ANWESHAN, Vol. 4, No. 1, March 2016

SELF-REPORT DRIVER STRESS AND ABERRANT BEHAVIOR

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Abstract

This paper reports an investigation of self-report driver stress and aberrant driver behaviour in a sample of 300 male bus and truck drivers in Manipur. The relationship between Driver Stress Inventory (DSI)developed by ***Matthews, Desmond, Joyner, Carcary and Gilliland (1997)****and Driver Behaviour Survey (DBS) developed by****Clapp et al., (2011)****were examined. The existing factor structure of both the DSI and DBS generally was supported.However, a fourth factor for the DBS, which provides increased emphasis on hostile gesture, was identified.The logistic regressions result revealed that the predictors (age, experience, mileage and the dimensions of DSI) could significantly predict penalties but cannot predict accidents.High levels of driver stress were consistently found to be associated with increased self-reported driving urgency/aggression and driving fear.*

Introduction

Stress is generally seen as a human response to an aversive or threatening situation. Distress arises from a judgment that demands excess resources. Although stress is beneficial to performance, distress adversely affects performance. Stress alone does not adversely affect performance, but rather how a person appraises and copes with a stressful situation determines how stress affects behavior **(Zuckerman, 1999).** Bus and lorry driving is an example of such a stressful job. Their job are reported to be at risk for negative health outcomes because of the unpredictable nature of the profession, the amount of time spent operating commercial vehicles and perceived barriers to achieving healthy lifestyle recommendations. Full-time professional drivers are exposed to a range of stressors such as the behaviour of other drivers, traffic congestion, ergonomic factors, noise, climate conditions, and work scheduling, resulting in poorer health and work performance **(Evans et al., 1999 as cited in Rowden, 2011)**. Almost 90 per cent of those drivers with high work experience left the bus company for reasons of poor health **(Kompier, 1996).**

Drivers experience stress from many sources. Long working hours, night work, or spending extended periods on the road away from friends and family can isolate drivers and leave them too exhausted to nourish their relationships. Pressure to stay on schedule even when road conditions are bad or they are fatigued can strain drivers' nerves. Delivering or picking up loads can be taxing, drivers are often required to wait for long and unpredictable periods of time; they may be denied opportunities for food, water, and

restroom facilities; and they may be treated disrespectfully.Bus and lorry drivers often spend days to weeks away from their home base, they commonly meet nutritional and dietary needs at restaurants or food stores convenient to the routes they serve and sleep and rest needs are often met in the sleeping berths of their cabs. This sleeper berths do not provide optimal sleeping conditions, and sleep likely is fragmented for solo driver and team drivers alike. Some drivers find it difficult to sleep in a moving vehicle, especially if they do not trust the driving ability of their partner, or if the vehicle is making numerous stops. Likewise, solo drivers' sleep may be fragmented while awaiting notification of the availability of their next load. Even moderate levels of sleep deprivation can cause neurobehavioral impairment equivalent to a blood alcohol. This is considered an unsafe level of functioning for drivers. Further adding the problem, a driver may not be aware of his level of impairment for two reasons: (a) over several days of sleep restriction, habituation may make sleepiness feel normal to the driver, and (b) "wake state instability" causes individuals with moderate sleep loss to perform optimally most of the time, but not reliably. Thus, while sleep-deprived individuals do not necessarily experience any immediate impairment of neurobehavioral function, lapses can occur when sustained cognitive accuracy and speed are critical.

It is also uncommon to find facilities or space to achieve recommended exercise along routes or at rest stops. In addition to these lifestyle challenges, work-related factors specific to driving also might play a role in health outcomes. Many drivers are subjected to lengthy periods of relative inactivity while sitting and driving that are interspersed with periods of high physical activity like loading and unloading, securing loads, installing tire chains. In addition, sitting in the work space of the truck cab subject's individuals to continuous vibration, which result in risk factor for low back pain and other musculoskeletal disorders **(Andersson 1997; Bernard 1997; Garg 1992** as cited in **Eric Wood et al, 2010).** And because of the time and distance away from a home base, accessing traditional health care resources is difficult. This unique constellation of lifestyle challenges and occupational demands result in chronic disease processes with potential for acute exacerbations like cardiovascular disease, diabetes mellitus, and hypertension**.**

Moreover drivers are exposed to a variety of conditions that are conducive to poor health, such as long hours and irregular sleep cycles. However, preliminary evidence suggests that commercial drivers may be at increased risk of early mortality and various chronic illnesses related to the lifestyle. Lack of proper exercise and unbalanced diets may lead to obesity, cardiovascular disease, diabetes and other poor health habits like prevalence of tobacco smoking, and elevated suicide rates. These diseases may in turn relate to musculoskeletal disease and impair driving ability. Findings revealed that half of driver injuries involving lost workdays were due to sprains caused by overexertion such as lifting heavy objects, the contribution of slips and falls from vehicles is on a similar level of incidence with driver strains. **Gregory and Michael (2007)** suggest that fatigue is the most critical problem for drivers. And this may be due to result of tight schedules. Drivers are often forced to exceed the legal speed limits to meet their schedules. This pressure leads to stress and to accidents. Insufficient sleep is also one of the important factors for fatigue.

Bus and lorry drivers can be also victims of either physical violence or verbal abuse like road rage or had been threatened or assaulted. At freight forwarding yards, verbal abuse and threats were closely linked with economic pressures in nearly all incidents. Loading delays, drivers cutting in line, and mistakes by forklift drivers fuelled tensions and led to the violent behaviours. Threat of such abuse and violence can increase psychological stress and use of maladaptive coping mechanisms. Thus they retire at an early age than other civil servants because of stress.

Literature review

This review was undertaken to identify issue cases relating to the stress of the lorry driver and bus or passenger driver. It was conducted through classic library style search as well as through an internet search, online data, articles and publications. This literature review focused on issues relevant to the driver stress, and its environments. It was also conducted to identify and summarize findings relating to the driver stress while performing their duties.

A large-scale survey **(Bifulco et al., 2014)** based on naturalistic (on-the-road) observation of driving behaviour with a view to obtain microscopic data for single vehicles on long road segments and for long time period was conducted by utilising an instrumented vehicle (IV), equipped with GPS, Radar, camera and other sensors. A non-parametric test, two-sample Kolmogorov-Smirnov, was applied. It was found that that the difference between the two experimental conditions (active and passive) was statistically significant, meaning which, the two experimental conditions induced different driver performance, whereas that between speeds was not. Equal speeds for active and passive observation were expected, given that overtaking was not allowed on the route under analysis. The drivers unaware of taking part in an experiment tended to maintain a lower headway with respect to the active drivers which confirms the findings of an earlier by **McDonald et al., (1997).**

Regarding rationale management approach in stress management from an information perspective, **Kumar, Dhanesh and Balan (2013)**opined that,by default, stressors have a degree of proportion pertaining to the type of organization. Manipulation of the existing proportion results in consideration of trade off among stressors. Control on job was considered as a factor of providing job satisfaction. Another optimal way of affording task related information was the availability of tools to access and assess decision information. Providing access to the precise rationale helped employees to get better solution, thus job satisfaction. Information by means of information systems' are considered as primary level intervention to avoid certain role stressors.

A study was initiated to demonstrate the prevalence of drug use by large truck drivers on the roads of Sao Paulo State in Brazil in the year 2009 by **Leyton et al. (2012).** In Brazil, truck drivers were found using amphetamine to maintain excessive work schedule and stay awake. Among the drivers who were using frequently abused drugs (amphetamines, cocaine and cannabinoids), young male adults aged between 18 to 35 years presented the highest prevalence of drug use. From around one third of the sample drivers who were reported to have health problems 14.6% are of stress related problem. A need to promote a healthier lifestyle among professional drivers and a need for preventive measures aimed at controlling the use of drugs by truck drivers was suggested by the researchers.

Employing 10 young drivers and 25 older drivers, **Susilowati andYasukouchi, (2012),** determined the attention and cognitive characteristics of young and older Japanese drivers. Correlation within driver stress inventory and driver coping questionnaire were observed only in older drivers. The age factor affects the attention and cognition of elder drivers but not driving experience itself, and coping measures such as emotion focus, reappraisal, and avoidance were not included as stress inventory parameters. Being prone to fatigue was found to be less for younger drivers than older drivers because older drivers have shorter distances, shorter drive times, and no need for expressways. Older drivers also had a significantly lower risk of thrill-seeking behaviour and more patience.

Burgle, Gillen and White (2012) studied on health and safety concerns and self-care strategies of San Francisco taxi drivers. Focus groups and a written cross-sectional survey were done in a convenience sample of taxi drivers working in San Francisco. Sessions were audiotape, transcribed in English, and independently coded to identify major health and safety themes, using thematic content analysis. They found out that major health and safety themes included stress, body pain, danger, vulnerable employment status, and concerns related to unhealthy working conditions.

Clapp et al. (2011) detailed development of a broad-based measure specific to the assessment of anxious driving behaviour conducted among college samples across three studies. Factor analytic procedures identified three distinct dimensions of potentially problematic behaviour: anxiety-based performance deficits, exaggerated safety/caution behaviour, and anxiety-related hostile/aggressive behaviour. Performance deficits evidenced convergent associations with perceived driving skill and were broadly related to driving fear. Safety/caution behaviours demonstrated convergence with overt travel avoidance. Safety/caution behaviours were associated specifically with accident and social-related driving fears. Hostile/aggressive behaviours evidenced convergent relationships with driving anger and were associated specifically with accident-related fear.

Taking a sample of 160 university students, a study aimed to understand the internal, driving related and external, situational – related factors influencing drivers' willingness to use hand-held mobile phone while driving was conducted in Australia by **Rozario, Lewis andWhite (2010)**. In relation to the external or situational – related factors resulting to the four different driving-related scenarios, differing in their descriptions of passenger presence (that is, alone versus with friends as passengers) and time urgency (low versus high), were devised intending to evoke differing levels of drivers' stress. The results revealed that the different driving scenarios were associated with varying levels of induced driver stress and, in particular, drivers reported more stress when driving with friends (as passenger present) than when driving alone as well as when under high rather than low urgency situations.

Machin (2010) examined the validity of using driving-specific measures of personality and coping to develop driver prototypes. The participants (323 females; 79 males) were mainly first to third year psychology students. A two-step clustering procedure produced a result with three clusters in the solutions. Cluster 1 (N = 152) was defined by more maladaptive coping (higher Confrontive, lower task-focused and lower reappraisal) and greater aggression and thrill-seeking. Cluster 2 (N = 150) was defined by more adaptive coping (lower Confrontive, higher task-focussed and higher reappraisal), lower aggression and greater hazard monitoring. The third cluster (N = 98) was defined by more moderate scores on the coping scales (apart from a much greater level of emotion-focussed coping, higher dislike of driving, and higher fatigue proneness). The cluster analysis confirmed that three subtypes of drivers can be identified from driver-specific measures of personality and coping. These subtypes were found to differ in their driving behaviour with one cluster being linked better driving outcomes (cluster 2) while clusters 3 and 1 were most at risk of adverse outcomes. These clusters also responded differently to road safety messages particularly as cluster 3 expressed a strong dislike of driving and greater emotional exhaustion from driving.

McLinton and Dollard (2010) conducted a study on work stress and driving anger in Japan and they observed that Stress experienced in the workplace originating from a perceived disparity in extrinsic efforts and rewards was associated with increased enduring feelings of anger in employees, and through this anger an elevated level of aggressive feelings on the road. Stress from ERI may spill over into other

domains, and changes at work are necessary to alleviate the impact on the individual, organization and economy.

Kavitha (2009) conducted a study in the Coimbatore city of Tamil Nadu, India, using questionnaire as the main tool for collecting data with convenient sampling method to select the sample among 150 city bus drivers as respondent. The questionnaire was adjusted to test its reliability by applying Cronbach Alpha Coefficient test for reliability of questionnaire. The study found that personal factors like marital status, educational level, monthly income, working sector and residence have a significant difference between average stress score. Some of the major reasons for stress are difficulties in work, insufficient time with families and boredom at work.

A study on truck driver's hours of service regulations and occupational health by **Jenser and Dahl (2009),** found out that truck drivers continue to have a high prevalence of back disorders, which have been linked with the time spent driving. They also have a high incidence of heart disease, which might be due to stress factors at work. Stress levels can be affected by hours of service (HoS) regulations that leave the driver little job control and lead to social isolation. HoS regulations could contribute more to the improvement of working conditions of truck drivers through counteracting irregular work schedules, night driving and social isolation. Moving the focus from simple control of time spent driving or not driving to fatigue management could improve job control and working conditions for truck drivers without loss of traffic safety.

A study on fatigue factors affecting metropolitan bus drivers found out that metropolitan bus drivers faced daily a stressful and draining work environment, exposing them to serious risk of driver fatigue **(Biggs, Dingsdag&Stenson, 2009)**. However, there has been a dearth of information exploring the unique antecedents and effects of such fatigue. To date, much of the research into metropolitan bus drivers has been under the umbrella of large heavy vehicle driving studies, which include a disproportionally large population of long-haul drivers, who are likely to face a significantly different set of fatigue factors. To this end, focus groups were held at five bus depots in Sydney and Newcastle, with an effort made to include a stratified sample of drivers at each. Each of the groups was invited to nominate what factors they felt were most salient, with a number of common factors emerging across the depots. Key themes identified were: support from management; ticketing and related issues; interaction with passengers; cabin ergonomics; tight route schedules; turn-around and shift irregularity; extended shift cycles; interactions with other road users; and extended commute times.

The influence of occupational stress and organisational safety climate on fatigue-related driver behaviour and fatigue-related near misses was empirically examined and evaluated **(Strahan, Watson, &Lennonb, 2008),** taking 219 driver respondents from two government organisations in Australia. The results demonstrated that both occupational stress and organisational safety climate were predictive of fatigue-related driver behaviour after controlling for several individual factors, with safety climate emerging as a stronger predictor than occupational stress. In addition, both the occupational stress and organisational safety climate were significantly predictive of fatigue-related near misses.

Excess stresses can influence driving performance and increase crash likelihood. The level of stress can also vary based on different driving conditions **(Hill & Boyle, 2007).** The goal of their study was to understand how different driving tasks and roadway conditions may influence the stress perceived by drivers. This was accomplished using data from a survey that assessed drivers' stress under various road, traffic and weather-related scenarios. Factor analytic techniques were used to find groups of driving

scenarios that generate similar stress levels in drivers. The results revealed four scenarios that were categorized in terms of (1) weather, (2) visibility, (3) interactions with other drivers, and (4) driving tasks. Ordered logistic regression models were then used to determine the effect of socioeconomic characteristics, trip behavior, and crash history for different stressful driving scenarios. Increases in stress with these four factors were influenced by age and gender, with females being more likely to report higher levels of stress than males. The effect of age varied in that older drivers generally reported higher stress levels, except when interacting with other drivers. Drivers with a history of crashes reported significantly higher stress levels when there was limited visibility, in adverse weather, and while performing common driving tasks. The results revealed that stress depends not only on driver characteristics, but also on driving environment.

To study the patterns of driver stress and coping strategies and their relationship to aberrant behaviours and traffic accidents, **Kontogiannis (2006),** extrapolated the revised version of Driver Behaviour Inventory (DBI, **Mathews et al., 1999)** and the revised version of Driver Behaviour Questionnaire **(DBQ, Kontogiannis, 2002)** on 714 Greek sample. A self developed inventory for coping strategies based on **Mathews et al.' (1997)** transactional model and the reduced version of **Driver Skill Inventory (Lajunen & Summala, 1995)** were further extrapolated. The findings of the study, in general, supported the factor structures of the measuring scales of driver stress, coping strategies and aberrant behaviours. As it was the case with the findings of other countries, driver stress in the form of aggression was associated with unsafe behaviours and traffic accidents. Drivers high in confidence were found reporting fewer mistakes and violations. The result of the contextual model of accident involvement revealed that violations yielded a direct effect whilst aggression yielded an indirect effect mediated by violations. Alertness and confidence were both related to safety orientation but failed to predict accident rates and speeding convictions. The study suggested that drivers should be screened for aggression since this sort of stress vulnerability may fuel even higher levels of frustration and anger on the roads and addressed the need of re-fresher training on the aspects of preparedness, alertness and driver communication since both violations and social disregard increased with experience and exposure to traffic.

Jennifer and Rosalind (2004) presented methods for collecting and analyzing physiological data during real world driving tasks to determine a driver's relative stress level. Electrocardiogram, electromyogram, skin conductance and respiration were recorded continuously while drivers followed a set route through open roads in the greater Boston area. Data from twenty- four drives of at least fifty minute duration were collected for analysis. In Analysis I, features from five minute intervals of data were used to distinguish three levels of driver stress with an accuracy of over 97% across multiple drivers and driving days. In Analysis II, continuous physiological features were correlated with a continuous metric of observable stressors showing that on a real-time basis metrics of skin conductivity and heart rate were most closely correlated with driver stress level.

A study was conducted among BMTA (Bangkok Mass Transportation Authority) bus drivers to determine the level of stress **(Rungkarn, 2004)**. Data were collected from 294 BMTA bus drivers using accidental sampling technique and interviewed them with three parts structured questionnaire: demographic factors, job satisfaction and stress. The results revealed that majority are male drivers with primary educational level aged between 30-39 years working ranged around 5-14 years. The majority (61.6) of the BMTA bus drivers had moderate stress whereas 11.2% had high stress level. The study revealed that the main cause of stress was responsibility of work followed next was income and thereafter freedom in work. It further

disclosed that age, income, work duration and job satisfaction have negative relationship with stress level.**Westerman and Haigney (2000),** extrapolated the Driver Behaviour Inventory (DBI, the revised **Glendon et al., 1993** version) and Driver Behaviour Questionnaire (DBQ, the **Parker et al., 1995** version) on a sample of 2806 men and women participants who had held a full driving licence for more than one year to find out the individual's differences in the experience of driver stress, error and violation. Their study supported the existing general factor structure of the DBQ, whilst a new five-factor was identified for the DBI, which endowed with increased emphasis on situation-specific stressors. High levels of driver stress were consistently found to be associated with increased self-report of lapses, errors and violations.

Research aims and Hypothesis

The present study aimed to empirically evaluate thepossible causes and frequencies of stress experienced by bus and lorry drivers and identify its aberrant behaviours. Despite the fact that Manipur is widely acknowledged for its significant road problems no study has explored on the level of stress experienced by bus and lorry drivers in Manipur.In light of this it is predicted that:

$H0_1$: Age, experience, mileage and the dimensions of DSI will significantly predict self – reported penalties and accidents.

$H0_2$: The meanscores of age, driving experience, mileage, DSI scale and DBS scale between bus and truck drivers will not differ significantly.

Method

Participants

Male professional truck drivers (goods transport workers) and bus drivers (passenger transport workers) over the age of 18 years currently in active employment in major district roads, state highways and national highways, having the experience of driving for more than five years will consist the sample. The sample size has been established through online via, the Sample Size Calculator developed by Creative Research Systems in 1982. Detail information about the transport and the drivers had been obtained from the Directorate of Transport, All Manipur Bus Owners Association (AMBOA), All Manipur Truck Drivers Association (AMTDA), and All Manipur Drivers Union (AMDU). A total of 300 drivers from above three organisations (AMBOA, AMTDA and AMDU), who have their name registered in either or all theorganisation(s)completed and returned the questionnaire. The final set questionnaire after necessary improvements and considering local adjustments had been tested for reliability using Cronbach Alpha Coefficient.

Materials

Drivers' stress level was measured using the ***Driver Stress Inventory*** questionnaire developed by **Matthews, Desmond, Joyner, Carcary and Gilliland (1997),** rated on a ten point scale (1 = not at all, 10 = very much) consisting of 41 items.Aberrant driving behavior was measured employing the ***Driver***

Behaviour Survey **(Clapp et al., 2011).** The DBS instrument comprised of 21 items with a 7-point word scale (7 = always, 4 = sometimes, 1 = never).

Procedures and Analysis

Questionnaires were distributed randomly to the drivers and were asked to answer according to how they usually feel and behave when driving. The data was administered using Statistical Product and Service Solutions (IBM - SPSS) English version 21.0. Relevant statistical tools such as factors analysis, regressions analysis and t-test which were applicable for the analysis of the data were employed for comparison, testing hypothesis and drawing conclusions.

Transport Statistics of Manipur

The total registered numbers of the entire vehicle including of Truck, Bus, Mini Bus, Jeep, Car, Taxi, Tractor, Auto Rickshaw, 2-Wheeler, Trailers, and Others as on 31-3-2013 in theTransport Department, Government of Manipuris 222234**(Government of Manipur, 2013).** The total registered number of Buses and Taxis are 2677 and 2477 respectively. Imphal East district scored the highest registered number of vehicle and Ukhrul district scored the lowest number of vehicle registered. It is estimated that about 8000 – 9000 vehicles per year are increasing & therefore by 2030, the vehicular population of the State would be around 4- 5 lakhs whereas the total road length & road density of the State may not have significant rise/increase accept PMGSY roads. However, the roads under NEC and New National Highways shall play an important role in overall development of socio- economic status of the State.

National Highways of Manipur

According the published report of the Public Works Department, **Government of Manipur (2013),** there are at present four NHs in Manipur:

a) NH-2: The highway starting from its junction with NH-15 near Dibrugarh in the State of Assam connecting Sibsagar and Amguri in Assam, Mokokchung, Wokha and Kohima in the State of Nagaland, Imphal, Churachandpur in the State of Manipur, Seling, Serchip, Lawngtla and terminating at Tuipang in the State of Mizoram.

b) NH-102: The highway starting from its junction with NH-2 near Imphal and terminating at Moreh (Indo/Myanmar Border) in the State of Manipur.

c) NH-202: The highway starting from its junction with NH-2 near Mokokchung in the State of Nagaland connecting Tuensang, Sampurre and Meluri in the State of Nagaland, Jessami, Ukhrul and terminating at its junction with NH-2 near Imphal in the State of Manipur.

d) NH-37: The highway starting from its junction with NH-2 near Imphal, Jiribam in Manipur, Jirighat, Lakhipur, Silchar, Badarpur, Karimganj in the State of Assam and terminates at Indo/Bangladesh Border.

State Highways and Other District Roads

There are 42 (forty-two) State highway under the PWD, Manipur having total of 926.54 km **(Government of Manipur, 2013).**There are 60 (Sixty major District Roads 9MDR) under the PWD, Manipur having total length of 1187.15 km **(Government of Manipur, 2013).**

There are 127 Other District Roads under the PWD, Manipur having total length of 1041.22 km **(Governmentof Manipur, 2013).**

Results

Composite Demographic Profile of the Respondents

Table 1: Summary of Demographic Profile of the Respondents

Variables	Group	Bus	Truck	Total
Age	Below 25	23	12	35
	26 – 30	42	45	87
	31 – 40	80	62	142
	41 – 50	25	9	34
	Above 51	1	1	2
Education	Illiterate	34	18	52
	Can only read	3	5	8
	Can read and write	10	19	29
	Primary	91	59	150
	High school and above	33	28	61
Marital status	Married	129	100	229
	Unmarried	42	29	71
Place of Residence	Rural	151	100	251
	Urban	20	29	49
Social Status	SC	10	7	17
	ST	17	4	21
	General	5	9	14
	OBC	139	109	248

Sources:*Field Survey*

Table 1show that 47.33% of the respondents are in the age group of 31-40 years. The information regarding education revealed that most of the drivers received education up to the primary level. It is understood that majority of the respondents 229 are married whereas just 71 are unmarried. The above table further indicates that 251 respondents reside in rural areas and 49 respondents reside in urban area. Large sections of the drivers are from OBC 248 followed by ST 21, SC 17, and general 14.

Driving Related Variables of the Respondents

Table 2: Summary of the Driving Related Variables of the Respondents

Variables	Group	Bus	Truck	Total
Driving experience (in years)	1 – 10	136	102	238
	11 – 20	29	21	50
	21 – 30	5	5	10
	Above 30	1	1	2
Vehicle ownership	Owned	16	6	22
	Government	2	1	3
	Private	153	122	275
Vocational training	Yes	-	-	-
	No	171	129	300
Distance travel per trip (kms)	Upto 20	0	3	3
	21 – 40	39	86	125
	41 – 60	59	34	93
	61 – 80	71	3	74
	Above 80	2	3	5
No.of hours per trip	Upto 2	147	102	249
	Above 2 – 4	23	24	47
	Above 4	1	3	4
No.of stops per trip	Below 5	16	121	137
	6 – 10	78	5	83
	11 – 15	58	1	59
	16 – 20	13	0	13
	Above 20	6	2	8
Penalties	Yes	27	3	30
	No	144	126	270
Accidents	Yes	39	28	67
	No	132	101	233

Source: *Field Survey*

The above table 2 shows the driving related variables of the respondents. The table depicts that mostdrivers 79.33% had an experience of driving betweenthe range of 1 – 10 years, in which, the experience of bus driversare more than that of truck drivers. Regarding ownership of the vehicle, 91.67%,

of the drivers drove for private agencies whereas just 7.3% drove their own vehicle and only 1% drove government vehicle. Majority of the driver did not receive any vocational training before their carrier as being a driver. Concerning mileage driven, most of the drivers125 (41.67%) drove,on average, a distance between 21 - 40 Kilo meters, while in general 83% of them drove for a duration of 2 hours per trip. The table further revealed that there are, in most cases 45.67%, upto5 stops per trip.

Analysis of the Driver Stress Inventory (DSI)

The factor structure of Driver Behaviour Survey (DSI) was examined using a principal components analysis with varimax rotation as shown in Table 3. Nine factors were extracted which explained 74.28% of the total variance.However, the scree plot suggested that a six-factor solution might be more appropriate. Thus, factor 7, factor 8 and factor 9 were excluded from subsequent analysis. The rational for the exclusion of the three factors were that these factors comprised of only one item each (item # 17, item # 48 and item # 32 respectively). Each factor contributions of the retained six factors to the total variance were 22.43%, 18.56%, 8.34%, 7.54%, 5.11%, 3.65%. The largest three factors: factor 1, factor2 and factor 3 were equivalent to 'driving urgency/aggression', 'speeding' and 'situation-specific tension' of other studies and includes 10 items each (#4, #5, #14, #21, #33, 40, 44, 45 and 46 for factor1); (#6, #9, #11, #12, #15, #18, #19, #20, #24, and #38 for factor2) and (#10, #23, #25, #26, #27, #29, #30, #31, #36 and 37# for factor3). Factor 4 was labeled 'irritation when overtaken', which was make up of 8 items (#3, #13, #16, #28, #34, #35, #39 and #47); the fifth factor comprised of items associated to 'driving fear', with 5 items (#1, #2, #3, #4 and #5); factor 6 was named 'fatigue', which contained 2 items (#41 and #42). Following the factor analysis, factor scores were computed for each participant by calculating the means of the marker items that comprised each of the corresponding factors. Alpha reliability coefficients for factor 2, factor 3 and factor 4 were approximately 0.92, whilst for factor 5 and factor 1 was 0.80 and 0.79. The alpha reliability coefficient for factor 6 was rather weak, that is, 0.62.

Table 3: Factor Loadings of Driver Stress Inventory (DSI)

Items	F1	F2	F3	F4	F5	F6	F7	F8	F9
Factor 1: Driving Urgency/Aggression									
1. Does driving, usually make you feel aggressive?	**.823**	.140	.031	.350	.028	-.154	-.098	.076	.058
2. Advice on driving from passenger is generally unnecessary	**.821**	.092	.153	.015	.022	-.061	.180	.105	.047
3. When you pass another vehicle do you feel tense or	**.710**	.161	-.036	.374	.104	-.143	-.004	.004	-.037

	nervous?								
4.	Do you find it difficult to control your temper when driving?	**.697**	.189	-.039	.364	.031	-.051	.052	-.067	-.010
5.	Increasingly difficult to judge your speed	**-.638**	.119	-.116	-.178	-.092	.085	.091	.506	-.029
6.	Maintain speed of reaction	**.626**	.126	.062	.336	.011	.084	.114	-.253	.440
7.	Do you think you have enough experience and training to deal with risky situations on the road safety?	**-.621**	-.189	.118	-.017	.027	.112	.401	.121	.272
8.	Normal Vision	**.604**	.022	.215	.238	-.044	.243	-.086	-.094	.064
9.	Maintain attention to road signs	**.570**	.149	.057	.269	-.010	.203	.126	-.370	.416
10.	I find myself worrying about my mistakes and the things I do badly when driving	**.485**	.038	.233	-.111	.378	-.281	.446	.067	-.124
Factor 2: Speeding										
1.	I get a real thrill out of driving fast	.030	**.904**	-.122	.045	.005	-.056	-.032	-.071	-.036
2.	I would enjoy driving with no speed-limit.	-.067	**.901**	-.174	.025	-.026	.065	-.045	-.021	-.010
3.	Do you think it is worthwhile taking risks on	.093	**.896**	-.137	-.005	-.027	-.083	-.023	.028	.007

	the road?								
4.	I like to raise my adrenaline levels while driving	.244	**.886**	-.141	.091	-.014	-.087	-.031	.021	.119
5.	I enjoy cornering at high speeds	.036	**.884**	-.102	.003	.079	-.017	-.009	.020	-.073
6.	I enjoy the sensation of accelerating rapidly	.196	**.801**	-.029	.161	.011	-.221	-.103	-.132	-.006
7.	I would like to risk my life as a racing driver	.127	**.749**	-.206	.015	-.061	.017	.069	.017	-.030
8.	Other drivers are generally to blame for any difficulties I have on the road.	-.033	**.537**	-.327	.133	.011	.289	.228	.072	-.073
9.	Do you usually make an effort to look for potential hazards when driving?	-.053	**.507**	-.170	-.233	.071	.180	.427	-.243	-.088
10.	Driving brings out the worst in people	.371	**.435**	-.267	-.188	-.129	.306	.149	.064	-.225
Factor 3: Situation-Specific Tension										
1.	I make an effort to see what's happening on the road a long way ahead of me	.096	-.194	**.843**	.188	-.020	.105	.125	-.025	.017
2.	I try very hard to look out for hazards even when it's not strictly	.150	-.224	**.817**	.180	.032	.045	.100	.101	-.029

	necessary								
3.	I always keep an eye on parked vehicles in case somebody gets out of them, or there are pedestrians behind them	-.005	-.213	**.740**	.273	.021	-.027	.210	.063	.165
4.	I make a special effort to be alert even on roads I know well	-.107	-.245	**.737**	.225	.075	.069	.069	-.099	-.002
5.	When I come to negotiate a difficult stretch of road, I am on alert	-.094	-.146	**.737**	-.094	-.018	.270	.043	.011	.006
6.	I feel more anxious than usual when I have a passenger in the vehicle	.472	-.119	**.717**	.033	.119	-.153	-.002	-.036	-.036
7.	Are you usually patient during the rush hour?	.385	-.174	**.704**	.134	.010	-.077	-.163	.139	.111
8.	Do you feel more anxious than usual when driving in heavy traffic?	-.095	-.029	**.662**	-.232	.146	.266	-.027	-.024	-.154
9.	I make a point of carefully checking every side road I pass for emerging vehicles	.045	-.155	**.654**	.195	.202	-.001	.244	.099	.283
10.	If I make a minor mistake when driving, I feel it's	.339	-.016	**.591**	-.321	.197	.014	-.172	.025	.001

something I should be concerned about.									
Factor 4: Irritation When Overtaken									
1. Do you lose your temper when another driver does something silly?	.118	-.036	-.010	**.884**	.106	.212	-.044	.050	.110
2. I become annoyed if another vehicle follows very close behind mine for some distance	.178	-.042	.157	**.876**	-.017	.165	.015	.031	.080
3. At times, I feel like I really dislike other drivers who cause problems for me	.216	.083	-.032	**.799**	.202	.182	-.147	.061	.095
4. When you are in hurry, other drivers usually get in your way	.517	.013	.205	**.732**	-.074	-.090	.108	-.014	-.098
5. Does it annoy you to drive behind a slow moving vehicle?	.254	.166	.080	**.726**	-.160	-.032	.237	-.091	.057
6. Are you annoyed when the traffic lights change to red when you approach them?	.572	.086	.228	**.670**	-.040	.003	.065	.122	-.054
7. `It's important to show other drivers that they	.442	.170	.135	**.596**	-.071	.100	.071	-.023	-.339

can't take advantage of you									
8. Interest in driving does not change	-.113	.000	.212	**.516**	.243	.425	-.196	-.260	.040
Factor 5: Driving Fear									
1. I sometimes like to frighten myself a little while driving	-.060	.066	-.073	-.092	**.805**	-.039	-.039	-.183	.129
2. Does it worry you to drive in bad weather?	.036	-.064	.241	.276	**.766**	.142	.248	.041	-.020
3. I am disturbed by thoughts of having an accident or the vehicle breakdown	.434	-.133	.259	.179	**.709**	-.082	.096	.047	-.009
4. When driving on an unfamiliar road do you become more tense than usual?	-.185	.039	.169	-.026	**.681**	.369	.000	-.003	-.369
5. My driving would be worse than usual in an unfamiliar rental bus truck	.571	.038	.051	-.199	**.606**	-.174	-.142	-.011	.093
Factor 6: Fatigue									
1. More uncomfortable physically (headache, muscle pain)	.084	.019	-.170	-.190	-.008	**-.724**	-.088	-.122	-.065
2. More drowsy or	.072	.130	-	-	-	-	-	.159	-

sleepy			.155	.242	.044	**.655**	.016		.015
Factor 7: Low Confidence in Accident Avoidance									
1. Do you feel confident in your ability to avoid an accident?	.000	-.024	.396	.130	.090	.086	**.731**	.020	.042
Factor 8: Irritation When Crossing									
1. Passing becomes increasingly risky and dangerous	-.091	-.041	.076	.065	-.068	-.051	.004	**.791**	.054
Factor 9: Irritation When Overtaking									
1. When you pass another vehicle do you feel in command of the situation?	.044	-.202	.297	.056	-.025	.117	-.026	.479	**.614**

Sources:*Computed from Primary Data*

Extraction Method: Principal Component Analysis.

Table 4: Reliability Test on Driver Stress Inventory (DSI)

Factors	**Cronbach's Alpha**	**Mean**	**No. of Items**
Factor 1: Driving Urgency/ Aggression	0.792	4.243	10
Factor 2: Speeding	0.929	2.546	10
Factor 3: Situation-Specific Tension	0.919	7.573	10
Factor 4: Irritation When Overtaken	0.923	4.921	8

Factor 5: Driving Fear	0.800	5.523	5
Factor 6: Fatigue	0.623	4.685	2

Sources:*Computed from Primary Data*

Table 5: Correlations among Factors of Driver Stress Inventory (DSI)

Factors	1	2	3	4	5	6
1. Driving Urgency/ Aggression	1					
2. Speeding	0.221** (0.000)	1				
3. Situation-specific Tension	0.289** (0.000)	-0.358** (0.000)	1			
4. Irritation When Overtaken	0.589** (0.000)	0.077 (0.183)	0.272** (0.000)	1		
5. Driving Fear	0.337** (0.000)	-0.018 (0.761)	0.308** (0.000)	0.169** (0.003)	1	
6. Fatigue	0.008 (0.889)	0.105 (0.069)	-0.240** (0.000)	-0.315** (0.000)	-0.074 (0.199)	1

Sources:*Computed from Primary Data*

**. Correlation is significant at 0.01 level (2-tailed).

*. Correlation is significant at 0.05 level (2-tailed).

Correlations among the six dimensions of DSI scale was shown in Table 5. There were strong positive correlations between 'driving urgency/aggression' factor and the other factors ($P< 0.01$, 2-tailed), except, a weak relation with 'fatigue'. With regard to 'speeding' factor, only one factor 'situation-specific tension' had a significant relationship, though negative. The 'situation-specific tension' factor had significant correlations, despite negative relationships with 'speeding' and 'fatigue'. 'Driving fear' correlates with all the other factors except 'speeding'. The factor 'fatigue' had a significantly negative relationship with 'situation-specific tension' and 'irritation when overtaken'.

Analysis of the Driver Behavior Survey (DBS)

The factor structure of Driver Behaviour Survey (DBS) was examined using a principal components analysis with varimax rotation. Table 6 shows the principal loadings on the four factors (all eigenvalues were greater than 1). Generally this analysis verified all the three factors as that of **Clapp et al. (2011),** and added a fourth factor which altogether accounted for 74.99% of the total variances in scores. The first factor accounted for 40.04% of the variance, and comprised of items associated with 'anxiety-based

performance deficits' (item #1, #4, #5, #6, #9, and 21); the second factor accounted for 18.13% of the variance and composed of items related to 'hostile/aggressive behaviors' (item #7, #15, #17, #18 and #20); the third factor accounted for 10.19% of the variance and comprised of items associated with 'exaggerated safety/caution behaviors' (item #3, #8, #11, #13, #16 and #19) and, the fourth factor accounted for 6.62% of the variance and make up of items related to 'hostile gestures' (item #2 and #10). Following the factor analysis, factor scores were computed for each participant by calculating the means of the marker items that comprised each of the corresponding factors. Alpha coefficients for anxiety-based performance deficits and aggressive gestures were approximately 0.95 whilst for hostile/aggressive behaviours was 0.92 and that of exaggerated safety/caution behaviors was 0.79. The most frequent aberrant driving behavior factor was exaggerated safety/caution behaviours (mean = 6.20) followed by aggressive gestures (mean = 3.28), then, hostile/aggressive behaviours (mean = 1.98) and anxiety-based performance deficits (mean = 1.43).

Table6: Factor Loadings of Driver Behavior Survey (DBS)

Items	F1	F2	F3	F4
Factor 1: Anxiety-Based Performance Deficits				
1. I have trouble staying in the correct lane	**.905**	.262	-.199	.035
2. I drift into other lanes	**.898**	.215	-.215	.078
3. I forget to get appropriate adjustments in the speed	**.881**	.280	-.209	.028
4. I have trouble finding the correct lane	**.802**	.401	-.228	-.009
5. I forget where I am driving to	**.788**	.348	-.247	-.006
6. I lose track of where I am going	**.757**	-.044	.095	.160
7. I have difficulty merging into traffic	**.749**	.424	-.259	-.037
Factor 2: Aggressive Behaviors				
1. I pound on the steering wheel when I'm nervous	.342	**.859**	-.050	.072
2. I try to find ways to let other drivers know that they are making me nervous	.174	**.855**	-.070	.261
3. I swear/use profanity while I am driving	.366	**.846**	-.033	.021
4. I honk my horn at the driver who made me nervous	.226	**.816**	.049	.241
5. I let the driver who made me nervous know that I am upset	.200	**.649**	-.005	.456
Factor 3: Exaggerated Safety/Caution Behaviors				
1. I try to stay away from other cars	-.170	-.019	**.865**	-.088
2. I try to put distance between myself and other cars	-.184	-.175	**.825**	.101
3. I slow down when approaching intersections, even when the light is green	-.204	-.120	**.768**	.060

4. I maintain a large distance between myself and the driver in front of me	-.142	-.157	**.758**	.060
5. I maintain my speed in order to calm myself down	-.036	.171	**.730**	-.254
6. During bad weather, I drive more cautiously than other vehicles on the road	.156	-.002	**.523**	.402
7. I decrease my speed until I feel comfortable	-.181	.127	**.449**	.126
Factor 4: Hostile Gestures				
1. I make gestures at the driver/drivers who made me nervous	.022	.284	.040	**.901**
2. I yell at the driver/drivers who make me nervous	.045	.264	.045	**.898**

Sources:*Computed from Primary Data*

Extraction Method: Principal Component Analysis.

Table 7: Reliability Test on Driver Behavior Survey (DBS)

Factors	Cronbach's Alpha	Mean	No. of Items
Factor 1: Anxiety-Based Performance Deficits	0.958	1.438	7
Factor 2: Aggressive Behaviors	0.926	1.987	5
Factor 3: Exaggerated Safety/Caution Behaviors	0.792	6.202	7
Factor 4: Hostile Gestures	0.948	3.287	2

Sources:*Computed from Primary Data*

Multiple regressions

Regressions of DBS Anxiety-Based Performance Deficits onto DSI scales

Table 8 showed the regressions of DBS 'anxiety-based performance deficits' onto DSI scales. From the model summary table it can be understood that about 45% of the variation in the dependent variable (anxiety-based performance deficits) was explained by the independent variables (DSI dimensions). A positive and significant relationships among the DSI factors were evident [F(6, 299) = 40.211, *P* = 0.01]. From the *P*-value for beta coefficient obtained in the table, F1 (urgency/aggression) and F3 (situation-specific tension) were found to be significant at 1% level.

Table 8: Regressions of DBS 'Anxiety-Based Performance Deficits' onto DSI scales (R^2 = 0.452, F(6, 299) = 40.211)

Independent Variables	B	*t*	*p*
Urgency/Aggression	.569	9.699	.000
Speeding	-.010	-.251	.802
Situation-Specific Tension	.096	2.047	.042
Irritation When Overtaken	.028	.947	.344
Driving Fear	.004	.132	.895
Fatigue	.032	1.268	.206

Sources:*Computed from Primary Data*

Dependent Variable: Anxiety-Based Performance Deficits
**. Significant at 0.01 level.

Regressions of DBS Aggressive Behavior onto DSI scales

Table 9 showed the regressions of DBS 'aggressive behavior' onto DSI scales. From the model summary table it can be understood that about 43% of the variation in the dependent variable (aggressive behavior) was explained by the independent variables (DSI dimensions). Significant relationships among the DSI factors were evident [F(6, 299) = 36.842, *P* = 0.01]. From the *P*-value for beta coefficient obtained in the table, F1 (urgency/aggression), F2 (speeding), F5 (driving fear) and F6 (fatigue) were found to be significant at 1% level.

Table 9: Regressions of DBS 'Aggressive Behaviour' onto DSI scales (R^2 = 0.43, F(6, 299) = 36.842)

Independent Variables	B	*t*	*p*
Urgency/Aggression	.644	7.294	.000
Speeding	-.239	-4.088	.000
Situation-Specific Tension	.045	.635	.526
Irritation When Overtaken	-.032	-.736	.462
Driving Fear	.273	6.645	.000
Fatigue	.135	3.541	.000

Sources:*Computed from Primary Data*

Dependent Variable: Aggressive Behaviour
**. Significant at 0.01 level.

Regressions of DBS Exaggerated Safety/Caution Behaviors onto DSI scales

Table 10showed the regressions of DBS 'exaggerated safety/caution behaviors' onto DSI scales. From the model summary table it can be understood that about 23% of the variation in the dependent variable (safety/caution behaviors) was explained by the independent variables (DSI dimensions). A significant relationships among the DSI factors were evident [F (6, 299) = 15.262, *P* = 0.01]. From the *P*-value for beta coefficient obtained in the table, F1 (urgency/aggression), F3 (situation-specific tension) and F5 (driving fear) were found to be significant at 1% level. Whereas, F2 'speeding' was found to be significant at 5% level.

Table 10: Regressions of DBS 'Exaggerated Safety/Caution Behaviors' onto DSI scales (R^2 = 0.238, F(6, 299) = 15.262)

Independent Variables	B	*t*	*p*
Urgency/Aggression	-.378	-6.351	.000
Speeding	.087	2.204	.028
Situation-Specific Tension	.230	4.842	.000
Irritation When Overtaken	-.012	-.411	.682
Driving Fear	.104	3.769	.000
Fatigue	-.047	-1.846	.066

Sources:*Computed from Primary Data*

Dependent Variable: Exaggerated Safety/Caution Behaviours

**. Significant at 0.01 levels.

Regressions of DBS Hostile Gestures onto DSI scales

Table 11 depicted the regressions of DBS 'hostile gestures' onto DSI scales. From the model summary table it can be understood that about 38% of the variation in the dependent variable (hostile gestures) was explained by the independent variables (DSI dimensions). A significant relationships among the DSI factors were evident [F (6, 299) = 30.761, *P* = 0.01]. From the *P*-value for beta coefficient obtained in the table, F1 (urgency/aggression), F4 (irritation when overtaken) and F5 (driving fear) were found to be significant at 1% level.

Table 11: Regressions of DBS 'Hostile Gestures' onto DSI scales (R^2 = 0.386, F(6, 299) = 30.761)

Independent Variables	B	*t*	*p*
Urgency/Aggression	-.490	-4.503	.000
Speeding	-.072	-1.000	.318
Situation-Specific Tension	-.095	-1.091	.276
Irritation When Overtaken	.525	9.671	.000
Driving Fear	.432	8.508	.000

Fatigue	.040	.851	.395

Sources:*Computed from Primary Data*

Dependent Variable: Hostile Gestures

**. Significant at 0.01 levels. *. Significant at 0.05 level.

Logistic Regressions

A logistic regression was undertaken to examine whether age, experience, mileage and the dimensions of DSI could predict self – reported penalties and accidents. To predict the number of penalties and accidents, the 'number of penalties' and the 'number of accidents' variables were recoded into binary variables (the subjects with no penalties/accidents were recoded as '0', and the subjects with one or more penalties/accidents were recoded as '1'). The analysis (target = penalties) revealed that the predictors did significantly predict penalties $x^2(9, n = 300) = 33.655$, $p < 0.001$, with Nagelkerke R^2 indicating that 22% of the variance in penalties was accounted for by the predictors. Overall, 89.7% of penalties were correctly classified. As shown in table 5.36, examination of Wald statistics revealed only 'situation-specific tension' to be significant predictors of penalties ($x^2(1) = 12.844$, $p < 0.001$). Again, the analysis (target = accidents) revealed that the predictors did not predict significantly. Overall, this model predicts 77% of accidents correctly. None of the DSI dimensions were related to the number of accidents.

Table 12: Logistic Regressions Analysis on Penalties and Accidents with DSI dimensions

Independent Variables	**B**	**S.E.**	**Wald Test (z-ratio)**	**Exp(B)**
Penalties				
Age	0.002	0.043	0.001	1.002
Experience	0.055	0.048	1.318	1.056
Mileage	-0.017	0.017	0.985	0.983
Urgency/Aggression	-0.270	0.373	0.525	0.763
Speeding	0.309	0.192	2.598	1.363
Situation-Specific Tension	-0.951	0.265	12.844	0.386**
Irritation When Overtaken	0.026	0.204	0.016	1.026
Driving Fear	0.069	0.149	0.213	1.071
Fatigue	0.184	0.152	1.462	1.201
Accidents				
Age	0.039	0.030	1.747	1.040
Experience	-0.029	0.035	0.678	0.971
Mileage	0.005	0.004	1.455	1.005
Aggression/Urgency	0.186	0.214	0.758	1.204
Speeding	-0.120	0.155	0.597	0.887
Situation-Specific Tension	-0.292	0.175	2.765	0.747
Irritation When Overtaken	-0.040	0.109	0.132	0.961

Driving Fear	0.178	0.105	2.836	1.194
Fatigue	0.008	0.093	0.008	1.008

Sources:*Computed from Primary Data*

Note: df is 1. ** p< 0.01

T-Tests

Table 13: Means, Standard Deviations and T-tests of the Major Variables and the Dimensions of theDSI and DBS scales.

Variables	Bus		Truck		t	p-value
	Mean	S. D.	Mean	S.D.		
Age	32.92	6.588	32.16	5.916	1.050	0.294
Driving Experience	8.380	5.623	8.581	5.617	-0.319	0.750
Mileage	52.754	12.515	45.116	42.474	1.979	0.050
Total Driver Stress Inventory	8.911	1.321	9.83	1.214	-6.231	0.000**
Total Driver Behaviour Survey	3.016	0.452	3.752	0.592	-11.761	0.000**

Sources:*Computed from Primary Data*

**Significant level at 5 %

T-tests were executed to examine the differences in scores for age, driving experience, mileage and the scales between bus and truck drivers. The meanscores of age and driving experience between bus and truck drivers did not differ significantly. However, with regard to mileage the mean scores of bus drivers were higher than that of their counterpart. Significant differences could be established for the scales of DSI (t = -6.231, p = 0.000) and DBS (t = -11.761).

Concluding Remarks

Despite the contribution of the present study, the findings should be interpreted in the light of its limitations. Methodological limitations include the fact that this study on sampled bus and truck drivers had an inadvertently limited mileage range consisting of short distance drivers only. This sample limited the external validity of the study, thus, challenging its generalisability to the driving population which includes vehicles other than bus and lorry, long distance, and female drivers. Thus care should be taken in attempting to generalise the results to drivers from other populations. An additional limitation of this research is the reliance on self-report data.There are limitations inherent to self report research such as memory biases and social desirability, with respect to the measures such as the DSI scale, DBS scale and WCC scale. As such, incorporation of observational data or informant reports would be a methodological improvement. Further, in the present study, a second outcome measure consisting of only a single-item question about stress-related near misses and involvement in accidents was utilised. Adding more items

specifically in relation to near misses and accident involvement may have increased the sensitivity and face validity of the measure.

Future directions

Previous research has shown that occupational stress is relatively complex. As the present research used an overall measure of occupational stress, it is likely that it did not capture this complexity. Accordingly, future research could employ more sensitive measures of occupational stress that examine their impact on stress-related driver behaviour. In addition, larger and more diverse samples as well as more diverse methodologies will counter the limitations noted in the present research.

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