid questionnaires were processed into SPSS software and AMOS software for post-processing. The general information of the respondents is shown in Table 1. The respondents were males (52.5%) and females (47.5%). Most of them (50%) were 16–25 years old. Of the respondents, 85.1% had a motorcycle riding license while 14.9% did not. Regarding education level, 33.2% of the respondents had a college and intermediate level or less and 66.8% of the surveyed respondents had a university degree or higher. For income, 42.8% of respondents had 5-10 million VND per month; 51.7% had below 5 million per

month and the remaining nearly 5.9% of respondents had over 10 million per month. With employment, students accounted for 38.8%; workers and employees accounted for 21.9%; government employees accounted for 20%; the rest were others. Concerning marital status, married with children accounted for 20.1%, married with no children accounted for 13.1% and the rest were unmarried. For riding experience, 21% of the respondents had under 3 years of riding experience; 23% of the respondents had 3-5 years of riding experience; 23.5% of the respondents had 5-7 years of riding experience; the rest had over 7 years of riding experience.

Table 1. The characteristics of the samples.

Personal data		Percentage (%)
Gender	Male	52.5
	Female	47.5
Age group	16 to 25	50.0
	25 to 35	31.7
	35 to 50	14.8
	Over 50	3.5
Education level	High school or lower	4.3
	College and Intermediate level	28.9
	Undergraduate and Graduate	66.8
Employment	Student	38.8
	Worker and employee	21.9
	Government employee	20.1
	Service worker	10.1
	Freelance work	9.1
The income per month (10^6VND)	Under 3	33.0
	3 to 5	18.7
	5 to 7	26.7
	7 to 10	15.8
	Over 10	5.9
Marital status	Married with children	20.1
	Married with no children	13.1
	Single	66.8
Riding license	None	14.9
	License for motorcycle	68.8
	Owned more than one license (motorcycle, car)	16.3
Riding experience	Less than 3 years	21.2
	3 - 5 years	23.0
	5 - 7 years	23.5
	More than 7 years	32.3
Related to an accident in the past 3 years	Never	58.4
	One time	28.9
	Two times	9.8
	Three times	1.8
	More than three times	1.1

Near-accident in the past 3 years	Never	69.1
	One time	21.2
	Two times	7.0
	Three times	1.5
	More than three times	1.1

Table 1 also describes the accident experiences of participants. Most of the participants (58.4%) were not involved in any accidents over the past three years.

3.2. Analysis results

a) Exploratory factor analysis (EFA)

Firstly, there were 15 such items for the EFA process of the measurement model and we achieved three factors with the KMO (Kaiser-Meyer-Olkin) of 0.909 (>0.5), and Sig. of 0.000, including Attitude towards traffic flow (AT), Attitude towards rule obedience and speeding (AR), and Attitude towards fun-riding (AF). The coefficients are all greater than 0.5 [39, 40], and the cumulative variance explained was 62.157% (larger than 50%). However, attitudes towards rule obedience and speeding (AR) were not on a unidirectional scale because the last three items (AR07, AR08, and AR09) have fallen into attitudes towards fun-riding (AF) factor. These items did not show excitement, so it was difficult to classify them as the AF factor. Hence, we removed these three items from the AR factor.

There were 12 remaindering items for the EFA process and we achieved three factors with a KMO of 0.893 and Sig of 0.000, including attitude towards traffic flow (AT), Attitude towards rule obedience and speeding (AR), and Attitude towards fun-riding (AF). The coefficients are all greater than 0.5 and the factors are all unidirectional. The cumulative variance explained was 65.982% (larger than 50%), and also was larger than the result of first the EFA process (62.157%), as shown in Table 2. That was appropriate for analysis reliability and the CFA.

b) Reliability test

The analysis results of the reliability test using the Cronbach's Alpha coefficient (α) show that no original observed variables are excluded and the Cronbach's Alpha coefficient of the four factors is in the range of 0.721~0.880 (>0.6) and the minimum of the Corrected Item-Total Correlation is 0.494 (larger than 0.3), showing that these scales have high reliability, as shown in Table 2.

Table 2. The results of the EFA and reliability test of riding attitude.

Item	Factor			α	Corrected Item-Total Correlation
	AR	AT	AF		
AT01		0.842		0.780	0.658
AT02		0.732			0.635
AT03		0.767			0.567
AR01	0.778			0.880	0.712
AR02	0.824				0.692
AR03	0.756				0.731
AR04	0.545				0.569

AR05	0.721				0.719
AR06	0.677				0.708
AF01			0.639	0.721	0.514
AF02			0.784		0.626
AF03			0.779		0.494
Eigenvalues	3.573	2.240	2.104		
Variance explained (%)	29.776	18.669	17.537		
Cumulative Variance explained (%)	29.776	48.445	65.982		

c) Confirmatory factor analysis (CFA)

After the EFA process, there were three factors of riding attitude (RA), including attitude towards traffic flow (AT), attitude towards rule obedience and speeding (AR), and attitude towards fun-riding (AF) with 12 items. We performed the second-order CFA model testing on AMOS software, corresponding to a significance level of each item being 0.01 The first results of the second-order CFA model showed that the standardized factor loadings of the items are in the range of 0.545~0.823 (larger than 0.5 [33]) and the goodness-of-fit statistics were obtained the requirements. However, the Average Variance Extracted (AVE) of the AF factor (0.39) is less than 0.5 [34]. Hence, to ensure reliability and convergence, we removed the lowest factor loading (0.545), namely AF03 "Riding is more than transportation, it is also speeding and fun".

The second results of the second-order CFA model testing with 11 items showed that the standardized factor loadings of the items are in the range of 0.636~0.825 (larger than 0.5 [41]) and the goodness-of-fit statistics have obtained the requirements. The results of goodness-of-fit statistics were Chi-square = 158.730 and df = 40. Therefore, the second-order CFA model had the value of chi-square/df = 3.968, which was lower than 5 [40]. Furthermore, RMSEA = 0.064< 0.08, GFI =0.963 > 0.9, CFI = 0.968 >0.9, IFI = 0.968> 0.9, and TLI = 0.956 ≥ 0.90 [32, 33], which met the criteria, as shown in Figure 2.

Moreover, the analysis results showed that all CRI values were higher than their critical value of 0.6. The highest CRI value was the attitude towards rule obedience and speeding (AR) factor with a value of 0.807 and the lowest CRI value was the attitude towards fun-riding (AF) factor with a value of 0.714. All AVE values were higher than the critical value of 0.5. The highest AVE value was the attitude towards traffic flow (AT) factor with a value of 0.562 and the lowest AVE value was the attitude towards rule obedience and speeding (AR) factor with a value of 0.502. Besides, the values of the critical ratio (C.R.) are larger than 1.96 [41] (see Table 3). This proved that the riding attitude scale met the requirements of reliability and convergence.

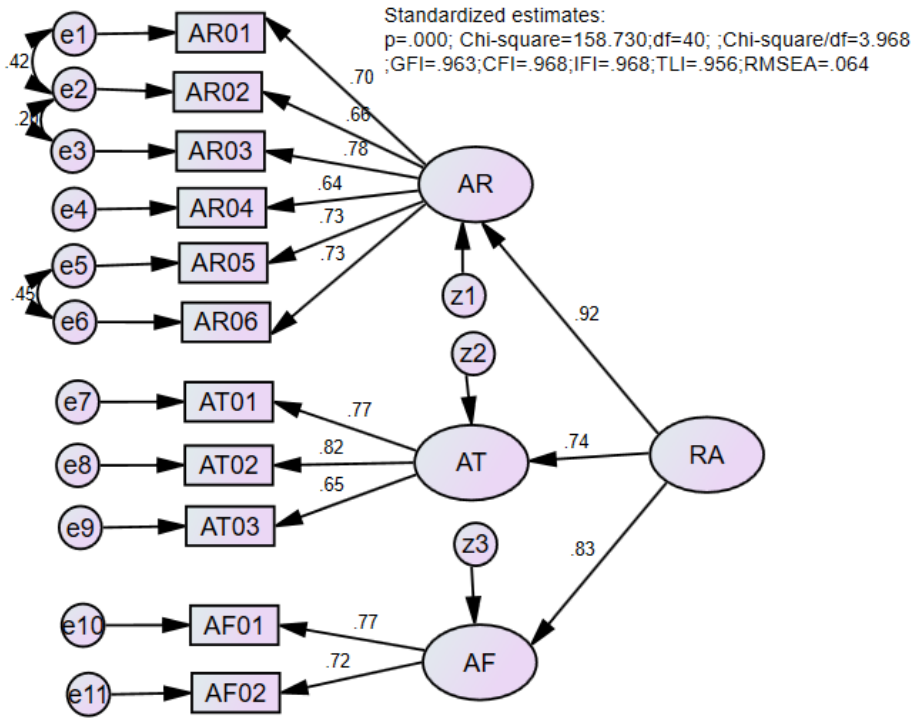

Figure 2. Measurement model for riding attitude by the second-order CFA.

Table 3. The results of the second-order CFA model of riding attitude.

Path	Estimate	S.E.	C.R.	Sig.	Std. Estimate	AVE	CRI
AR ← RA	0.58	0.023	25.4	***	0.915	0.691	0.869
AT ← RA	0.58	0.023	25.4	***	0.744		
AF ← RA	0.58	0.023	25.4	***	0.826		
AR01 ← AR	1				0.704	0.502	0.807
AR02 ← AR	0.913	0.044	20.864	***	0.656		
AR03 ← AR	1.169	0.057	20.381	***	0.778		
AR04 ← AR	0.958	0.058	16.432	***	0.637		
AR05 ← AR	1.057	0.056	19.022	***	0.734		
AR06 ← AR	1.1	0.058	18.952	***	0.732		
AT01 ← AT	1				0.766	0.562	0.792
AT02 ← AT	0.936	0.045	21.017	***	0.821		

AT03	←	AT	0.788	0.047	16.935	***	0.652		
AF01	←	AF	1				0.769	0.555	0.714
AF02	←	AF	0.99	0.06	16.486	***	0.72		

*Note: Std. Estimate— Standardized estimate; ***— significant at 0.001 level; C.R. — critical ratio; S.E.— standard error; Sig.—probability.*

The analysis of the EFA and the CFA for items showed that the Vietnamese motorcyclists' attitudes can be grouped into three factors, including attitude towards traffic flow (AT), attitude towards rule obedience and speeding (AR), and attitude towards fun-riding (AF) through 11 items. The values of goodness-of-fit statistics for the second-order CFA model met all the criteria for hypothesis testing. The estimation results of the model parameters of the second-order CFA model showed that the questionnaire can be appropriately used to study the riding attitude of a Vietnamese person. Table 3 and Figure 2 easily show the three items that have the greatest influence on riding attitude, including AT02 "Sometimes it is necessary to bend the rules to keep traffic going", AF01 "Riders maybe increase fun and excitement in traffic", and AF02 "Speeding and excitement belong together when you are riding".

In comparison with previous studies, for example, Chen (2009) [25] used a 15-item safety attitude scale of three 3 factors (traffic flow and rule obedience, speeding, and fun-riding) that adapted from Ulleberg and Rundmo (2003) [21], but reliability and validity of the scale for Taiwanese motorcyclists were not discussed. In the study of Zhang et al. (2017)[26], an 18-item attitude scale with three factors adapted from Ulleberg and Rundmo (2003) [21] could explain 63.24 % of the variance in safety attitudes of car drivers in China. The riding attitude scale in this study had only 11 items for 3 dimensions but explained 65.982% of the variance. This result was similar to the results of Zhang et al. (2017) [26].

d) Demographic factors associated with riding attitudes

To assess the significant differences between some demographic factors in terms of the factors of riding attitudes, an analysis of variance (ANOVA) with a significance level of 5% was carried out (see Table 5). Accident involvement comprised two observed variables (items): (1) Related to accidents in the last three years and (2) involvement in near-accidents in the last three years. Accident (near-accident) involvement is dichotomized (0 = none, 1 = one or more accident/near-accident). To evaluate the significant differences between the factors of accident involvement in terms of the factors of riding attitudes, a T-test with a significance level of 5% was carried out as shown in Table 6.

Table 5. The results of ANOVA and T-test.

Demographic factor	Variable	N	Mean		
			AR	AT	AF
Gender	Male	376	2.18	2.37	2.10
	Female	340	2.12	2.16	2.12

	F-statistics		0.97	13.43	0.13
	p-value		.326	**.000**	.715
Age group	16 to 25	358	2.09	2.34	2.10
	25 to 35	227	2.14	2.10	2.09
	35 to 50	106	2.40	2.51	2.21
	Over 50	25	1.99	2.00	1.96
	F-statistics		4.00	9.16	0.87
	p-value		**.010**	**.000**	.456
Education level	High school or lower	31	2.23	2.14	2.16
	College and Intermediate level	207	2.31	2.23	2.30
	Undergraduate and Graduate	478	2.07	2.30	2.02
	F-statistics		6.55	1.09	7.91
	p-value		**.002**	.336	**.001**
Riding experience	Less than 3 years	152	2.14	2.35	2.15
	3 - 5 years	165	2.14	2.32	2.07
	5 - 7 years	168	2.29	2.28	2.26
	More than 7 years	231	2.06	2.19	1.99
	F-statistics		3.35	1.55	4.14
	p-value		**.019**	.201	**.006**
Related to accidents in the last three years	none	418	2.06	2.23	2.02
	one or more	298	2.27	2.34	2.23
	T-test		-3.76	-1.96	-3.36
	p-value		**.000**	.051	**.001**
Involvement in	none	495	2.09	2.25	2.06

near-accidents in the last three years	one or more	221	2.29	2.34	2.21
	T-test		-3.41	-1.58	-2.19
	p-value		**.001**	.115	**.029**

Regarding gender, there were significant differences in "attitude towards traffic flow (AT)" between males and females, males scored significantly higher than females. No significant differences were found between males and females in "attitude towards rule obedience and speeding (AR)" and "attitude towards fun-riding (AF)".

For age groups, there were significant differences in "attitude towards rule obedience and speeding (AR)" and "attitude towards traffic flow (AT)" between age groups. Post-hoc comparisons confirmed the "35 to 50" age group of motorcyclists showed a significant difference in "attitude towards rule obedience and speeding (AR)" in the "16 to 25" age group and the "25 to 35" age group. The "25 to 35" age group of motorcyclists showed a significant difference in "attitude towards traffic flow (AT)" with the "16 to 25" age group and the "35 to 50" age group. The higher score belongs to the "35 to 50" age group.

With education level, there were significant differences in "attitude towards rule obedience and speeding (AR)" and "attitude towards fun-riding (AF)" among groups of motorcyclists with differences in education level. Post-hoc indicated that the "college and intermediate level" group showed a significant difference (higher) when compared with the "undergraduate and graduate" group. It indicated that the "college and intermediate level" group has a higher attitude towards risk behaviors than the "undergraduate and graduate" group.

For riding experience, there were significant differences in "attitude towards rule obedience and speeding (AR)" and "attitude towards fun-riding (AF)" among motorcyclists with differences in riding experiences. Post-hoc analysis indicated that the "5-7 years" group showed a significant difference (higher) when compared with the "upper 7 years" group. It found that more riding experience could reduce the attitude towards unsafe behaviors.

Concerning "Related to accidents in the last three years" and "Involvement in near-accidents in the last three years", the "one or more" group showed a significant difference (higher) when compared with the "none accident/near-accident" group in "attitude towards rule obedience and speeding (AR)" and "attitude towards fun-riding (AF)". The above analysis results show that hypotheses H2 and H3 are accepted.

The analysis results showed that the self-reported questionnaire on riding attitudes was a clear structure with higher factor loadings, indicating better construct validity. The correlation between each factor and riding attitudes was significant, reflecting good content validity. At the same time, the items had good homogeneity reliability. Therefore, it can be used as an effective tool to explore and evaluate the riding attitude of Vietnamese motorcyclists. Besides, this study showed that males between the ages of 25 and 35 with an education level of "college and intermediate level" are more likely to have attitudes to unsafety behaviors. These people need more safety education and propaganda than others. This study has also revealed that people who have been in an accident or have been near an accident have a higher attitude towards risky behavior than others.

4. CONCLUSION

In this study, we aimed to explore the riding attitudes of Vietnamese motorcyclists based on a self-reported questionnaire with EFA and CFA approaches. This research showed that this scale was appropriate for Vietnamese motorcyclists with three factors of 11 items. Attitude towards traffic flow, attitude towards rule obedience and speeding, and attitude towards fun riding were consistent with the factors found in other countries, but based on the best of our knowledge a multi-item questionnaire has not been explored in Vietnam yet. The results are to provide a reliable measurement for further research in the future. Besides, the results can be used to create a riding self-report of motorcyclists before the exams.

The limitation of this study consisted of the place (i.e. Hanoi City, Vietnam) and the effect of riding attitudes on risky behaviors and accidents of motorcyclists. In future works, we will analyze the factors of riding attitudes in affecting risky behaviors and accidents of motorcyclists in a wider study area.

APPENDIX A

See Table A1

Table A1. Riding attitude measurement factors.

No	Item	Symbol	Mean	SD	Reference
	Attitude towards traffic flow	AT			
1	There are many traffic rules which cannot be obeyed in order to keep up the traffic flow	AT01	2.33	0.988	Chen, 2009 [25]
2	Sometimes it is necessary to bend the rules to keep traffic going	AT02	2.19	0.877	Chen, 2009 [25]
3	It is more important to keep up the traffic flow rather than always follow the traffic rules	AT03	2.31	0.936	Chen, 2009 [25]
	Attitude towards rule obedience and speeding	AR			
4	Sometimes it is necessary to break the traffic rules in order to get ahead	AR01	2.11	0.952	Chen, 2009 [25]
5	Sometimes it is necessary to take chances in the traffic	AR02	2.03	0.911	Chen, 2009 [25]
6	Sometimes it is necessary to bend the traffic rules to arrive in time	AR03	2.20	0.962	Chen, 2009 [25]
7	A person who take chances and violate some	AR04	2.28	0.960	Chen, 2009 [25]

	traffic rules is not necessary a less safe driver				
8	If you have good skills, speeding is OK	AR05	2.10	0.921	Chen, 2009 [25]
9	I think it is OK to speed if the traffic conditions allow you to do so	AR06	2.19	0.961	Chen, 2009 [25]
10	Driving 5 or 10 kilometres above the speed limit is OK because everyone does it	AR07	2.28	0.949	Chen, 2009 [25]
11	If you are a safe rider, it is acceptable to exceed the speed limit by 10 km/h	AR08	2.30	0.948	Chen, 2009 [25]
12	If you are a safe rider, it is acceptable to exceed the speed limit by 20 km/h	AR09	2.13	0.901	Chen, 2009 [25]
	Attitude towards fun-riding	AF			
13	Riders may be increasing fun and excitement in traffic	AF01	2.05	0.882	Zhang et al., 2017 [26]
14	Speeding and excitement belong together when you are riding	AF02	2.16	0.957	Chen, 2009[25]
15	Riding is more than transportation; it is also speeding and fun	AF03	2.44	1.004	Chen, 2009 [25]

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