

1 **Assessing Driving Anger among Vietnamese Motorcyclists**

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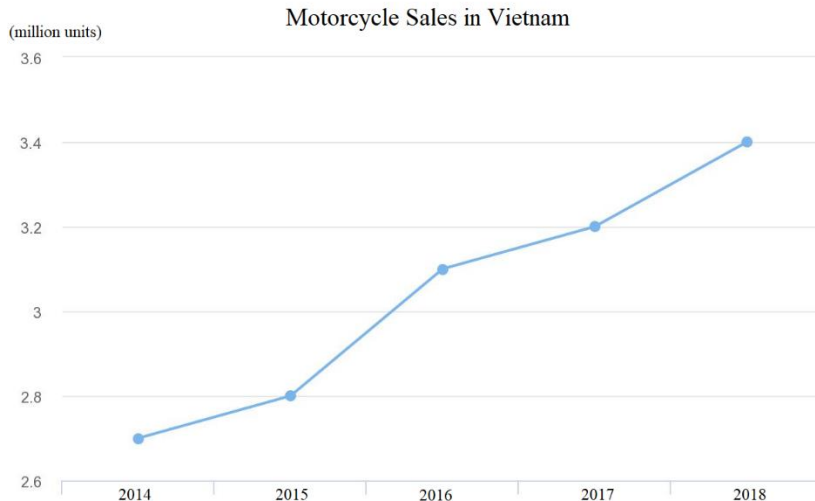
1 **ABSTRACT**

2 To fill the research gaps concerning riding anger in the context of motorcycling-based traffic
3 systems, this paper examines the factor structure of the Driving Anger Scale (DAS) in Vietnam.
4 To this end, a survey among 962 motorcycle riders (65.3% females, 34.7% males) aged 16–61
5 years was conducted. An exploratory factor analysis of the short version of DAS is performed and
6 reveals a clear three-factor structure of 12 items. The new explored version of DAS could be
7 replicated to investigate driving anger in other motorcycling countries. Besides, we also examine
8 the predictive validity of DAS factors, riding information and demographic variables in terms of
9 self-reported crashes of riders. We find significant effects of age, gender, and DAS subscales
10 (hostile gestures, arrival blocking) on crash involvement. Overall, this study provides further
11 insights into the current traffic situation in Vietnam. Based on the robust relationships between the
12 DAS factors and accident risk, new effective on-road safety campaigns can be developed to reduce
13 on-road crash risk for motorcyclists in Vietnam.

14 **Keywords:** Driving Anger, DAS, Vietnam, Motorcyclist, On-Road Safety, Crash Involvement

1 INTRODUCTION

2 The Vietnam Association of Motorbike Manufacturers (1) revealed that the number of
3 motorbikes sold in 2018 in Vietnam is around 3.38 million vehicles, a rise of 3.5% in comparison
4 to 2017 (Figure 1). The total motorbike fleet in Vietnam corresponds to more than 55 million
5 motorcycles. Non-surprisingly, the motorcycle is the dominant mode in traffic; 79% of the
6 population uses it for daily commuting, which makes Vietnam one of the top motorcycling
7 countries in the world. However, the increase in motorcycle sales in recent years is accompanied
8 by a soaring number of fatalities on Vietnamese roads. In 2018, there were around 18.700 road
9 traffic accidents in Vietnam, where 8.200 people died, and 14.800 people became injured. Notably,
10 the National Traffic Safety Committee of Vietnam announced that more than 23 people died per
11 day from road traffic collisions, and nearly 90% of victims are motorcyclists (2, 3). Statistics from
12 the World Health Organization also indicate that motorcyclists are overrepresented in all traffic
13 casualties, as they account for 43% of all mortality in South-East Asia (4). Although enhancing
14 traffic safety for motorcyclists is a pressing matter, there is still a lack of systematic research on
15 factors that influence motorcyclists' driving behavior and involvement in traffic accidents.
16



17 **FIGURE 1** Motorcycles sales (in million units) in Vietnam from 2014 to 2018.

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20 A particular aspect of driver behavior is driving anger, a situation-specific form of trait
21 anger. Driving anger has been extensively studied for more than twenty five years, which offered
22 a profound understanding on the anger-provoked circumstances, the road rage expression, its
23 effects to driving outcomes (5–7), as well as effective road safety interventions aimed at reducing
24 anger-related driving (8). Angry drivers tend to diminish their safety attitudes (9) and driving
25 abilities, such as slower responses to traffic circumstances (10), impaired cognitive performance
26 (11), deteriorated in-vehicle handling skills, and increased odds of collision involvement (12).

27 The Driving Anger Scale (DAS), the leading measure of anger propensities across different
28 traffic scenarios, has been adapted for a diverse range of drivers sampled from various cultures
29 (7). Drivers are asked to rate their anger level elicited by each anger-provoking situation that they
30 could experience. The original (long) version of DAS contained 33 items measured on a 5-point
31 Likert scale, and was composed of the following 6 factors: “Hostile gesture”, “Illegal driving”,
32 “Police presence”, “Slow driving”, “Discourtesy” and “Traffic obstruction”, whereas the

1 Cronbach’s alpha of the factors ranged from 0.78 to 0.87. The short version of DAS was acquired
 2 by selecting items from each of the six factors that were highly correlated with that factor. It
 3 consisted of 14 representative situations and revealed a reasonably high internal reliability of 0.80.
 4 This short version of DAS reduces the respondent effort considerably, while maintaining the
 5 necessary validity and reliability (13). Applications of the short version of DAS across different
 6 countries resulted in different factor structures, as could be seen from Table 1.

7
 8 **TABLE 1 Dimensions of the Short Version DAS in Previous Studies**

Model	Author(s)	Country	Factor structures: Items from short DAS
1. (One-factor)	Deffenbacher et al. (13)	USA	1 factor: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
	Yasak and Esiyok (14)	Turkey	
	Sullman and Stephens (15)	New Zealand	
	Sullman et al. (16)	Malaysia	
2. (Three-factor)	Zhang et al. (17–19)	China	Safety Blocking: 1, 2, 3, 4 Arrival Blocking: 5, 6, 7, 8, 12, 13, 14 Hostile Gesture: 9, 10, 11
3. (Three-factor)	Herrero-Fernandez (20)	Spain	Progress Impeded: 2, 5, 7, 8, 11, 12, 14 Reckless Driving: 1, 3, 4, 6, 13 Direct Hostility: 9, 10
4. (Four-factor)	Egea-Caparrós et al. (21)	Spain	Infringement by other driver: 1, 3, 4, 6, 13 Progress Impeded: 2, 7, 8, 11, 14 Direct Offense / Hostile Gesture: 9, 10 Possible Sanction / Police Presence: 5, 12 <i>(Poor road infrastructures: 4 additional items in a fifth factor in Argentina)</i>
	Escanés and Poó (22)	Argentina	

9
 10 While the majority of studies on validation and application of driving anger measures was
 11 conducted in America and Europe, there still is a need for investigating driving anger and its effects
 12 in Asian countries, where the severity of road rage has become a serious public problem. Within
 13 Asian contexts, an initial attempt, focusing on the exploration of cultural differences in the
 14 experience of driving anger, was conducted in Japan, and indicated that Japanese motorists possess
 15 a different acceptance and expression of anger on the road compared to American and Australian
 16 populations (23). Since 2013, different researchers in China and Malaysia (16, 18, 19, 24–33) have
 17 validated and adapted instruments measuring driving anger, such as the Trait Anger Scale, the
 18 long/short version of DAS, the Propensity for Angry Driving Scale, the Driving Anger Expression
 19 Scale. These instruments were used to estimate the trait anger, the driver’s propensity to become
 20 angry while driving (trait driving anger or driving anger), traffic-related anger-provoking
 21 situations, the expression of road rage, and the proneness to engaging in aggressive driving
 22 behaviors. The results indicated that driving anger in China has a lower intensity and a stronger
 23 association with aggressive driving, while Malaysian motorists state similar anger tendencies to
 24 those found in Western nations.

25 The problem of driving anger has not received enough attention in countries whose
 26 transportation systems are centered on motorcycles. Due to the particular cultural, socio-economic,
 27 and infrastructural backgrounds in these nations (e.g. the scarcity of public transportation services,
 28 the middle/low income and the dense population), alongside the indisputable advantages of
 29 motorcycles (their relatively small size, the maneuvering flexibility, and the affordable price),
 30 motorbikes became the primary vehicle choice for mobility to ensure the livelihood of the majority
 31 of people (34, 35).

1 Despite the notable positive impacts of motorbikes, the essential threatening attributes of
2 motorcycle traffic and the complexity of riding situations contribute to the hazards for
3 motorcyclists, especially in developing countries with the highest level of motorcycle dependence.
4 Understanding driving anger is critical for the development and the evaluation of the
5 countermeasures specifically targeted for reducing both the number of crashes and the severity of
6 riders' injury. This study; contributes to this understanding by investigating driving anger among
7 a sample of riders in Vietnam. The main objectives of this paper are (i) the exploration of driving
8 anger in Vietnam using the short version of DAS, with a particular focus on the factor structure of
9 DAS with regard to motorcycling driving behavior, and (ii) using the DAS factors to understand
10 the relationships between driving anger and self-reported driving characteristics and crash risk of
11 motorcyclists.

12 13 **MATERIALS AND METHODS**

14 Two researchers used the back-translation technique for translating the DAS from English
15 to Vietnamese. We conducted focus group discussions with 20 Vietnamese motorcyclists and two
16 traffic police officers to find out what they understood from each question, and noted unclear items.
17 We defined the final (translated) scale by considering their recommendations. Data collection was
18 conducted in Vietnam by using the snowball sampling technique. Trained students of the
19 University of Da Nang (Vietnam) delivered the paper-based questionnaire to the participants at
20 parking lots and residential areas from January to June 2019. Only respondents who have ridden
21 motorcycles were invited to participate in this survey, and they were assured of confidentiality and
22 anonymity. Initially, the total number of motorcyclists interviewed for this survey was 1116. After
23 removing incomplete observations, 962 observations were retained.

24 The questionnaire included items asking participants' socio-demographic background, i.e.
25 age, gender, education level, and their riding information, i.e. license tenure, riding purpose, riding
26 frequency, average riding distance per week and self-reported traffic accidents during the last 12
27 months. In addition, the short version of DAS was used to measure Vietnamese riders' anger levels
28 toward improper traffic circumstances. Recall that the short version of DAS has 14 items, and the
29 respondents were asked to rate the amount of anger they felt when encountering the situation
30 described in each item on a 5-point scale, ranging from 1 (not at all) to 5 (very much).

31 The underlying factor structure of the short version of DAS was defined based on the
32 studies reported in Table 1. Confirmation Factor Analysis (CFA) was performed to examine
33 whether the factor structures reported in literature fitted the data from the motorcyclist riders in
34 Vietnam. Since this data violated the multivariate normality assumption, the robust Satorra-Bentler
35 method was selected to evaluate the goodness-of-fit indices. Model fit was evaluated with the
36 Satorra-Bentler Chi-squared/degree of freedom (χ^2/df) ratio, the Goodness-of-Fit Index (GFI), the
37 Comparative Fit Index (CFI), the Tucker-Lewis Index (TLI), the Standardized Root Mean Square
38 Residual (SRMR), and the Root Mean Square Error of Approximation (RMSEA) (36, 37). In
39 general, appropriate fitted models should have $\chi^2/df > 5$, GFI > 0.9 (38), CFI > 0.9 (39), and
40 RMSEA, SRMR < 0.06 (40). In the case of poor fit, an Exploratory Factor Analysis (EFA) was
41 conducted to investigate the factor structure of the scale. The internal consistency of the new scale
42 was assessed by computing the Cronbach's alpha reliability coefficients.

43 Finally, a binary logistic regression analysis was conducted to test the relationship between
44 self-reported crash involvement and the DAS factors, while controlling for the influence of
45 demographic measures and riding information.

46

RESULTS

The sample composition in terms of socio-demographics and motorcyclist riding behavior is presented in Table 2. Most respondents are female (65.3%), hold a valid driving license (86.7%), and regularly use their motorcycle (83.1%) to go primarily to working/studying places (94.9%). The age of the participants ranges from 16 to 61 years old. The average number of years of riding experience is 7.3 years (with a S.D. of 6.8 years). The mean self-reported riding distance equals 99.2 km per week, which is in line with the fact that a motorcycle is typically used for a short trip in motorcycling countries. Concerning traffic accidents over the last 12 months, 391 riders (40.6 % of the sample) indicated that they were involved in at least one crash.

TABLE 2 Basic Descriptive Statistics

Variable	Category	Coded	n	Proportion (in %)
Age	Less than 20	1	375	39.0
	Between 20 and 39	2	504	52.4
	At least 40	3	83	8.6
Gender	Male	1	334	34.7
	Female	0	628	65.3
Possession of university degree	No	0	614	63.8
	Yes	1	348	36.2
Possession of driving license	No	0	128	13.3
	Yes	1	834	86.7
Possession of driving license	Everyday	2	799	83.1
	Several times per week	1	138	14.3
	Once or less than once a week	0	25	2.6
Riding frequency	To working/studying places	0	913	94.9
	Other purposes	1	49	5.1
Main riding purposes	No	0	130	13.5
	Yes	1	832	86.5
Have own motorcycle	No	0	571	59.4
	Yes	1	391	40.6

CFA has been applied to validate the internal structure of the DAS (Table 3). Given that no model has provided a satisfactory fit to the Vietnamese data, the data have been re-examined within an EFA framework (41, 42). While the Bartlett’s Test of Sphericity value is noticeably significant: $\chi^2(91) = 3878.8$ and $p < 0.001$, the Kaiser-Meyer-Olkin (KMO) value is $0.89 > 0.7$; thus, in conformity with analytical guidelines, the obtained values suggest that the EFA can be reliably used in the context of further analysis (43).

TABLE 3 Summary of Goodness-Of-Fit Statistics for Competing Models of the DAS from Table 1

Model	S-B χ^2	df	S-B χ^2/df	CFI	GFI	TLI	SRMR	RMSEA [C.I. 90%]
1 One factor	659.358	77	8.563	0.820	0.886	0.788	0.066	0.096 [0.089, 0.103]
2 Three factors	476.503	74	6.439	0.876	0.919	0.847	0.059	0.081 [0.075, 0.089]
3 Three factors	476.503	74	6.439	0.876	0.919	0.847	0.059	0.081 [0.075, 0.089]
4 Four factors	460.715	71	6.489	0.880	0.920	0.847	0.055	0.082 [0.075, 0.089]

First, an EFA is performed on the 14 items to determine the factor structure. Initially, 3 factors had eigenvalues higher than 1. Both the Scree plot and the parallel analysis recommended the 3-factor solution to be the most interpretable one. As there have been some relatively high inter-correlations, the Maximum likelihood extraction and the Promax rotation method was applied. The factor analysis was then rerun designating three factors.

1 When interpreting the rotated factor patterns, item 11 “A bicyclist is riding in the middle
 2 of the lane and slowing traffic” had low weights for all the factors, and item 8 “You are stuck in a
 3 traffic jam” had large cross-loading. For these reasons, they were removed from the analysis. The
 4 remaining items and their corresponding factor loading are presented in Table 4, whereas a loading
 5 value of 0.3 was used as a cut-off point to display the loadings. The three-factor model, based on
 6 the 12 retained items of the short version of DAS, explained 41.4% of the total variance. The DAS
 7 total scale scores showed good internal consistency ($\alpha=0.86$). The first factor, named “Hostile
 8 gesture” (HG), explained 31.3% of the variance, and consisted of 3 items, which involved direct
 9 impertinent gestures and behaviors from another driver. The second factor accounted for 5.1% of
 10 the variance, included 5 items referring to the anger-provoked situations due to traffic violations
 11 perpetrated by other drivers. This dimension was labelled “Infringements by other driver” (IBOD).
 12 The third factor linked to 4 traffic situations in which the motorcyclists were hindered while riding
 13 on the road. Therefore, this factor was labelled as “Arrival-blocking” (AB).
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TABLE 4 Achieved Results for the Rotated Factor Pattern Matrix

Item	Mean	S.D.	Factor		
			HG	IBOD	AB
13. A truck kicks up sand or gravel on the motorcycle you are riding	3.6	1.23	0.668		
10. Someone honks at you about your riding	2.9	1.24	0.691		
9. Someone makes an obscene gesture toward you about your riding	3.3	1.31	0.905		
6. Someone speeds up when you try to pass them	2.5	1.17		0.322	
2. A slow vehicle on a mountain road will not pull over and let people by	2.3	1.13		0.505	
4. Someone runs a red light or stop sign	2.8	1.17		0.613	
3. Someone backs right out in front of you without looking	3.4	1.13		0.709	
1. Someone is weaving in and out of traffic	3.4	1.21		0.760	
14. You are behind a large truck and cannot see around it	2.6	1.16			0.350
7. Someone is slow in parking and holding up traffic	2.6	1.10			0.364
12. A police officer pulls you over	2.1	1.19			0.536
5. You pass a radar speed trap	1.5	0.90			0.756

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 17 Three factors had good reliability with Cronbach’s alpha, ranging between 0.65 and 0.75,
 18 and they shared moderate correlations, suggesting that each factor seemed to measure a
 19 conceptually distinct construct. In this context, the Vietnamese three-factor structure proved to be
 20 reasonably interpretable.

21 Pearson’s correlational analysis was adopted to examine the relationships between the three
 22 DAS dimensions with the continuous demographic variables (Table 5). Age was negatively
 23 correlated to anger driving subscales, suggesting that younger motorists were more likely to
 24 become angered over adverse traffic situations. Average riding distance per week was not
 25 significantly related to driving anger. Controlling for age, partial correlation analysis among riding
 26 years, years licensed and the three DAS subscales revealed that only the years of holding the
 27 driving license had a statistically significant, but weak correlation with anger evoked by the
 28 infringements of other drivers. This result was partially similar to previous findings of no
 29 substantial association between driving experience and driver anger (22).
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1 **TABLE 5 Correlations among Demographic Variables and DAS Factors**

Variable	Age	Weekly mileage	Years licensed	Riding years
Infringements of other driver	-.136*	-0.053	.0096*	0.037
Hostile gesture	-.184*	-0.057	0.030	0.012
Arrival-blocking	-.087*	-0.016	-0.004	-0.042

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According to the MANOVA results, there were significant differences in DAS scores between the different gender, possession of university degree and involvement in crash conditions. Additionally, there were no interaction effect between those variables (Table 6).

7 **TABLE 6 Multivariate Analysis of Variance (MANOVA) Test**

Variables	Pillai's trace	F	Hypothesis df	Error df	p	Eta Squared
Gender	0.010	3.109	3	958	<0.001	0.026
Possession of university degree	0.010	3.189	3	958	0.023	0.010
Possession of driving license	0.006	1.86	3	958	0.135	0.006
Possession of own motorcycle	0.008	2.509	3	958	0.058	0.008
Involvement in crash	0.014	4.53	3	958	0.004	0.014

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The independent-samples t-test results (Table 7) showed that gender had a significant effect on the anger level from “Hostile gesture”. Vietnamese females felt more irritated than males when they were intimidated by abhorrent gestures ($t(654.6) = 3, p = .003$). University graduates likewise expressed less resentful toward defiant acts than people without a university degree ($t(823.2) = 2.98, p = .003$). There was a significant difference in "Arrival-blocking" subscale among traffic accident victims and riders who have not been involved in crashes ($t(960) = -3.02, p = .003$). The victims reached a higher level of anger when their progresses were impeded. In term of “Infringement by other driver”, provoked anger levels were similar between subgroups.

18 **TABLE 7 Differences in Driving Anger between Subgroups**

Category	Hostile gesture				Infringement BOD				Arrival-blocking			
	M.	SD	t	df	M.	SD	t	df	M.	SD	t	df
Gender			3.00*	654.6			1.68	660.2			1.63	960
Female	3.35	1.01			2.91	0.78			2.21	0.72		
Male	3.13	1.05			2.82	0.81			2.12	0.81		
University degree possession			2.98*	702.6			1.11	691.5			0.90	704.1
No	3.35	1.01			2.90	0.78			2.01	0.75		
Yes	3.14	1.04			2.84	0.82			2.15	0.77		
Crash involvement			0.24	823.2			-1.25	843.8			-3.02*	960
No	3.28	1.01			2.85	0.80			2.12	0.71		
Yes	3.26	1.04			2.92	0.79			2.27	0.81		

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Logistic regression was performed to set-up a predictive model for motorcycle crash involvement on Vietnamese roads. In the analysis, the following predictors were considered: age, gender, university degree attained, possession of a riding license, years of holding the driving license, weekly riding distance, motorcycle ownership, main riding purpose and DAS factor (Table

8). The results satisfied Hosmer and Lemeshow goodness of fit test: $\chi^2(8) = 11.490$, $p = .175$. The logistic regression model was statistically significant with Omnibus test: $\chi^2(11) = 40.669$, $p < .0005$, and correctly classified in 62.5% of cases. Of the 11 predictor variables, only 4 were statistically significant: age, gender, Hostile gesture, and Arrival-blocking. The 7 non-significant were retained in the model to account for potential confounding effects. Males had 1.37 times higher odds of involvement in a crash compared to females. Increasing the age of the motorcyclist was associated with a reduction in the likelihood of collision. Riders, who experienced more anger against Hostile gestures, had lower likelihood of traffic accidents than those who felt less angry. Especially, according to the rate ratio, there was an increase of nearly 1.5 times higher odds to crash risk with each increment of one unit in the driving anger level toward Arrival-blocking situations.

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TABLE 8 Logistic Regression Analysis on Crash Risks

Variable	Odd ratio	Sig.	95% C.I.for EXP(B)	
			Lower	Upper
Age	0.905	0.000	0.857	0.956
Gender (cat = Male)	1.372	0.033	1.026	1.833
Hostile gesture	0.843	0.036	0.718	0.989
Arrival-blocking	1.495	0.000	1.204	1.857
Infringements of other driver	0.996	0.970	0.812	1.222
Weekly riding distance	1.001	0.106	1.000	1.003
Years licensed	1.023	0.480	0.960	1.090
Possession of university degree (cat = Yes)	0.932	0.670	0.675	1.287
Possession of driving license (cat = Yes)	1.010	0.967	0.638	1.597
Possession of own motorcycle (cat = Yes)	1.406	0.123	0.912	2.169
Main riding purposes (cat = 'Other purposes')	0.760	0.166	0.516	1.120

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DISCUSSION AND CONCLUSION

The present research investigated the factor structure of the short version of DAS and explored the associations between DAS factors, demographic variables, riding information and accident risks of motorcyclists in Vietnam. An exploratory factor analysis of the DAS items was conducted and revealed a three-factor structure grouping a total of 12 items. The results indicate that riders are likely to feel more frustrated toward “Hostile gesture” than “Infringements by other drivers” or “Arrival-blocking” incidents. The Vietnamese motorcyclists reported that they rarely use safety equipment while riding as there are no binding rules for using protective gears, except for the mandatory helmet laws (44–47). Therefore, they are more irritated against hostile gestures, which may directly cause emotional and corporal damages.

The study reveals that younger riders tend to become more angered than the elder riders in Vietnam do. This finding is in line with the results presented in the psychometric adaptations of DAS in China, Malaysia, Spain and UK (18, 21, 33, 48), suggesting that driving anger is likewise a problem for younger drivers (18, 33), while more contrasted with the Argentinian sample (22). Older people may have more experiences and are aware of the negative consequences concerning anger, so they may try to adjust their emotions toward unpleasant situations (27).

In concordance with most previous studies on the relationship between demographic variables and anger provoked by Hostile gestures, was the finding that Vietnamese females reported a higher angry level than males (22, 33, 49). Probably, women’s greater anger at hostile gestures may be explained by the fact that they are expected to react with more emotional expressivity in situations involving negative affects (50). The Ministry of Education and Training

1 of Vietnam requires compulsory contents of traffic safety guidelines in the curriculum of all
2 universities, which are implemented by the Student Affairs Departments in coordination with the
3 city's traffic police. So, university graduates have learned to tolerate frustrating driving situations
4 thereby they likely reported less anger toward Hostile gesture than people without a university
5 degree.

6 The results from the logistic regression analysis raised some useful supports for predicting
7 crash risk by demonstrating the combined utility of DAS and individual differences in Vietnam.
8 The present study showed that Vietnamese motorcyclists who showed more anger because of
9 Arrival-blocking are expected to have higher odds for having crashes than those who did not.
10 When progress was impeded, arrival-blocking anger would be stimulated, causing riders likewise
11 to engage in aggressive riding behaviors and further increasing the crash risk (51, 52). It is
12 suggested that countermeasures, which make circulation more smoothly, have the potential to
13 reduce the crash rate in Vietnam. In term of Hostile gestures, riders who experienced more anger
14 were less likely to be involved in traffic accidents than those who had a lower anger level.

15 Besides, the current predictive model reveals that findings are consistent with previous
16 cross-cultural studies. First, gender is an important determinants of collision risks, whereas females
17 report lower rates of involvement than males (53). Second, riders' age is negatively related to the
18 odds for having crashes. These common characteristics provide an opportunity for Vietnamese
19 authorities to operate the interventions that have been effectively implemented in countries with
20 lower traffic fatality rates.

21 The current study still has some limitations. Firstly, considering the shortage of questions
22 measuring driving anger in motorcycle-traffic systems, it might be essential to expand the DAS
23 framework by including additional situations related to specific traffic conditions in Vietnam.
24 Secondly, there are some concerns about biases when using self-report methodology for collecting
25 data. However, anonymous participants were explained about the purposes of the study and have
26 been given enough time to answer the questionnaire, so the influence of social desirability bias is
27 likely to be negligible. Lastly, in motorcycling countries, where most Vietnamese riders (94.9%)
28 prefer riding motorcycle to working/studying places within a traffic system that contains inherent
29 chaotic characteristics, our DAS factor structure should be analyzed with the Motorcycle Rider
30 Behavior Questionnaire (54) to investigate whether the effects of driving anger on-road crash risk
31 are mediated by aberrant riding behavior.

32 Unexpectedly, there is practically an insufficiency of systematic research on driving anger,
33 one of the main determinants threatening traffic safety, and its consequences in Vietnam. This
34 study gives some new insights into the contemporary motorcycling traffic system in Vietnam. The
35 Vietnamese version of 12-item DAS could be replicated to study driving anger in other
36 motorcycling nations. Following the significant associations between DAS factors and accident
37 risks, new practical on-road safety campaigns can be developed to overcome the adverse driving
38 outcomes such as new countermeasures, which make circulation more smoothly or reinforcement
39 on driving anger awareness in the compulsory motorcycle training education in Vietnam.

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AUTHOR CONTRIBUTIONS

The authors confirm contribution to the paper as follows: study conception and design: H.T. Bui, M. Cools; data collection: H.T. Bui; analysis and interpretation of results: H.T. Bui, I. Saadi, M. Cools; draft manuscript preparation: H.T. Bui, I. Saadi, M. Cools. All authors reviewed the results and approved the final version of the manuscript.

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