Stress and Anxiety on the Road: The Silent Victims and Their Sufferings

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ABSTRACT

This paper explores the issue of stress and anxious behaviour among frequent drivers. Driver Stress Inventory and Anxious Driving Behaviour scales were adopted to probe private car vehicle drivers through an online survey. Driver samples were obtained within the vicinity of three states in Malaysia which are Selangor, Putrajaya and Kuala Lumpur. Analysis suggests that hazard monitoring particularly on difficult road stretch and pedestrian are the main source of driving stress while exaggerated safety/caution behaviour involving bad weather and driving speed adjustment are the most frequently exhibited form of anxious driving behaviour. Narrowing down into hazard monitoring and exaggerated safety/caution behaviour, findings suggest that older age, longer driving distance and higher income level contribute to level of stress while trauma due to past history of crash involvement affect the level of anxiety while driving. The findings highlight that road environments and weather condition can influence driver stress and anxiousness. Further studies are needed to establish the extend of impact from stress and anxiety but improving road infrastructure to segregate vulnerable road users and increase visibility may help in curbing problems related to road stress and anxiety among drivers.

Keywords:
Driver stress; driver anxiety; driver stress
Inventory; anxious driving behaviour;
hazard monitoring; exaggerated caution

1. Introduction

Stress and anxiety are common issues in modern society. Within the realm of road safety however, the prevalence and effect of stress and anxiety are lacking in systematic documentation most probably due to the complexity in measuring the signs or symptoms. While many can relate to feeling stress and anxious while commuting, especially for drivers or riders, some may not actually recognize their own mental state while on the road. While anxiety may have more distinctive symptoms, stress is usually perceived as typical occurrence among drivers. Contrary to popular belief however, stress is not optional nor just an onset of bad emotion that can simply be disregarded, thus making the common advice to not get stress (i.e. don't be stress, stop stressing etc.) as something impractical. In the context of driving, telling drivers to not get stressed out by road congestion or the confusing road signs are not feasible as solution to destress. Anxiety on the other hands, can be a form of stress manifestation after a period of severe stress.

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In year 2020, a new global health concern has change human way of life in numerous ways while also having the potential to induce stress and anxiety. Baum *et al*., [1] described stress as negative responses that involve changes in biochemical, physiological and behaviour as people try to adapt or adjust to the event causing the stress. The triggers for stress are all primarily detected in the brain and thus differ according to individual traits and characteristics. According to McEwen and Gianaros [8], evaluation of any event as stressful begins in the brain which can occur without human even realizing the process. The consequence of how human brain choose to handle the stressful situation will influence the resulting behavioural or psychological responses. Though there seems to be no link between the pandemic with road driving, prolonged stress can be amplified in other demanding situation which may lead to anxiety and other skill impairments.

On the other hand, the causes of stress and anxiety while driving can be multifaceted. Other than the driving activity itself, other occurrences in life such as job demand, health status, social issue, mental state and individual experience can cause stress and anxiety on the road [10,5]. Gottholmseder *et al*., [4] found that travel time and distance, predictability and mode of transport as significant influence to stress with long working hours, higher job rank and lack of job satisfaction leading to more stress. Crash related distress was also found to be associated to anxious driving behaviour. Interestingly, Clapp et. al (2012) suggested that instead of crash severity, the link between accident stress and anxious behaviour can be established among those experiencing significant life stress. This highlight the importance of healthy overall life quality and the needs to not just address and reduce the impact of road stress and anxiety but also to recognize the group of people who is exposed and more prone to this problem such as delivery and commercial drivers.

Measurement of driving stress was originally carried out by Gulian *et al*., [5] and after several modification later on, the Driver Stress Inventory includes five components namely aggression, dislike of driving, proneness to fatigue, thrill-seeking and hazard monitoring [9]. All the five components are proportionate to each other except for the thrill seeking with hazard monitoring. This implied that those with stress due to hazard monitoring have lower score for thrill seeking. Gender, length of trip, road crash history and traffic violations especially on speeding and failure complying to road signs were shortlisted as the factors while hazard monitoring came out as the most stressful event causing driving stress.

Meanwhile, anxious driving was studied by Clapp *et al*., [2] who conceptualized anxious driver behaviour as the exaggerated and disorderly form of anxiety manifestation due to vehicle driving. The study evaluated anxiety through three broad domains which are exaggerated safety/caution behaviours, anxiety-based performance deficits, and hostile/aggressive driving behaviours. All three domains were found to be related to driving or accident-related fear, travel avoidance and perceived driving skill. Anxiety due to past history with road crashes had been found prevalent especially among female road crash victims regardless a drivers or passengers [3]. Anxiety is also studied among older people where older drivers were found to be immobilized and dependant due to driving related anxiety issues Taylor *et al*., [11].

2. Study Objective

The aim of this paper is to determine the characteristics of drivers with high level of stress and anxiety due to driving as well as recognizing the driving situations that are the most stressful and anxiety inducing.

3. Methodology

3.1. Instrument

The scales used in this study are adopted and adapted from Driving Stress Inventory (DSI) as studied by Qu *et al.,* [9] and Anxious Driving Behaviour (ADB) by Clapp *et al.,* [2]. The DSI was first designed by Gulian *et al.,* [5] with five driving stress components which are aggression, dislike of driving, tension and frustration due to overtaking, irritation when overtaken and heightened alertness and concentration

Both DSI and ADB were back to back translated into Malay language from English and went through deliberation by a group of researchers prior to the main data collection. DSI is made of five subscales denoting the driving stressors while ADB is made of three subscales on the form of anxious behaviour behind the wheel. Table 1 summarizes the scales and the examples of items in each scale. The reliability coefficients are tested for samples obtained from this study.

Table 1
Items, reliability and description of DSI and ADB scales

Items	🔲	No. of items	Scale	Study
Driving Stress Inventory		*49*		
Aggression • I find controlling my temper is difficult when driving • I become annoyed if another vehicle follows very close behind me for some distance	0.813	12	11-point Likert scale (0: strongly disagree – 10: strongly agree)	
Dislike of driving • Driving in bad weather worries me • I feel more anxious than usual when driving in heavy traffic	0.767	12	11-point Likert scale (0: strongly disagree – 10: strongly agree)	
Hazard monitoring • When I have to negotiate a difficult stretch of road, I am on the alert • If I make a minor mistake when driving, I feel that it's something I should be concerned about	0.876	8	11-point Likert scale (0: strongly disagree – 10: strongly agree)	Qu et. al (2016)
Thrill seeking • I would enjoy riding a sports vehicle on a road without a speed limit • I get a real thrill out of riding fast	0.919	8	11-point Likert scale (0: strongly disagree – 10: strongly agree)	
Proneness to fatigue (after driving non-stop or without rest for hours)) • Overtaking skill	0.918	9	11-point Likert scale (0: no change – 10: critical change)	

• Attention to road sign				
Anxious Driving Behavior		21		
Anxiety-based performance deficits • I have difficulty merging into traffic • I forget where I am driving to	0.865	7	7-point Likert scale (1: never – 7: always)	
Exaggerated safety/caution behaviour • I try to stay away from others cars • I decrease my speed until I feel comfortable	0.772	7	7-point Likert scale (1: never – 7: always)	Clapp et. Al (2011)
Hostile/aggressive behaviour • I honk my horn at the driver who made me nervous • I swear/ use profanity while I am driving	0.806	7	7-point Likert scale (1: never – 7: always)	

3.2. Survey Sampling

The survey for this cross-sectional study was done through online platform, targeting drivers in Klang Valley areas of Kuala Lumpur, Selangor and Putrajaya, Malaysia. The reasons for choosing the locations are due to the fact that road network, traffic volume and transport infrastructures are highest and most prominent here compared to other areas in Malaysia. The sampling targeted about 400 samples with the online survey conducted within four months in the end of 2020, which was the period where the movement control order due to the pandemic in Malaysia was temporarily relaxed. During this period, most working sectors were allowed to open under strict regulations. However, for safety purpose, the survey was completely carried out online to avoid any physical contact.

Respondents were required to be frequent drivers with a least weekly driving frequency for any purpose and only those aged 17-year-old and above. To approach the samples, individuals and companies were contacted through calls and emails for consent to recruit their staff as respondents. Link to the online survey form was provided once consent was obtained. To filter the responses for eligibility, only those agreeing to the survey and selecting at least weekly drive can proceed to answer the rest of the survey questionnaire. Due to the hefty number of questions, small token was provided for those interested.

3.3 Analysis

Frequency is used to analyse the demography and driving details of the samples. Mean scores denoting the level of stress/anxiousness for each subscale will be depicted using histogram with normal curve to allow examination on the distributions. To determine the contributing factors for subscales with highest mean scores in each DSI and ADB, scores for top items are examined and logistic regression will be performed. The following Table 2 list the variables and each corresponding coding used in the analysis procedure.

Table 2
Variables and corresponding coding

Variable	Coding (type)
Dependant variables	*Mean of scores from items in each subscale*
Aggression	0 – 10 (scale)
Dislike of driving	0 – 10 (scale)
Hazard monitoring	0 – 10 (scale)
Thrill seeking	0 – 10 (scale)
Fatigue	0 – 10 (scale)
Anxiety-based performance	1 – 7 (scale)
deficits	1 – 7 (scale)
Exaggerated safety/caution	1 – 7 (scale)
behaviour	
Hostile/aggressive behaviour	
	1= mean score 8 and above, 0=mean less than 8 (categorical)
Modified for Chi square test	1= mean score 5 and above, 0=mean less than 5 (categorical)
Hazard monitoring	
Exaggerated safety/caution	
behaviour	
Independent variables	
Gender	1= Male, 2= Female (categorical)
Age (year old)	1= 17 – 25, 2= 26 – 35, 3= 36 – 45, 4= 46 – 55, 5= Above 55 (categorical)
Marital	1= Single, 2= Married, 3= Divorcee (categorical)
Education	1=First degree/ Master/ PHD, 2=SPM or equivalent, 3=STPM/ Diploma or equivalent, 4=UPSR/ PMR or equivalent, 5=Others (categorical)
Income	0=No income, 1=RM1000 and below, 2=RM1001 - RM3000, 3=RM3001 - RM5000, 4=Above RM5000 (categorical)
Driving distance daily	0=No daily driving, 1=Below 25km, 2=25km - 60km, 3=Above 60km (categorical)
Driving distance monthly	1=Below 500km, 2=500 - 1500km, 3=Above 1500km
Driving License type	(category)
Fined for traffic offenses	1= D only, 0= D and others
Involvement in road crash	1= Yes, 0= No (categorical)
Trauma from road crash	1= Yes, 0= No (categorical)
	1= Yes, 0= No (categorical)
Modified for Chi square test	
Gender	
Age (year old)	1= Male, 2= Female (categorical)
Marital	0= below 36, 1= 36 and above (categorical)
Education	0= Single, 1= Married (categorical)
Income	0=lower than STPM level 1=STPM and higher level
Driving distance daily	(categorical)
Driving distance monthly	0=3000 or below, 1=RM3001 and above (categorical)
	0=Below 25km, 1=25km and above (categorical)
	0=Below 500km, 1=500 and above (category)

4. Results and Discussion

A total of 567 samples are included in the analysis and results for this study. Majority of samples are frequent drivers driving at least weekly for work related purpose. From Table 3, about one third

of the samples are males, aged between 26 – 35 years old and have income ranging from RM1000 to RM3000 per month. The distribution of samples among age group, income level and education level are quite diverse while less than a quarter are made of unmarried drivers.

Table 3
Demographic profiles

Variable	N	Percentage (%)
Gender		
Female	356	61.8
Male	220	38.2
Total	576	100.0
Age		
17 - 25	40	6.9
26 - 35	211	36.6
36 - 45	239	41.5
46 - 55	68	11.8
Above 55	18	3.1
Total	576	100.0
Marital status		
Single	124	21.5
Married	429	74.5
Widow/divorcee	23	4.0
Total	576	100.0
Education		
Others	5	0.9
First degree/ Master/ PHD	285	49.5
SPM or equivalent	80	13.9
STPM/ Diploma or equivalent	201	34.9
UPSR/ PMR or equivalent	5	0.9
Total	576	100.0
Income		
No income	9	1.6
RM1000 dan ke bawah	14	2.4
RM1001 - RM3000	194	33.7
RM3001 - RM5000	184	31.9
Above RM5000	175	30.4
Total	576	100.0

Table 4 illustrates the details related to driving exposure and crash histories. Almost half of the samples drove less than 25km per day or below 500km per month. Less than one fifth of samples have experienced either being fined for traffic offense, involved in road crash or feeling traumatized by prior road crash involvement.

Table 4
Driving details

Variable	N	Percentage (%)
Distance Daily		
No daily driving	12	2.1
Below 25km	250	43.4
25km - 60km	228	39.6
Above 60km	86	14.9
Total	576	100.0
Monthly distance		
Below 500km	258	44.8

500 - 1500km	208	36.1
Above 1500km	110	19.1
Total	576	100.0
Fined/Arrested		
No	486	84.4
Yes	90	15.6
Total	576	100.0
Road crash history		
No	516	89.6
Yes	60	10.4
Total	576	100
Trauma from road crash		
No	476	82.6
Yes	100	17.4
Total	576	100.0

4.1 Driver Stress

As mentioned in methodology section, there is no one score to measure the level of driving stress. Instead, the scores are calculated for each five of the subscales. The average mean scores, standard deviations and the distribution of mean scores for each of the five subscales of DSI are as depicted in Figure 1. Hazard Monitoring is found to have the highest mean scores as the source of driving stress while Thrill Seeking has the lowest scores. The distributions of mean scores among the samples show that the scores for hazard monitoring are skewed to the right with many samples scoring 10 (highest score). On the opposite, thrill seeking has the distribution skewed to the left with many scoring 0 (lowest score)

Examination of the scores for all eight items in hazard monitoring subscale reveals that all items have mean scores above seven (7). Negotiating difficult stretch of road and looking out for pedestrians while driving have highest mean scores. On the opposite, trying to see ahead of the road and making minor mistakes during driving have the lowest scores. The standard deviations are also higher on the items with lower scores. Table 5 lists down the mean scores for each item in Hazard Monitoring subscale.

To find the factor contributing to stressful hazard monitoring, the scores of Hazard Monitoring is divided into high and low level of stress. Considering that average score is 8.14 (from Figure 1), those scoring nine and above are considered high stress while those below nine are categorized as low stress. About 58% of the samples fall under high stress due to hazard monitoring. Chi Square test is performed to eleven independent variables which are modified into dichotomous variables as described in methodology section. The modified exaggerated caution scores under Anxious Driving Behavior scale is also included as independent variable. The results return with only four variables coming out significant at $p < 0.05$ as illustrated in Table 6. The odd ratio for Exaggerated Caution is the highest, suggesting a likelihood of 3.2 for high stress in the event of high anxiousness due to exaggerated caution. Driving distance, income level and age also influence the likelihood of stress level.
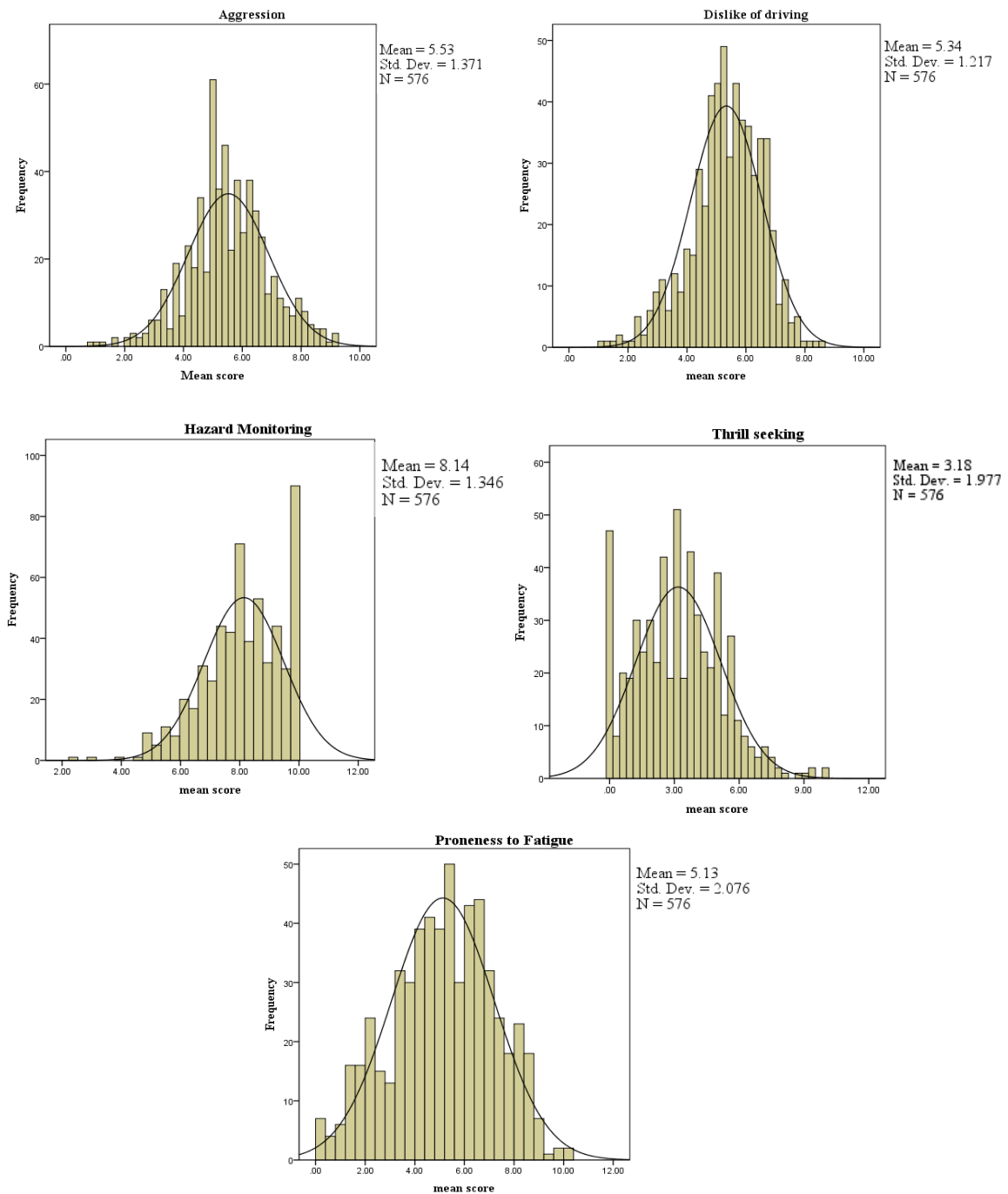
Fig. 1. Mean scores for five DSI scales

Table 5

Mean scores for Hazard Monitoring (DSI) items

Items (N = 576)	Mean (SD),
DSI: Hazard monitoring	
I make a point of carefully checking every side road that I pass for emerging vehicles	8.39 (1.737)
When I have to negotiate a difficult stretch of road, I am on the alert	8.73 (1.513)
If I make a minor mistake when driving, I feel that it's something I should be concerned about	7.62 (1.970)

I always keep an eye on parked cars in case somebody gets out of them or there are pedestrians behind them.	8.58 (1.619)
I try very hard to look out for hazards even when it's not strictly necessary.	7.68 (2.100)
I put effort to see what's happening on the road a long way ahead of me	7.57 (2.249)
I make a special effort to be alert even on roads that I know well.	8.06 (1.801)
I usually put effort to look for potential hazards when driving	8.49 (1.577)

Table 6
Chi square test for high and low stress (hazard monitoring)

Variable	Low stress	High stress	X2	OR*	p-value
Monthly driving distance					
Below 500km	120	138	4.513	1.435	p<0.05
500km and above	120	198			
Income level					
Below RM3001 monthly	106	11	7.387	1.603	p<0.05
RM3001 and above monthly	134	225			
Age	125	126	12.110	1.812	p<0.05
Below 36-year-old	115	210			
36-year-old and above					
ADB: Exaggerated caution	102	63	38.634	3.203	p<0.05
Low	138	273			
High					

*Odd ratio

4.2 Anxious Driving Behavior

The average mean scores, standard deviations and the distribution of mean scores for each of the three subscales of ADB are as depicted in Figure 2. Exaggerated safety/caution behavior is found to have the highest mean scores as the form of anxious behavior. The distributions of mean scores among the samples show that the scores for exaggerated caution are skewed to the right with quite a number of samples scoring 7 (highest score). On the opposite, the other two subscales namely anxiety-based performance deficit and hostile behaviour have their corresponding distributions skewed to the left with handful scoring 1 (lowest score).
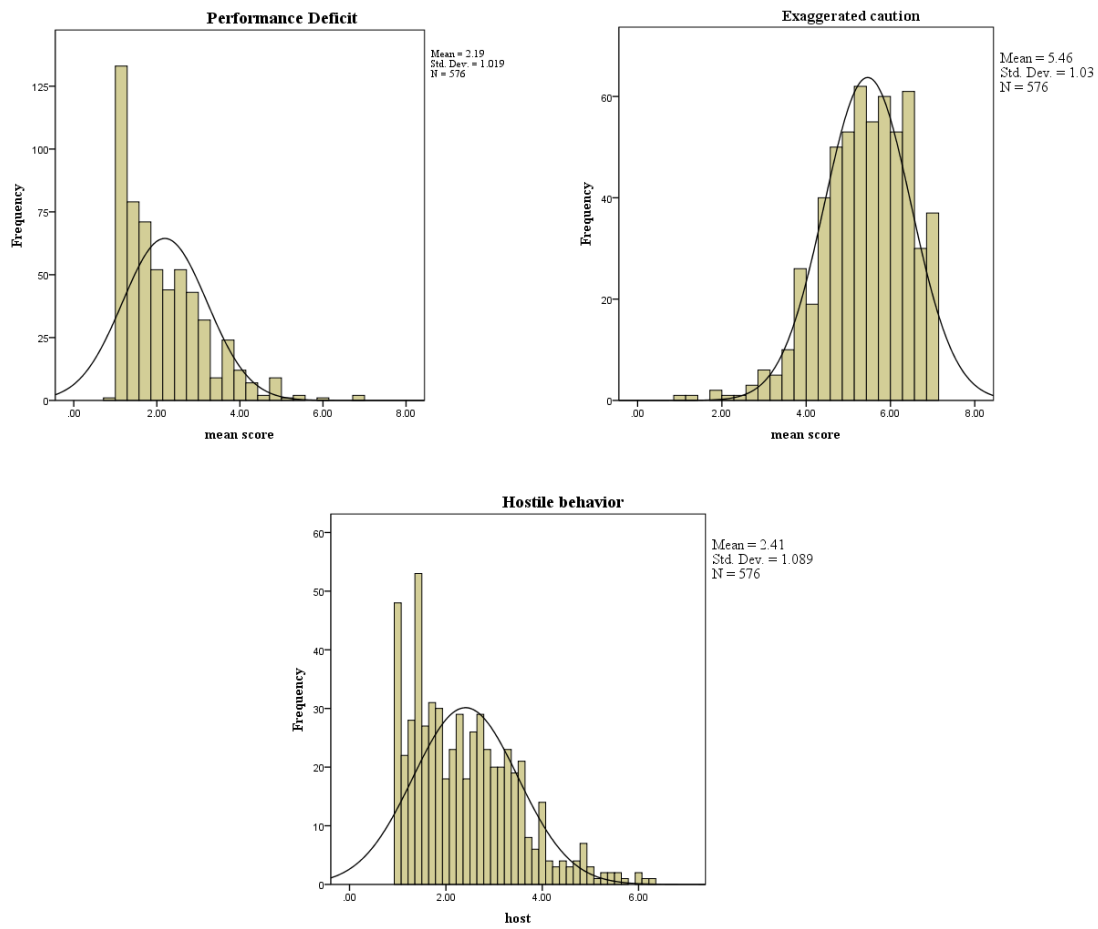
Fig. 2. Mean scores for five ADB scales

Examination of the scores for all seven items in exaggerated caution revealed that bad weather and driving speed have highest mean scores. Exaggeration is most frequent through reducing speed and minding other vehicles during bad weather with highest mean scores among the seven items under the exaggerated caution/safety behaviour subscale. The standard deviation under these two items are also the lowest compared to other items, as shown in Table 7.

Table 7
Mean scores for Exaggerated Caution (ADB) items

Items (N = 576)	Mean (SD),
ADB: Exaggerated safety/caution behaviour	
I maintain a large distance between myself and the driver in front of me	5.02 (1.836)
I try to put distance between myself and other cars	5.34 (1.663)
I try to stay away from other vehicles	5.00 (1.800)
I decrease my speed until I feel comfortable	5.61 (1.420)
I maintain my speed in order to calm myself down	5.34 (1.617)
During bad weather, I drive more cautiously than other vehicles on the road	6.38 (1.098)

I slow down when approaching intersections even when the light is green	5.52 (1.540)

To find the factors contributing to anxious behavior through exaggerated caution/ safety behavior, the scores of Exaggerated Caution are divided into high and low level of anxiety. Considering the average score for exaggerated caution is 5.46 (from Figure 2), those scoring five and above are considered high anxiety while those below nine are categorized as low anxiety. About 71% of the samples fall under high anxiety. Chi Square test is performed to eleven independent variables. The results return with only one variable coming out significant at $p < 0.05$ as illustrated in Table 8. The likelihood of high anxiety due through exaggerated caution behavior increases by 1.8 times if the drivers are traumatized due to past crash history.

Table 8
Chi square test for high and low anxiety (Exaggerated caution)

Variable	Low anxiety	High anxiety	X^2	OR*	p-value
Trauma from road crash					
No	145	331	4.425	1.752	p<0.05
Yes	20	80			

Odd ratio

4.3 Discussion

Internal consistency of the scales is tested using Cronbach Alpha. The results are comparable with previous studies where DSI by Qu *et al.*, [9] had a range of 0.63 - 0.75 while ADB by Clapp *et al.*, [2] had a range of 0.85 – 0.91. The distribution of samples obtained in this study is quite interesting due to the fact that there are more female respondents than male. This may be due to the large group of office workers involved and consented to participate in the online survey. Statistically, the number of car driving license holder (D) in Malaysia is almost comparable among the genders. Thus, the interpretation of findings must consider the skewness in gender distribution.

It should be noted that classification of high and low level of stress and anxiety is done arbitrarily based on the mean scores since the original scales are not diagnostic by nature. Study by Qu *et al.*, [9] interpret the subscales in DSI individually. In summary, Agression reflects aggression and irritation, Dislike of Driving explains anxiety, tension and lack of skill, Hazard Monitoring includes coping mechanism in handling potential danger, Proneness to Fatigue measures perception to physical strain while driving persistently and Thrill-Seeking evaluates dangerous enjoyment among driver. Since the mean scores for Hazard Monitoring is far higher than the rest four subscales, the analysis in this paper is purposely narrowed down to allow for closer examination into this prominent source of stress. Difficult road and pedestrian can be associated in the way that many drivers consider city or town driving for instance at crowded shopping areas with double parking problem and high volume of pedestrian as especially challenging. Providing separate walkway and strategic pedestrian crossing can potentially reduce the burden to driving in such locations.

Hazard monitoring as the most stressful suggests that there are both positive and negative outcomes to the drivers and safety. As Qu et. al (2016) argued, those with high scores of hazard monitoring reported less violation and crash involvement as the results of their tendency to constantly monitor any source of hazard on the road while driving. Unfortunately, this demands both physical and mental resources which can be prolonged with long distance and frequent driving. In order to device strategy to minimize stress due to hazard monitoring, intervention efforts must consider how the brain perceive and process stress. McEwan and Gianaros [8] proposed programs

that can promote optimism among the drivers while allowing for sense of control and confidence in making decision. It is important that drivers feel informed and guided in their constant search for hazardous situations while driving to reach their destinations safely.

The three factors found to contribute the high level of stress are older age, long driving distance and higher income. Though not examined through the survey, all these three variables match the characteristics of people working or employed in top position and thus very likely to be exposed to or suffering from job stress. Idris *et al*., [6] recognized that job stress in prevalent in Malaysia where most workers choose to avoid conflict. This can potentially add to pent up emotion that can likely contribute to worsen driving. Another study by Gottholmseder [4] found that commuting stress are contributed by high travel time, number of working hours and superior position. Further study is needed to properly assess the influence of job stress to driving impairment especially on stress and anxiety.

In addition, Hazard Monitoring is found to have strong link with Exaggerated Caution in which drivers who tend to exaggerate their safety behaviour during driving may be three times more likely to be highly stressed by hazard monitoring. A study on Malaysian driving style by Karjanto *et al*., [7] revealed that there are four driving styles namely careful, risky, anxious-dissociative and angry driving. Two of the styles, namely careful and anxious-dissociative, have resemblance to hazard monitoring and exaggerated caution. Though Karjanto *et al*., [7] didn't examine the relation between the styles, careful and anxious-dissociative are both about control during driving. In this sense, investigating the sense of control may shed lights on how to further impede the occurrence of stress and anxiety on the road.

Clapp *et al*., [2] described anxious driving behaviour scales as the forms of maladaptive coping response from anxiety manifestation. The more frequent the behaviours are committed basically means the more anxious the driver becomes. Contrary to previous researches, this study doesn't establish the link of exaggerated caution to gender or age. However, the effect of trauma due to past road crash to anxious driving is similar to the findings by Fitzharris *et al*., [3] which also pointed out that acute stress can be relatable to neuroticism and generalised coping style. Thus, anxiety while and due to driving must be treated as serious threat to driver's safety. To older drivers, severe anxiety may cause them to give up driving which brings to immobility and dependency problems [11].

5. Conclusions

This study establishes that traffic and road condition are driver's main source of stress on the road as supported by the high level of stress from hazard monitoring, specifically at difficult roads and with pedestrians around. Anxiety while driving is most observable through exaggerated safety/caution behaviour especially involving bad weather and driving speed adjustment. While level of stress is influenced by older drivers, longer driving distance and higher income level, anxiety on the road is only found affected by trauma due to road crash. The findings suggest that road environment and weather play significant roles in affecting drivers. Observation on type of traffic offenses and severity of crash may provide better picture of the characteristics of drivers prone to stress and anxiety, which should be considered in future studies. However, in the meantime, improving road infrastructure to segregate vulnerable road users and increase visibility may help in curbing problems related to road stress and anxiety among drivers.

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