

## **Aggressive Driving: Self-Reported Anger Expression and its Relationship with Driver Personality**

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### **Abstract**

Aggressive driving is a global road safety concern. However, little research has been conducted to understand the frequency of aggression nor what factors contribute to this. Moreover, in these researches, the effect of personality aspects on various driving anger expressions has not been investigated. The current study aims to investigate how drivers express their anger aggressively and its relationship with The Big Five personality traits. A total of 534 licensed drivers; 36.1 % had been involved in at least one crash in the last three years completed a brief survey assessing aggression and personality. Specifically, the driving anger expression inventory, which measures the frequency of verbal aggression, personal physical aggression, aggressive use of the vehicle and adaptive constructive responses, was investigated. The most common type of aggression was verbal aggression. Younger, and male drivers reported more frequent aggression. Neuroticism was related to all types of aggression, showing individuals with more neurotic characteristics also have more frequent verbal, personal physical aggression, use the vehicle more often to express anger and have less frequent adaptive constructive ways of dealing with anger. Neuroticism was also related to more crash involvement. In contrast, drivers with higher levels of conscientiousness more frequently dealt with anger in a constructive way and had been involved in fewer crashes. These findings show that the behavior and performance of drivers can be related to their personality and individuals higher in neuroticism report more dangerous behavior. This is important to assist with strategies to reduce high-risk driving in individuals.

**Keywords:** Driving Anger Expression, Safety strategies, Aggressive driving, Accidents, The Big Five Personality traits

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## 1. Introduction

Driving is a stressful activity and certain driving situations can provoke anger among driver [Qu et al. 2016]. Angry drivers tend to engage in behaviors that increase their crash risk [Stephens and Sullman, 2015]. For example, some drivers tend to drive faster when they are angry [Mesken J et al. 2007; Stephens and Groeger 2009; Sanghavi et al. 2020], suffer more losses of control or express their anger aggressively [Sullman et al. 2013; Sullman et al. 2015].

A large amount of research has been conducted to understand how drivers express their anger while driving. Deffenbacher et al. (2002) developed the Driving Anger Expression inventory (DAX) which contains four broad categories of anger expression; three aggressive expressions of anger (verbal aggression, using the car to express anger, and personal physical aggression) and one positive way of dealing with anger (adaptive constructive aggression). The DAX has been used and validated in many countries including France [Villieux and Delhomme, 2010], Turkey [Esiyok et al. 2007], Brazil [Olandoski et al. 2019], Serbia [Jovanovic' et al. 2011], China [Qu et al. 2016], America [Deffenbacher et al. 2002], and New Zealand [Sullman et al. 2015]. However, no research has been conducted to examine aggression in Iran. This is a significant drawback due to the high mortality rates in the country ranging between 30 - 44 deaths per 100,000 persons [Nordfjærn et al. 2015]. In 2005, 30,721 Iranians died in road traffic crashes and over one million were injured [Sadeghi-Bazargani et al. 2016]. Because extensive descriptive and experimental research

studies have supported a reliable association between aggressive driving and increased risk of motor vehicle accidents [Qu et al. 2016], [Stephens and Sullman, 2015], understanding aggression in Iran is critical to road safety.

The DAX is a useful tool to understand the safety implications of driver anger because it measures the frequency of different types of responses. Further, the DAX can be used to understand which drivers are more likely to respond aggressively; as the relationships between anger and aggression are often mediated by other factors. For example, women tend to report more adaptive constructive ways of dealing with their anger than men [Jovanović et al. 2011]. Likewise, males are more likely to have aggressive expressions of anger [Sullman et al. 2002]. Younger drivers also tend to deliberately violate traffic rules, e.g., run red lights, disregard speed limits, more than older drivers [Lajunen et al. 1998; Escanés and Poó, 2018]; express their anger more than their older counterparts [Wickens et al. 2011]; and are more aggressive [Ge et al., 2015; Lajunen et al. 1998]. This may explain why young male drivers are over-represented in motor vehicle crashes [Parker et al. 2002; Sullman et al. 2002; Chraif et al. 2016]. And particularly so in Iran, based on a study by Hamzeh et al. (2016) younger male drivers had the most fatal crashes among other groups. Also, some studies have indicated that the highest risk of crash is related to the youth and its rate in young individuals was higher than that among older ones [Lotfi et al. 2017; Rahemi et al. 2017].

In addition to age and gender, other factors have been found to influence the

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relationship between anger and aggression. For example, Stephens and Groeger (2009), found that trait anger was only related to aggression in relatively innocuous driving situations; suggesting evaluations of the driving situation play an important role in whether a driver becomes angry or not. In support of this, mindfulness [Stephens et al. 2018], narcissism [Edwards et al. 2013], forgiveness and consideration [Moore and Dahlen, 2008] and are all associated with aggressive expressions of anger. Drivers higher in mindfulness and less emotionally reactive reported lower anger and aggression. Likewise, forgiveness and consideration were negatively related to self-reported aggression. In contrast, higher levels of narcissism (egocentricity) were related to more aggression.

Thus, personality characteristics are important considerations in whether a driver may display anger aggressively [e.g., Jensen-Campbell et al. 2007; Lajunen, 2001; Yasak and Esiyok, 2009]. A number of researchers have considered The Big Five personality and their relationships with aggression and hazard while driving [see Iancu et al. 2016; Asadamraji et al. 2017; Asadamraji et al. 2019] and some have shown the personality related to the accidents [Landay et al. 2020]. The big five are five broad personality traits of agreeableness (i.e. being cooperative, good-natured, tolerant), extraversion (i.e., being sociable, talkative, impulsive, assertive), openness to experience (i.e., being interested, intellectual, original), neuroticism (i.e., being emotionally instable, nervous, anxious, depressive, hostile), and conscientiousness (i.e., being achievement-oriented, responsible, organized) are the factors to summarize the

differences between individuals in thought, feelings, and behaviors [John and Srivastava, 1999; McCrae and Costa, 2003]. A recent meta-analysis by Iancu et al. (2016) showed weak positive relationships between neuroticism, lower agreeableness and extraversion with aggressive driving. This shows that drivers higher in these traits also tend to report more aggressive driving. However, across the studies, aggression was operationalized differently and the nuances of how these factors may relate to the different types of aggression was lost. Further, relationships between adaptive ways of dealing with anger and The Big Five were not included.

In summary, many studies have highlighted the importance of how drivers express their anger and its effects on crash risk. This has not yet been explored in Iran, where there is a high crash rate and a large population of young drivers. Therefore, this issue has a high importance. Further, although there have been a lot of studies of personality impact on driving and crashes, the relationship between the big five personality traits and driving anger expressions, considered across verbal, physical or using the vehicle as well as adaptive ways of dealing with anger while driving has not yet been investigated.

## **1. Method**

### **2.1 Participants**

A total of 534 (males=339; 63%) participants were included in the study. Participants ranged in age from 19 to 72 years ( $M=31.8$  years,  $SD=10.57$ ). Participants were recruited from the general community. All participants held a

valid driving license and had been driving between 4 months to 50 years (M=9.9 years, SD=8.9). Table 1 shows the sample demographics and reported crash history. A notable proportion of the sample (36%) reported being involved in a crash in past three years.

Table 1. Sample demographics

Attribute	Option	Number	Percentage (%)
Gender	Male	339	63.48%
	Female	195	36.51%
Age	19-24	196	36.70%
	24-40	229	42.88%
	40-55	95	17.79%
	55-72	14	2.62%
Marital status	Married	248	46.44%
	Single	286	53.55%
Educational level	Diploma & lower	73	13.67%
	Associate	51	9.55%
	Bachelor	234	43.82%
	master & higher	176	32.95%
Driving experience	< 3 years	70	13.10%
	3-5	117	21.91%
	5-10	114	21.34%
	> 10	233	43.63%
Crashes per 3 years	Yes	193	36.14%
	No	341	63.85%

The study reported in this paper aimed to understand the relationship between different types of anger expression modes, including adaptive constructive and The Big Five personality traits. It is crucial to understand driver factors that are associated with behaviors that are known to

increase crash risk and whether these are also prevalent with Iranian drivers. It is equally important to understand what facets of personality are associated with more frequent adaptive constructive ways of dealing with anger, a question that has yet to be explored in the literature. This would inform road safety strategies.

## 2.2 Materials

The survey contained demographic variables of age, gender, education level, driving frequency, driving experience (length of license), and the number of crashes in the previous three years based on their own statements. Crashes included property damage only crashes as well as injury crashes. The following questionnaires were also included, in the order presented below.

### *The Driving Anger Expression Inventory – short form*

The short version of DAX (25-items) is a revised version of the original one containing 49 items [Deffenbacher et al. 2002], and was developed by Stephens and Sullman (2014). The 25 items form the same broad classifications as the original scale. These are “Verbal Aggressive Expression (VAE)”, “Personal Physical Aggressive Expression (PPAE)”, “Use of the Vehicle to Express Anger (UoV)”, and “Adaptive/Constructive Expression (A/C)”. Respondents rate how frequently they engage in each item, using a four-point scale (1 = almost never, 4 = almost always). The DAX\_short has demonstrated good validity with Cronbach alphas ranging from .74 to .88.

### *The Big Five personality traits*

The Big Five personality traits measure the dimensions of an individual's personality,

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which include agreeableness, extraversion (extroversion), openness to experience, neuroticism, and conscientiousness. Participants respond to 25 adjectives related to their personality (e.g. Outgoing, Helpful, Reckless and Moody), and they had to answer by the scales from 1 (not at all) to 4 (a lot).

### 2.3 Procedure

Data collection was conducted via a paper-based questionnaire survey in public places of Tehran including shopping centers, universities, offices, bus terminals and etc. The English version of questionnaires were translated into Persian. The questionnaires consisted of three parts: demographic data, DAX, and The Big Five personality traits. In total, 591 tests were distributed, and 534 of them were collected complete. In this questionnaire ethics has been observed and all data was anonymous with no identifying data collected. The specified time for the test was about 15 minutes. Data collection lasted approximately three months. The general process is shown in a flowchart (figure 1) below.

### 2.4 Data Analysis

Prior to analysis, the distribution of sample age was checked for normality. Sample age distribution was within normal range (Skewness  $< 2$ ; Kurtosis  $< 2$ ). An exploratory factor analysis (EFA) and a confirmatory factor analysis (CFA) was conducted on the items of DAX to determine the most appropriate factor structure were subjected to. The suitability of the data for factor analysis was assessed by using KMO measure of sampling adequacy and Bartlett's Test of Sphericity. Chi-Square, t-tests, and Mann-Whitney U-

tests were conducted to analyze the relationships between the four DAX variables with descriptive variables including gender, age and education level. Pearson correlations were also conducted to analyze the relationships between the DAX variables with age, driving experience and crash rate; and Spearman rank correlation was used to study relationships between score variables. Four hierarchical multiple regressions were conducted understand the relationships between driver factors and DAX scores.

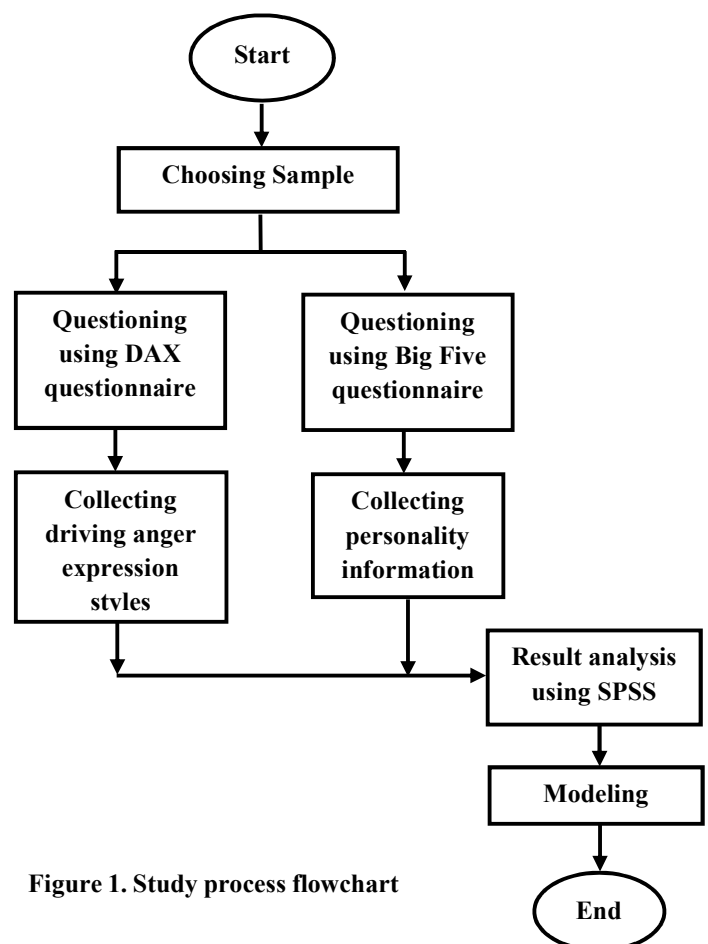


Figure 1. Study process flowchart

## 2. Results

### 3.1 DAX Factor Structure in the Iranian Sample

Given that the DAX has not previously been used on a sample of drivers from Iran, an initial Exploratory factor analysis was conducted to confirm the most appropriate factor structure for the sample. KMO was .88 and Bartlett's test was significant ( $p < .001$ ) indicating the data were suitable for factor analysis. Table 2 shows the final solution, which was similar to previous research [Stephens and Sullman, 2014]. There were two exceptions. Item 6, "Being angry, I roll down the window to help communicate my anger" from the PPAE factor, had a stronger loading onto the UoV factor in the current sample (.55). Also, item 9, "Being angry with another driver, I try to scare him/her by my car" from the original PPAE factor had a strong loading on VAE in the current sample (.70). This might be explained by the use of "by my car" in the question that implies the concept of Use of Vehicle. Given the loadings, these two questions were included as VAE and UoV items in subsequent analyses. The final solution contained all 25 items. Confirmatory factor analysis (CFA) was used to confirm the four-factor structure of the 25-item DAX. The goodness of fit statistics was:  $\chi^2 = 656.91$ ,  $p < 0.001$ ,  $\chi^2/df = 2.54$ , CFI = 0.91, TLI = 0.90, RMSEA = 0.05; 90% CI = 0.05–0.06;  $pclose > 0.05$ . The  $\chi^2$  was significant, which is common with larger samples and therefore remains acceptable [Sullman et al. 2017].

### 3.2 DAX item means

Table 2 shows the mean and standard deviations for the 25 DAX items. Based on this, the three most commonly reported responses were: I decide not to stoop to their level ( $M=3.01$ ;  $SD = 0.88$ ); I pay even closer attention to being a safe driver ( $M = 2.98$ ;  $SD = 0.86$ ); I just try to accept that there are bad drivers on the road ( $M=2.98$ ;  $SD=0.87$ ). The most commonly reported items were from the Adaptive/Constructive factor. The three least frequently reported responses were: I bump the other driver's bumper with mine ( $M=1.04$ ;  $SD = 0.24$ ); I try to get out of the car and have a physical fight with the other driver ( $M=1.07$ ;  $SD=0.33$ ); I try to get out of the car and tell the other driver off ( $M=1.12$ ;  $SD=0.37$ ). These three were all from Personal Physical Aggressive Expression subscale. The internal consistency of three of the four scales was acceptable, with Cronbach alpha coefficients ranging between 0.73 and 0.88. However, the alpha for personal physical aggressive expression was 0.65. Sullman et al. [2017] used the DAX on a sample of drivers in France and reported similar alpha levels (0.51). They cited the lack of this factor due to the less frequent repetition of the behavior among the drivers.

### 3.3 DAX across Gender and Age

Table 3 shows that age was significantly and positively related to the A/C factor, and significantly negatively related to all the anger factors of PPAE, UoV and VAE. This suggests that as a driver ages, they tend to report less aggressive displays of anger and more adaptive ways of dealing with anger. The DAX factors for VAE and UoV shared moderate positive

relationships, and all were moderately negatively related to the A/C factor.

Table 4 shows the DAX variables considered across gender. Due to the results of the Kolmogorov–Smirnov test and anomalous data distribution, a Mann–Whitney U test was used. Based on the Mann–Whitney U test there was a significant difference in average aggression frequencies between males and females for all the factors. Also, according to the average of each factor, it is evident that females control their aggression more than males and express lesser aggression using their vehicles, consequently it could be the reason for fewer crashes of females than males. In this regard, Stephens et al. (2014) found the difference between males and females only significant in the factor of UoV.

Over one third of the sample (36.1%) reported having been involved in a crash in the past three years. Table 5 shows the gender breakdown across crashes (yes, no). There was a significant relationship between gender and crash involvement with 40% of males in the sample reporting a recent crash compared to 30% of females.

### 3.4 DAX and driver personality

Table 6 shows the results of the regression analyses conducted to understand factors associated with each type of aggression. Hierarchical methods were used whereby age and gender were added at Step 1, mileage and crashes on Step 2, and personality traits on Step 3. Interestingly, across all four regression tests, gender, age and crash involvement significantly predicted the frequency of aggression. Of the Big Five personality traits, only neuroticism was consistently significantly related to aggression. As was evident in the correlations, drivers with less neuroticism had higher frequencies of adaptive constructive ways of dealing with anger, while higher neuroticism was significantly related to all three of the aggressive expressions of anger. Across all regression models, the inclusion of personality traits, increased the variance explained. The AC factor was predicted by a combination of driver factors and Agreeableness, Conscientiousness and Neuroticism explaining 19% of the variance. Personality traits, age, gender, experience and crashes also explained 14% of the variance in the VAE factor and 11.7% of the variance in the UoV factor.

Table 2. Means, Standard deviations and Load factors for the DAX items

DAX items	Load factor (EFA)	N=534 Mean (SD)	Cronbach's alpha
<b>Adaptive/constructive expression</b>		<b>2.75 (0.60)</b>	<b>.88</b>
23 I pay even closer attention to being a safe driver.	0.60	2.98 (0.86)	
26 I try to think of positive solutions to deal with the situation.	0.67	2.48 (0.88)	
29 I tell myself it's not worth getting all mad about.	0.67	2.57 (0.89)	
30 I decide not to stoop to their level.	0.65	3.01 (0.88)	
35 I try to think of positive things to do.	0.67	2.09 (0.89)	
36 I tell myself it's not worth getting involved in.	0.69	2.92 (0.90)	
42 I just try to accept that there are bad drivers on the road.	0.66	2.98 (0.87)	
45 I just try and accept that there are frustrating situations while driving.	0.75	2.84 (0.82)	
48 I tell myself to ignore it.	0.66	2.72 (0.79)	
49 I pay even closer attention to other's driving to avoid accidents.	0.61	2.90 (0.91)	
<b>Verbal Aggressive Expression</b>		<b>1.74 (0.51)</b>	<b>.73</b>
5 I call the other driver names aloud.	0.62	1.72 (0.70)	
6 I make negative comments about the other driver	0.70	1.86 (0.85)	
10 I roll down the window to help communicate my anger.	0.69	1.53 (0.65)	
28 I swear at the other driver aloud.	0.78	1.49 (0.73)	
31 I swear at the other driver under my breath.	0.39	2.38 (0.89)	
38 I yell at the other driver.	0.72	1.46 (0.69)	
<b>Use of Vehicle to Express Anger</b>		<b>1.46 (0.46)</b>	<b>.76</b>
2 I drive right up on the other driver's bumper.	0.72	1.36 (0.61)	
7 I follow right behind the other driver for a long time.	0.66	1.27 (0.59)	
15 I speed up to frustrate the other driver.	0.54	1.77 (0.81)	
21 I try to scare the other driver.	0.75	1.21 (0.55)	
22 I do to other drivers what they did to me.	0.47	1.28 (0.57)	
27 I drive a lot faster than I was.	0.65	1.89 (0.81)	
<b>Personal Physical Aggressive Expression</b>		<b>1.08 (0.24)</b>	<b>.65</b>
8 I try to get out of the car and tell the other driver off	0.67	1.12 (0.37)	
17 I bump the other driver's bumper with mine.	0.63	1.04 (0.24)	
41 I try to get out of the car and have a physical fight with the other driver.	0.70	1.07 (0.33)	



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**Table 3. Intercorrelations between variables**

	1	2	3	4	5	6	7	8
1.Age	-							
2.Years licensed	.810**	-						
3.Crashes per 3 years	-.138**	-0.078	-					
4.A/C	.293**	.194**	-.199**	-				
5.VAE	-.222**	-.102*	.144**	-.419**	-			
6.UoV	-.337**	-.174**	.234**	-.414**	.407**	-		
7.PPAE	-.087*	.01	.07	-.264**	.338**	.330**	-	
8.TAE	-.337**	-.163**	.228**	-.507**	.848**	.790**	.480**	-
9.Extraversion	.03	.06	-.056	.065	-.039	-.049	.075	-.023
10.Agreeableness	.136**	.104*	-.087*	.266**	-.114**	-.103*	-.020	-.126**
11.Conscientiousness	.265**	.258**	-.148**	.280**	-.191**	-.199**	-.044	-.227**
12.Neuroticism	-.240**	-.158**	.121**	-.267**	.334**	.333**	.205**	.398**
13.Openness to Experience	-.095*	.02	-.041	.109*	-.057	.053	.041	.003
Mean (SD)	31.8(10.57)	9.9(8.9)	0.36(0.48)	2.75(0.6)	1.74(0.51)	1.46(0.46)	1.08(0.24)	1.43(0.32)

A/C = Adaptive Constructive; PPAE = Personal Physical; VAE = Verbal; UoV = Use of Vehicle; TAE=Total Aggressive Expressions.  
 Upper panel: Pearson's correlation coefficient; lower panel: Spearman's Rho.  
 \*\* p < .01. \* p < .05.

**Table 4. DAX factors by gender**

	Male M(SD) (N=339)	Female M(SD) (N=195)	
Adaptive/Constructive	2.69(0.61)	2.85(0.56)	U = 28632.5, z = -2.57, p < 0.05
Verbal Aggressive Expression	1.82(0.51)	1.61(0.48)	U = 24102, z = -5.24, p < 0.001
Personal Physical Aggressive Expression	1.11(0.28)	1.02(0.14)	U = 27351.5, z = -5.5, p < 0.001
Use of Vehicle to Express Anger	1.54(0.49)	1.34(0.39)	U = 24289.5, z = -5.17, p < 0.001
Crashes per 3 years	0.64(1.16)	0.44(0.76)	U = 29721, z = -2.33, p < 0.05

**Table 5. Crashes across age, gender and Average Driving**

Variables	Groups	Crashes last 3 years? (Yes)	Pearson Chi-Square	Asymptotic Significance(2-sided)
Gender	Female	29.74%	5.44	.020*
	Male	39.82%		
Age	19-24 years old	44.89%	10.92	.012*
	24-40 years old	31.87%		
	40-55 years old	30.52%		
	55-72 years old	21.42%		
Average Driving	< 1 hour/day	27.53%	11.41	0.01**
	1-3 hour/day	41.39%		
	3-5 hour/day	39.47%		
	> 5 hour/day	50%		

**Table 6. Hierarchical regressions on driving anger expressions with demographic variables**

	B	t	p	ΔR2	F	P
<b>A/C</b>						
1- Gender	-.12	-3.00	.003	.08	24.41	<.001
Age	.26	6.30	.000			
2- Mileage	.16	3.87	.000	.06	19.65	<.001
Crashes per 3 years	-.20	-4.7 <sup>v</sup>	.000			
3- Extraversion	-.04	-.88	.377	.18	24.7	<.001
Agreeableness	.23	5.00	<.001			
Conscientiousness	.18	4.49	<.001			
Neuroticism	-.23	-5.9 <sup>v</sup>	<.001			
Openness to Experience	.02	.63	.0527			
<b>VAE</b>						
1- Gender	.19	4.77	<.001	.08	25.71	<.001
Age	-.22	-5.35	<.001			
2- Driving experience	-.10	-2.55	.011	.02	7.618	.001
Crashes per 3 years	.12	2.84	.005			
3- Extraversion	-.06	-1.30	.193	.14	18.37	<.001
Agreeableness	-.00	-.05	.959			
Conscientiousness	-.11	-2.6 <sup>v</sup>	<.001			
Neuroticism	.35	8.74	<.001			
Openness to Experience	.01	.31	.754			
<b>UoV</b>						
1- Gender	.20	5.03	<.001	.115	35.75	<.001
Age	-.27	-6.80	<.001			
2- Driving experience	-.12	-3.13	.002	.093	28.21	<.001
Crashes per 3 years	.27	6.69	<.001			
3- Extraversion	-.06	-1.38	.167	.117	15.17	<.001
Agreeableness	-.02	-.52	.599			
Conscientiousness	-.12	-2.74	.006			
Neuroticism	.31	7.58	<.001			
Openness to Experience	.11	2.54	.011			
<b>PPAE</b>						
1- Gender	.18	4.32	<.001	.038	11.39	<.001
Age	-.08	-2.03	.043			
2- Driving experience	.00	.05	.954	.070	21.07	<.001
Crashes per 3 years	.27	6.48	<.001			
3- Extraversion	.09	1.82	.069	.049	6.47	<.001
Agreeableness	-.09	-1.86	.062			
Conscientiousness	-.01	-.25	.796			
Neuroticism	.19	4.54	<.001			
Openness to Experience	.04	.93	.353			

### **3. Discussion**

The aim of this study was to understand how drivers in Iran express their anger and whether aggressive expressions are common. A further aim was to understand what personality characteristics from the Big Five were related to the frequency of different types of aggressive behavior, measured with the driving anger expression inventory (DAX). This is the first study to apply the DAX on a sample of drivers in Iran. Therefore, the factor structure was assessed with an exploratory factor analysis. The resulting factor structure was similar to what has been reported previously [Stephens and Sullman, 2014]. Further the pattern of responses on the resulting factors was also similar to previous countries, highlighting the suitability of the DAX for the current sample. Using the DAX, our findings showed that drivers tend to most commonly deal with anger in adaptive ways and when aggressive, verbal aggression is the most common, followed by use of vehicle. Neuroticism was positively related to aggression, while conscientiousness and agreeableness had weak negative relationships with aggression. The results also showed that people who used their vehicle to express anger had also reported more crashes in past three years. These findings are discussed in more detail below.

The EFA supported a four-factor structure of the DAX showing that drivers tended to deal with anger through verbal or physical aggression, by using the vehicle to express anger or through adaptive constructive ways. In-line with previous research [e.g. Stephens and Sullman, 2014, Sullman, 2015], drivers

in Iran reported adaptive constructive ways of dealing with anger as being the most common and personal physical aggression as the least common. Compared to the samples from other countries, drivers in Iran reported lower average frequencies of verbal aggression and personal physical aggression and more frequent adaptive constructive ways of dealing with anger. However, for the drivers in Iran, use of the vehicle was more frequent than has been reported previously. Higher tendencies to use the vehicle to express anger, aligns with the higher rate of crashes in Iran compared to other countries. Indeed, use of vehicle includes tailgating and speeding which are known to be key contributors to crash. According to statistics from the Forensic Medicine Organization of Iran, between 2006 to 2008, traffic crashes resulted in an average of 24 000 people (i.e., 3 persons per hour) dead annually [Kashani et al. 2012]. The death rate (44 per 100,000) is the highest of any country in the world for which reliable estimates are available [Sadeghi-Bazargani et al. 2016].

Also, in-line with previous research [Sullman, 2015; Gras, 2016], we found that younger drivers tended to report more frequent aggressive displays of anger, and less frequent adaptive constructive ways of dealing with aggression. This corresponds with our analyses showing a negative relationship between crashes and age and also more broadly to crash data showing younger drivers are over-represented in crashes. Likewise, males reported more aggression than females; while females reported more frequent adaptive constructive ways of dealing with anger. These findings are also

consistent with previous research [Deffenbacher et al. 2002].

When the Big Five personality traits were considered, neuroticism was consistently related to increased aggressive displays and less adaptive constructive ways of dealing with anger. Neuroticism is related to individual differences in sentimental negative reactions to threat, disappointment, and loss; it is defined by irritability, aggression, sadness, anxiety, enmity, self-consciousness, and weakness, which are all correlated to each other [Costa and McCrae, 1992a; Goldberg, 1993]. Therefore, the finding that neuroticism was the main personality factor associated with all four DAX factors might be explained by the fact that it has a component of aggression embedded within it. It might be that angry and neurotic people rarely accept the situation and they are more likely to behave riskily while driving, therefore, they have had more crashes than others in recent three years.

Conscientiousness was related to less frequent verbal aggression and use of the vehicle to express anger and more frequent adaptive constructive aggression. Conscientious people comply with rules and social commitments more than others [Sârbescu and Maricuțoiu, 2019], therefore, they are likely to have more compliance with driving laws and avoid risky behavior. [Arthur and Graziano, 1996; Dahlen et al., 2012]. In our study, conscientiousness was not related to personal physical aggression when all personality traits were considered in the regression. Therefore, suggesting other factors are more predictive of this type of reaction. Indeed, Iancu et al. (2016) found

only neuroticism, agreeableness and extroversion to be associated with aggression. However, as mentioned above, this was using a combined aggression score and not considering specific aggression expressions nor adaptive ways of dealing with anger.

In our study, agreeableness was only related to personal physical aggression and adaptive constructive aggression. Agreeableness is a trait exhibiting compatibility and kindness as well as obedience, co-operation and being more relaxed [Roccas, et al. 2002]. Adaptive constructive ways of dealing with anger, fit directly into this as they represent a more relaxed, non-reactive way of dealing with anger. Thus, the higher levels of this trait a driver has, the better they may be able to control his anger and accept the situation.

In contrast to Iancu et al. (2016), in our study extraversion was unrelated to aggression when all personality traits were considered in the regression equation. Extraversion is a trait that is related to active, social and sometimes impulsive or dominant behaviors [Sârbescu and Maricuțoiu, 2019]. In this regard, other researches have also reported no significant relationships between extraversion and crash involvement [Wilson and Greensmith, 1983]. Our data align with this. One of the reasons for the difference between these results is the variety of Eysenck Personality Questionnaire (EPQ) for studying different dimensions of the individual personalities [Lajunen, 2001].

Our findings also showed relationships between aggression and crash involvement. In particular, drivers who more frequently use the vehicle to express anger, had more verbal aggression. In addition, drivers who

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have less frequent adaptive constructive ways of dealing with anger also tended to report more crashes over the past three years. This is in-line with previous research that has shown relationships between crash rate and use of the vehicle to express anger [Deffenbacher et al. 2002; Sullman et al. 2013, 2015]. Dahlen and Ragan (2004) reported a significant relationship between crashes and personal physical aggression and a negative relationship between crashes and adaptive constructive responses. Deffenbacher et al. (2002) also reported that crash rate was significantly related to verbal aggressive expression, using the vehicle aggressively and total aggressive expression. These suggest a relationship between crashes and anger expression modes of drivers in Iran.

According to Simons et al. (2017), The participants of this study are based on a random sampling and are non-professional and ordinary people of the society and driving was not their career. Accordingly, we expect our result to be generalized to a wide range of people in society. However, these results are based on a culture and may be different for individuals with different backgrounds.

### *Limitations*

The present study suffers from the usual limitations of research based on self-reported data, which is social desirability bias. However, as no names were collected, the impact of social desirability bias is unlikely to have significantly influenced the results [Shiwakoti et al. 2020, Grimm, 2010, Fisher, 1993]. Also, in this study, accident

statistics are based on individuals' sentences. Further research can be conducted based on accurate statistics from accidents to compare with the obtained results. In addition, in this study drivers have not been separated, which is better to collect data separately from non-professional and professional drivers in the future.

## 4. Conclusions

This study aimed to investigate self-reported aggression in a sample of drivers in Iran and to investigate the relationship between different types of aggression with demographic variables and personality traits. The Big Five personality questionnaire was used which measures neuroticism, agreeableness, conscientiousness, extroversion and openness to experience. The results showed that younger drivers engaged in more frequent aggression, Younger drivers also reported being involved in more crashes in the last three years, compared to older drivers. Relationships were also observed between aggression and crash involvement; suggesting that using the vehicle for aggression may be contributing to crash risk. Personality traits were also found to be related to aggression. Most notably, neuroticism characteristics, specifically higher levels of neuroticism, have direct associations with increased aggression as well as the number of traffic crashes. These findings can help identify individuals with high-risk driving behaviors for safety and insurance organizations. The present research found that the different dimensions of human personality could partly recognize aggressive behaviors when driving and it is possible with a closer look to teach people according to their weak personality characteristics.

Besides, driving risk can be predicted from their kind of aggression. These findings can be attractive to organizations providing driver licenses and also insurance companies.

Further research needs to explore this using objective behavior, such as driving simulator or naturalistic studies that can examine relationships between personality and high-risk driving.

## 7. References

-Arthur Jr, W. and Graziano, W.G., (1996) "The five-factor model, conscientiousness, and driving Accident Involvement", *Journal of Personality*, Vol. 64, No. 3, pp. 593-618.

-Asadamraji, M., Saffarzadeh, M. and Mirzaee Tayeghani, M. (2017). Modeling driver's hazard perception using driver's personality characteristics. *International Journal of Transportation Engineering*, Vol. 5, No. 2, pp. 167-182.

-Asadamraji, M., Saffarzadeh, M., Ross, V., Borujerjian, A., Ferdosi, T. and Sheikholeslami, S., (2019). A novel driver hazard perception sensitivity model based on drivers' characteristics: A simulator study. *Traffic injury prevention*, Vol. 20 No. 5, pp. 492-497.

-Chraif, M., Dumitru, D., Aniței, M., Burtăverde, V. and Mihăilă, T., (2016) "Developing of an English Version of the Aggressive Driving Behavior Test (AVIS). Improving the Construct Validity of Aggressive Driving ", *Current Psychology*, Vol. 35, No. 1, pp. 29-38.

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-Costa Jr, P.T. and McCrae, R.R., (1992) "Reply to Eysenck", *Personality and Individual Differences*, Vol. 13, No. 8, pp. 861-865.

Dahlen, E.R. and Ragan, K.M., (2004) "Validation of the propensity for angry driving scale", *Journal of Safety Research*, Vol. 35, No. 5, pp. 557-563.

Dahlen, E.R., Edwards, B.D., Tubré, T., Zyphur, M.J. and Warren, C.R., (2012) "Taking a look behind the wheel: An investigation into the personality predictors of aggressive driving", *Accident Analysis & Prevention*, Vol. 45, pp. 1-9.

Deffenbacher, J.L., Lynch, R.S., Oetting, E.R. and Swaim, R.C., (2002) "The Driving Anger Expression Inventory: A measure of how people express their anger on the road", *Behaviour research and therapy*, Vol. 40, No. 6, pp. 717-737.

Edwards, B. D., Warren, C. R., Tubré, T. C., Zyphur, M. J. and Hoffner-Prillaman, R. (2013) "The validity of narcissism and driving anger in predicting aggressive driving

## Aggressive Driving: Self-Reported Anger Expression and its Relationship with Driver...

- in a sample of young drivers”, *Human Performance*, Vol. 26, No. 3, pp. 191-210.
- Escanés, G. and Poó, F.M., (2018) “Driving anger in Argentina”, *Safety Science*, Vol. 105, pp. 228-237.
- Fisher, R.J. (1993) “Social desirability bias and the validity of indirect questioning”, *J. Consumer Res.*, Vol. 20, No. 2, pp. 303-315
- Ge, Y., Qu, W., Zhang, Q., Zhao, W. and Zhang, K., (2015) “Psychometric adaptation of the driving anger expression inventory in a Chinese sample”, *Transportation Research Part F: Traffic Psychology and Behaviour*, Vol. 33, pp. 75-86.
- Goldberg, L.R., (1993) “The structure of phenotypic personality traits”, *American Psychologist*, Vol. 48, No. 1, pp. 26.
- Gras, M.E., Font-Mayolas, S., Patiño, J., Baltasar, A., Planes, M. and Sullman, M.J., (2016) “Resilience and the expression of driving anger”, *Transportation Research Part F: Traffic Psychology and Behaviour*, - Vol. 42, pp. 307-316.
- Grimm, P., (2010). *Social Desirability Bias*. Wiley International Encyclopedia of Marketing.
- Hamzeh, B., Najafi, F., Karamimatin, B., Ahmadijouybari, T., Salari, A. and Moradinazar, M., (2016) “Epidemiology of traffic crash mortality in west of Iran in a 9 year period”, *Chinese Journal of Traumatology*, Vol. 19, No. 2, pp. 70-74.
- Iancu, A. E., Hogeia, A., Olteanu, A. F. (2016) “The association between personality and aggressive driving: A meta-analysis”, *Romanian Journal of Psychology*, Vol. 18, No. 2.
- Jensen-Campbell, L.A., Knack, J.M., Waldrip, A.M. and Campbell, S.D., (2007) “Do Big Five personality traits associated with self-control influence the regulation of anger and aggression?”, *Journal of Research in Personality*, Vol. 41, No. 2, pp. 403-424.
- John, O.P. and Srivastava, S. (1999) “The Big Five trait taxonomy: History, measurement, and theoretical perspectives”, *Handbook of personality: Theory and research*, Vol. 2, No. 1999, pp. 102-138.
- Jovanovic, D., STANOJEVIĆ, P.R.E.D.R.A.G. and Stanojević, D., (2011) “Motives for, and attitudes about, driving-related anger and aggressive driving”, *Social Behavior and Personality: An International Journal*, Vol. 39, No. 6, pp. 755-764.
- Kashani, A.T., Shariat-Mohaymany, A. and Ranjbari, A., (2012) “Analysis of factors associated with traffic injury severity on rural roads in Iran”, *Journal Of Injury And Violence Research*, Vol. 4, No. 1, p. 36.
- Lajunen, T. and Parker, D., (2001) “Are aggressive people aggressive drivers? A study of the relationship between self-reported general aggressiveness, driver anger and aggressive driving”, *Accident Analysis & Prevention*, Vol. 33, No. 2, pp. 243-255.
- Lajunen, T., Parker, D. and Stradling, S.G., (1998) “Dimensions of driver anger, aggressive and highway code violations and their mediation by safety orientation in UK drivers”, *Transportation Research Part F*:

Traffic Psychology and Behaviour, Vol. 1, No. 2, pp. 107-121.

-Landay, K., Wood, D., Harms, P.D., Ferrell, B. and Nambisan, S., (2020) "Relationships between personality facets and accident involvement among truck drivers", Journal of Research In Personality, Vol. 84, p. 103889.

-Linkov, V., Zaoral, A., Řezáč, P. and Pai, C.W., (2019). Personality and professional drivers' driving behavior. Transportation research part F: traffic psychology and behaviour, Vol. 60, pp. 105-110.

-Lotfi, S., Yazdanirad, S., Pourabdiyan, S., Hassanzadeh, A. and Lotfi, A. (2017) "Driving behavior among different groups of Iranian drivers based on driver coping styles", International Journal of Preventive Medicine, Vol. 8, No. 52, pp. 1-5

-McCrae, R.R. and Costa, P.T., (2003) "Personality in adulthood: A five-factor theory perspective" Guilford Press.

-Mesken, J., Hagenzieker, M.P., Rothengatter, T. and de Waard, D. (2007) "Frequency, determinants, and consequences of different drivers' emotions: An on-the-road study using self-reports(observed) behaviour, and physiology", Transportation Research Part F: Traffic Psychology and Behaviour, Vol. 10, No. 6, pp. 458-475.

-Moore, M. and Dahlen, E.R., (2008) "Forgiveness and consideration of future consequences in aggressive driving", Accident Analysis & Prevention, Vol. 40, No. 5, pp. 1661-1666.

-Nordfjærn, T., Hezaveh, A. M. and Mamdoohi, A.R., (2015) "An analysis of **International Journal of Transportation Engineering, Vol. 8/ No.3/ (30) Winter 2021**

reported driver behaviour in samples of domestic and expatriate Iranians", Journal of Risk Research, Vol. 18, No. 5, pp. 566-580.

-Olandoski, G., Bianchi, A. and Delhomme, P. (2019) "Brazilian adaptation of the driving anger expression inventory: testing its psychometrics properties and links between anger behavior, risky behavior, sensation seeking, and hostility in a sample of Brazilian undergraduate students", Journal of Safety Research, Vol. 70, pp. 233-241.

-Parker, D., Lajunen, T. and Summala, H., (2002) "Anger and aggression among drivers in three European countries", Accident Analysis & Prevention, Vol. 34, No. 2, pp. 229-235.

-Qu, W., Dai, M., Zhao, W., Zhang, K. and Ge, Y. (2016) "Expressing anger is more dangerous than feeling angry when driving", PLoS one, Vol. 11, No. 6, p.e0156948.

-Qu, W., Sun, H. and Ge, Y., (2020). The effects of trait anxiety and the big five personality traits on self-driving car acceptance. *Transportation*, pp. 1-17.

-Rahemi, Z., Ajorpaz, N.M., Esfahani, M.S. and Aghajani, M., (2017) "Sensation-seeking and factors related to dangerous driving behaviors among Iranian drivers", Personality and Individual Differences, Vol. 116, pp. 314-318.

-Roccas, S., Sagiv, L., Schwartz, S.H. and Knafo, A. (2002) "The big five personality factors and personal values", Personality and Social Psychology Bulletin, Vol. 28, No. 6, pp. 789-801.



## Aggressive Driving: Self-Reported Anger Expression and its Relationship with Driver...

- Sadeghi-Bazargani, H., Ayubi, E., Azami-Aghdash, S., Abedi, L., Zemestani, A., Amanati, L., Moosazadeh, M., Syedi, N. and Safiri, S. (2016) "Epidemiological patterns of road traffic crashes during the last two decades in Iran: a review of the literature from (1996) to (2014)", *Archives of Trauma Research*, Vol. 5, No. 3.
- Sanghavi, H., Zhang, Y. and Jeon, M., (2020) September. Effects of Anger and Display Urgency on Takeover Performance in Semi-automated Vehicles. In 12th International Conference on Automotive User Interfaces and Interactive Vehicular Applications, pp. 48-56.
- Sârbescu, P. and Maricuțoiu, L., (2019) "Are you a "bad driver" all the time? Insights from a weekly diary study on personality and dangerous driving behavior", *Journal of Research in Personality*, Vol. 80, pp. 30-37.
- Shiwakoti, N., Wang, H., Jiang, H. and Wang, L., (2020). A 'role-rule' model to examine passengers' likely behaviour and their perceived ability to evacuate safely from airport in an emergency evacuation. *Safety science*, Vol. 124, p.104584.
- Simons, D.J., Shoda, Y. and Lindsay, D.S. (2017) "Constraints on generality (COG): A proposed addition to all empirical papers", *Perspectives on Psychological Science*, Vol. 12, No. 6, pp. 1123-1128.
- Stephens, A. N., Groeger, J. A. (2009) "Situational specificity of trait influences on drivers' evaluations and driving behaviour", *Transportation Research Part F: Traffic Psychology and Behaviour*, Vol. 12, No. 1, pp. 29-39.
- Stephens, A. N., Koppel, S., Young, K. L., Chambers, R. and Hasted, C. (2018) "Associations between self-reported mindfulness, driving anger and aggressive driving", *Transportation Research Part F: Traffic Psychology And Behaviour*, Vol. 56, pp. 149-155.
- Stephens, A. N. and Sullman, M. J., (2014) "Development of a short form of the driving anger expression inventory", *Accident Analysis & Prevention*, Vol. 72, pp. 169-176.
- Stephens, A. N. and Sullman, M. J. (2015) "Trait predictors of aggression and crash related behaviors across drivers from the United Kingdom and the Irish Republic", *Risk Analysis*, Vol. 35, No. 9, pp. 1730-1745.
- Sullman, M.J., (2015) "The expression of anger on the road", *Safety Science*, Vol. 72, pp. 153-159.
- Sullman, M.J., Meadows, M.L. and Pajo, K.B., (2002) "Aberrant driving behaviours amongst New Zealand truck drivers", *Transportation Research Part F: Traffic Psychology and Behaviour*, Vol. 5, No. 3, pp. 217-232.
- Sullman, M.J., Paxion, J. and Stephens, A.N. (2017) "Gender roles, sex and the expression of driving anger", *Accident Analysis & Prevention*, Vol. 106, pp. 23-30.
- Sullman, M. J., Stephens, A. N. and Kuzu, D. (2013) "The expression of anger amongst Turkish taxi drivers", *Accident Analysis & Prevention*, Vol. 56, pp. 42-50.
- Sullman, M. J., Stephens, A. N. and Yong, M. (2015) "Anger, aggression and road rage behaviour in Malaysian drivers",

Transportation Research Part F: Traffic Psychology and Behaviour, Vol. 29, pp. 70-82.

-Villieux, A. and Delhomme, P. (2010) "Driving anger and its expressions: Further evidence of validity and reliability for the Driving Anger Expression Inventory French adaptation", Journal of Safety Research, Vol. 41, No. 5, pp. 417-422.

-Wickens, C.M., Wiesenthal, D.L., Flora, D.B. and Flett, G.L., (2011) "Understanding driver anger and aggression: Attributional theory in the driving environment", Journal

of Experimental Psychology: Applied, Vol. 17, No. 4, pp. 354.

-Wilson, T. and Greensmith, J., (1983) "Multivariate analysis of the relationship between drivometer variables and drivers' accident, sex, and exposure status", Human Factors, Vol. 25, No. 3, pp. 303-312.

-Yasak, Y. and Esiyok, B., (2009) "Anger amongst Turkish drivers: Driving Anger Scale and its adapted, long and short version", Safety Science, Vol. 47, No. 1, pp. 138-144. Scale and its adapted, long and short version", Safety Science, Vol. 47, No. 1, pp. 138-144.