Driver Behaviour Inventory as Predictors of Driving Crashes and Near Misses among Professional Drivers: Testing a Contextual Mediated Model

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Abstract

The adjusted version of Driver Behaviour Inventory devised by ***Kontogiannis (2006)*** *based on previous research* ***(Mathews et al., 1999)*** *was used as a measure of stress in this study. Three hundred and twenty two male professional bus (n = 36) and lorry (n = 286) drivers aged between 20 and 61years (mean = 37.96, SD = 8.19 years) participated in the study. The varimax extractions through PCA summarised all the original five factors. A contextual mediated model was proposed to distinguished the distal (demographic and traffic related variables) and proximal (aberrant driving behaviours) factors in predicting near misses and accidents. Examination of the structural path parameters through SPSS-AMOS v 22.0 revealed that five out of sixteen possible paths from the distal context to proximal context were significant and also five out of eight possible paths from the proximal context to the outcomes were significant.The level of driving confidence and general overtaking decreased as drivers became older. Similarly, drivers' driving confidence level decreased as their driving distance increased. As expected, driving confidence and general overtaking level increased as their years of driving experience increased. Occurrences of near misses were positively predicted by driving confidence, general overtaking and dislike of driving. Also, occurrences of major accidents increased with an increased in the level of driving confidence and dislike of driving. Age, experience and mileage indirectly predicted both near misses and accidents via driving confidence. Also, age, experience and mileage indirectly predicted near misses via general overtaking, but did not necessarily predict accidents.*

Introduction

Although stress is beneficial to performance, distress adversely affects performance. Stress itself 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 behavior 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).**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.

Professional Drivers

There are several sub types of professional drivers. Drivers in public transport, drivers of long distance coaches, drivers of trams and trains, taxi, bus and truck drivers. To simply describe this group, we can just summate that driving their vehicle is their occupation; they are getting paid and have to keep specific demands from the employer and the society **(Hanzlikova, 2014).** The most important skills and requirements of professional drivers are; reaction time – the ability to quickly respond, far and near vision – the ability to see things close at or at distance, operation and control – controlling operations of equipment or systems, equipment maintenance – performing routine maintenance and determining when and what kind of maintenance is needed, and psychological eligibility – low level of aggression **(DelVecchio, 2004).** Amongst the specifics of professional driver's work, responsibility for lives of many persons in the vehicle (in case of passenger bus), material responsibility in case of lorry drivers (high price of vehicle and of load), and the fact that professional drivers spend practically all of the work time by driving a vehicle, which is a high demanding activity both from cognitive perspective and from emotional and social point of view. In both these cases the psychological phenomena of responsibility can be perceived as stressful **(International Labour Office, 1996).**

Work Stress of Professional Drivers

Stress can have a significant impact on driving performance. Although moderate levels of stress can be beneficial in maintaining driver attention **(Matthews, Sparkes, &Bygrave,1996;** as cited in **Hill & Boyle, 2007),** too much stress has been related to impaired driving performance, increases in crash risks **(Beirness, 1993;** as cited in **Hill & Boyle, 2007),** and increases in traffic violations **(Simon & Corbett, 1996;** as cited in **Hill & Boyle, 2007).** Occupation of professional driver is perceived as very stressful, and stress is here the result of conflict demands on driver, and low level of control by driver on these demands and circumstances, such as time press, long shifts, responsibility for security of passengers **(Dorn, 2003).** Work-related stress in professional drivers may result from a range of work and driving demands such as tight deadlines, traffic congestion, behaviours of other drivers, weather, ergonomic factors (e.g., noise, temperature), irregular and long working hours, solitary work and lack of social support **(Vivoli, Bergomi, Rovesti et al. 1993; Orris, Hartman, Strauss et al., 1997; Salanne, Keskinen, Kärmeniemi et al., 2006;**as cited in **Pylkkönenet al, 2013).**The driving task for driver is mentally demanding because it involves having to cope with conflicting demands. This is especially the case of public transport drivers. The company and the public want the driver to maintain good contact with passengers and to be service - oriented, for example, through the provision of information to passengers on time tables, routes, stops and fares. The driver is required to drive safely according to traffic rules and conditions. More severe stress reaction may seriously disrupt driver performance and hence reduce safety **(Dorn, 2003).** Study by **Kostyniuk et al. (2002;** as cited in **Hanzlikova, 2014)** has identified four factors that are more likely to occur in fatal crashes. These factors are following other vehicles improperly, driving with vision obscured by rain, snow or fog, drowsy and fatigued driving and improper lane changing. It has been demonstrated that, all over the world drivers face many work-related stress problems. Many recommendations have been made to manage or reduce stress.However, stress monitoring and stress reduction is not merely a technical process, based on a technical analysis and on the simple, straight-forward realization of recommendations and receipts. Stress monitoring and stress reduction relate to changing and improving organizations and organizational processes (**Kompier & Martino, 1995).**

Workplace Safety and Driving Stress

Work-related vehicle crashes have been reported as the leading cause of work-related injury and death in number of countries, including India **(Mohan, 2004),** US **(Pratt, 2003),** France **(Charbotel, Chiron, Martin, & Bergeret, 2001),** UK **(Health and Safety Executive, 2001)** and Australia **(Haworth, Tingvall, &Kowaldo, 2000).** Total direct costs of crashes (from all causes) in India are estimated at 3% of GDP thus amounting to Rupees 3.8 lakh crores **(Autocar Pro News Desk, 2015),** making these work-related crashes expensive to business, with indirect cost from physical, psychological and economic consequences having substantial impact on the community. Organisational safety climate is a conceptually related construct describe as the psychological mechanism through which safety culture impacts the way in which employees behave at work **(Cooper, 2000; Glendon & Stanton, 2000; Wills, Biggs, & Watson, 2005).** Consistent with this, fleet safety culture may be considered an aspect of safety culture that is specific to road safety **(Strahan, Watson, &Lennonb, 2008).** Fleet safety culture encompasses not only the safety behaviours of fleet drivers, but also how management practices impact on driving and how driver safety is valued within the organisation. Road safety researchers have provided support for the link between safety climate and safety-related driver behaviour and outcomes. For instance, **Wills et al. (2005;** as cited in **Strahan et al., 2008)** found that safety climate was able to significantly predict a number of driver safety related behaviour including traffic violations, driver error, driving while distracted and pre-trip vehicle maintenance. In addition, **Strahan et al. (2008)** reported that organisational safety climate and occupational stress were related to self-reported fatigue-related driver behaviour and fatigue-related near misses. However, the findings of **Strahan et al. (2008)** are in relation to the outcomes of both drivers' organisational safety climate and occupational stress, but the relationship between workplace safety and driving stress among bus and lorry driver populations driving under different pressurising situational driving scenarios prevailing in Manipur is yet to be examined.

The Driver Behaviour Inventory

The psychological health and well-being of professional drivers and its linkage on driving performance has been a subject of interests in recent decades **(Clapp et al., 2011; Kontogiannis, 2006; Westernman & Haigney, 2000; Matthews et al., 1999; Glendon et al., 1993; Gulian et al., 1989).** The Driver Behaviour Inventory (DBI) adopts a 'transactional approach' (**Lazarus &**

Folkman, 1984 as cited in **Westerman & Haigney, 2000),** in which driver stress, and consequent driving performance, are held to be determined through interactive effects of driver's assessment of traffic demands, appraisal of personal competence and selection of behavioural strategies to cope with stress **(Kontogians, 2006).** Another inherent trait of this approach is the acknowledgement of 'cross-situational' stressors, that is, experienced of stress is not explicitly confined to driving, but as contributing to overall levels of driver stress **(Westerman & Haigney, 2000).** The DBI dimensions can be conceptualized as behavioural dispositions related to the accumulation of stress in the driving context **(Kontogiannis, 2006).** Researches on DBI at the initial period were comparatively based on small samples. **Gulian et al. (1989;** n = 61**)** and **Glendon et al. (1993;** n = 61**)** identified two coexistent factor structures. First, a single 'general stress' factor, and second, a five-factor solution comprising of 'driving aggression', 'irritation when overtaken', 'driving alertness', 'dislike of driving' and 'frustration when overtaken'. At a little later period, incorporating greater samples, the DBI was extrapolated on Finnish **(Lajunen & Summala, 1995;** n = 113) and Japanese **(Matthews et al., 1999;** n = 510**)** drivers and found that their factor solutions result were somewhat different from the earlier studies. **Lajunen**and **Summala (1995)** recovered only the three largest factors from the earlier factor solutions: 'driving aggression', 'driving alertness' and 'dislike of driving'. Whereas, **Matthews, Tsuda, Xin**and **Ozeki (1999)** identified a rather somewhat different five-factor structure, that retained the 'driving aggression' factor; the 'driving alertness' factor which added items related to experience of anxiety in driving scenarios; a 'general overtaking factor' which was a combination of the previous two overtaking factor; a more specific 'dislike of driving' factor; and added a new factor 'confidence', which appeared to be something of a 'catch-all', and was not identified in earlier studies.

In more recent researches on factor analytic and reliability of DBI with large samples suggested several refinements, as briefly presented here. A study of UK drivers (**Westerman&Haigney, 2000;** n = 2806, male = 2452 & female = 354**)** using principal component analysis with oblique rotation **(**as per **Gulian et al., 1989),** a five-factor solutions was obtained (being eigenvalues of each of these five-factors exceeded 1, according to Kaisers's criterion) which accounted for 43.17 % of the total variances. This analysis retained three factors ('driving aggression', driving alertness', and 'dislike of driving') from the original five- factors DBI solutions **(Gulian et al., 1989)**. And added two new items, of which, one appears to relate to an experience of tension under situation-specific driving conditions and the other appears to relate to an adjustment of concentration levels according to situation-specific requirements. The first factor 'driving aggression/urgency' accounted for 20.84% of the variance, the second factor 'general driving alertness/anticipation' accounted for 7.72% of the variance, the third factor 'situation-specific tension' accounted for 6.86% of the variance, the fourth 'dislike of driving' accounted for 4.08% of the variance, and the fifth factor 'situation-specific concentration' accounted for 3.67% of the variance. Alpha reliability coefficients for the five scales respectively were 0.83(12 items), 0.61 (5 items), 0.72 (5items), 0.55 (3 items), and 0.58 (2 items). Again in contrast to the original DBI, the item 'I feel confident in my ability to avoid an accident' loaded on ‘general driving alertness/anticipation’ rather than the ‘dislike of driving’ factor. One item ‘When I try but fail to overtake I am usually bothered’ was not included in the revised ‘driving aggression/urgency’ scale due to similarity with the more strongly loaded item ‘When I try but fail to overtake I am usually frustrated’. The rational given for this exclusion was that this scale was sufficiently long, that DBI must accommodate five scales in total, and such content similarity tend to encourage ‘bloated specifics’.

Whereas, study of Greek employee drivers **(Kontogians, 2006;** n = 714, male = 67.7% & female = 32.3%), suggested four-factor solutions (all eigenvalues were greater than 1.5). The principal component analysis with oblique rotation was used since **Gulian et al. (1989) and Westerman&Haigney (2000)** assumed that dimensions of DBI were correlated. Here, in consistent with earlier study of **Westerman&Haigney (2000)** three largest factors (‘driving aggression’, driving alertness’, and ‘dislike of driving’) were again identified. Another fourth factor ‘driving confidence’, which was not included in the original DBI (**Gulian et al., 1989)** but earlier identified by **Matthews et al. (1999); Hartley and Hassani, (1994),** was evident from the study of Greek population. In the oblique solution, the first factor contributed 20.2% to the total variance, the second factor contributed 16.7%, the third 11.5 and the fourth 7.9%. Factor 1 was equivalent to ‘driving aggression’ of other studies and relates to feelings of anger, hostility, and impatience. Factor 2 was labelled ‘driving alertness’ and relates to hazard monitoring and increased concentration. Factor 3 was named ‘dislike of driving’ and includes feelings of anxiety, tension and negative appraisals of driving. Factor 4 resembles the ‘confidence’ factor of the Japanese and Australian samples **(Matthews et al., 1999; Hartley &Hassani, 1994).** Alpha reliability of all the factor scales were approximately 0.75. In the not too distant past, making use of the reduced version of the 19-item DBI **Matthews, Tsuda, Xin**and **Ozeki (1999),** a somewhat similar five-factor structure accounting for 56.3% of the variance in scores was demonstrated by **Kontogiannis (2006),** thus, chosen as a measure of driver stress in this research.

Contextual Mediated Model

In this study, to better acquaint with the relative contributions of demographic factors and driving related factors (acting as distal context) and the subscales of DBI (acting as proximal context) in predicting near misses and accident involvement, a more general contextual model was proposed in line with an earlier model proposed by **Bradburry and Fincham (1988;** also adopted by **Sumer, 2003).** The integral purpose of the proposed contextual model was to distinguish the distal and proximal contextual factors that are related to accident involvement and misses in a mediating framework and classify the correlates of DBI subscales according to their contextual closure to accident involvement and near misses. As depicted in Figure 1, on the basis of **Lajunen’s (1997)** general factors, the distal context could be consisted of a number of extrinsic elements, ranging from more general cultural factors (such as, safety attitudes, political and enforcement environment); socio-demographic factors (such as, age of the drivers, driving experience, road, vehicle and other environmental factors); relatively stable personality factors, attitudes and beliefs (such as, sensation seeking and fatalism) to cognitive factors (such as, attributions regarding accident causation), which indirectly contribute to accident causation and predict accident via proximal factors. Whereas, the proximal context could also be consisted of aberrant driving behaviors (such as, driving aggressions, violations, hostile gestures, risk driving, and emotional driving); safety skills; and drinking and driving. Consistent with the earlier mediated contextual model, it was further presumed that the elements in the distal context does not predict or poorly predict traffic accidents and near misses, while they were expected to have significant indirect effects via the proximal factors.

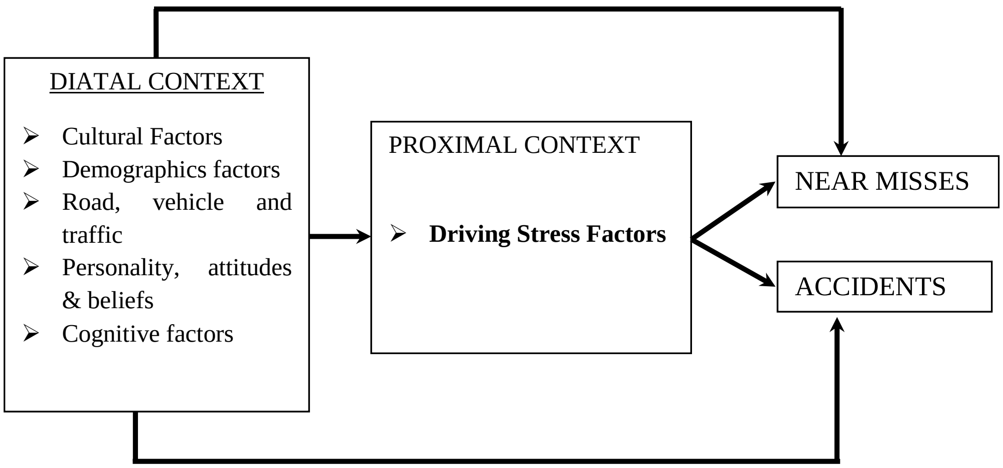

Figure 1Contexual Mediated Model

(adapted and modified from **Bradburry** and **Fincham, 1988;** also adopted by **Sumer, 2003)**.

Objective of the Study

Despite the fact that Manipur, a smallState in North Eastern India is widely acknowledged for its significant road problems no study had ever conducted to explore on the experience of stress by long distance bus and lorry drivers using the DBI. In line withthe stated problem, this study aim to test a proposed contextual model.

Hypothesis of the Study

The given contextual mediated modelwas hypothesised:

Ho: The distal variables, namely, age, experience, mileage and income predict the proximal subscales of DBI and these proximal scales, in turn, directly predict an outcome of near misses and accidents. In addition, the distal variables indirectly predict the outcome variables via the proximal latent variables.

Proposed Contextual Mediated Model

DISTAL CONTEXT PROXIMAL CONTEXT OUTCOME

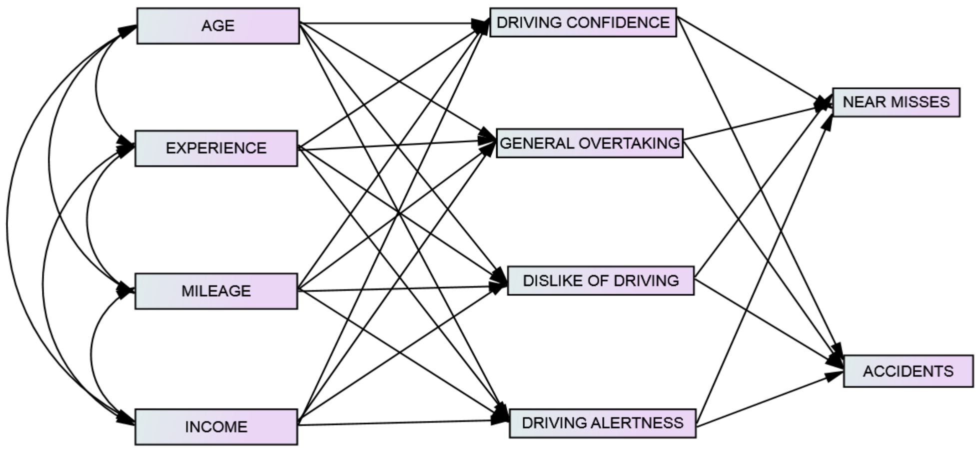

Fig 2: Proposed Contextual Mediated Model of DBI

Methods

Sample and Procedure

Three hundred and twenty two male professional bus and lorry drivers aged between 20 and 61years (mean = 37.96, SD = 8.19 years) participated in the study. Bus and lorry drivers who were plying along the two National Highways of India (NH 2 and NH 37) were randomly approached spreading over different depots (stations/stops/check posts/ fuelling stations, FCI godowns and others), between summer 2015 to spring 2016. The questionnaires were self administered by the researchers, thus 100% correct response rate was achieved. Consistent with research of the nature of professional drivers, work-related drivers were considered to be those who drove professionally for work purposes for at least once in a week **(Strahan, Watson, &Lennonb, 2008; Newman, Watson, & Murray 2004; Wills, Watson, & Biggs, 2006).** The participants were required to be a holder of valid driver's licence who had been engaged as professional drivers along the two National Highway(s) for at least 1 year. The drivers had approximately 12 years of driving experience, driving on average 769 kilometres per trip (one way). In all, professional drivers from 12 States of India participated in the study.

Measures

Driver Stress

Driver stress has been addressed in earlier studies **(Kontogiannis, 2006; Westerman & Haigney, 2000; Matthews et al., 1999; Glendon et al., 1993; Gulian et al., 1989)** with the use of Driver Behaviour Inventory. In the present research, the adjusted version of Driver Behaviour Inventory devised by **Kontogiannis (2006)** based on previous research **(Mathews et al., 1999)** was used as a measure of stress. The DBI has been chosen as it adopts a 'transactional' approach (in line with **Lazarus & Folkman, 1984** as cited in **Westerman & Haigney, 2000),** in which driver stress, and consequent driving performance, are held to be determined through interactive effects of driver's assessment of traffic demands, appraisal of personal competence and selection of behavioural strategies to cope with stress. **Kontogiannis (2006),** on administering the reduced 19-item DBI questionnaire on a sample of 714 Greek company employees, identified four-factor solutions using principal components analysis with oblique rotation since DBI dimensions were assumed to be correlated **(Gulian et al., 1989; Glendon et al., 1993).** Consistent to the previous study of Japanese samples **(Matthews et al., 1999), Kontogiannis (2006)** recovered the largest four factors from the Greek samples, they are, 'driving aggression' with 6-items, 'driving alertness' with 4-items, 'dislike of driving' with 4-items, and 'confidence' with 4-items, which accounted for 20.2%, 16.7%, 11.5% and 7.9% of the total variance. However, the fifth factor of the earlier study 'overtaking tension' **(Matthews et al., 1999),** consisted mainly of items related to 'irritation when overtaking' and 'frustration in overtaking' which, nevertheless, were found to be predominantly loaded on aggression was excluded in the reduced version of DBI questionnaire **(Kontogiannis, 2006),** thus, consequently, cannot be obtained. Further, item number 15 'it worries me to drive in bad weather or heavy traffic' was not included in the 'dislike of driving' factor because it loaded high on all other factors too, therefore abstained from further analysis in the shortened version. Using the revised DBI **(Matthews et al., 1999),** more recently, a somewhat similar five-factor structure (accounting for 56.3% of the variance in scores) has been demonstrated by **Kontogiannis (2006).** Given this, the reduced 19-item version of *Driver Behaviour Inventory* (DBI) devised by Matthews and colleagues **(Matthews, Tsuda, Xin, &Ozeki, 1999),** which was further adjusted by**Kontogiannis (2006)**was chosen as a measure of driver stress. A 5-point likert type scale was used to answer each question: never, seldom, sometimes, frequently, and always.

Age

Middle-aged drivers (between 25 and 60 years of age) are generally less at risk for accidents than young (especially male**) (Williams, 1985)** and older drivers **(Chipman et al., 1993).** Olderdrivers are also less prone to mistakes and violations. The higher accident rates was partly due to young drivers' tendency to drive more at night, but it holds up also in non-violational samples, like truck drivers, where men in their twenties have a substantially higher accident rate, with all other variables cancelled out **(Campbell, 1991).** Another reason for this higher rate of accidents seem to be that mean speed is higher for young drivers. For professional drivers like public goods and passengers, one motivational aspect of the job would be to be there in time, especially as earlier work has hinted that younger bus drivers are more motivated to try to keep the time table. Also, by driving faster and succeeding in keeping the schedule, this would serve as a reinforcement, which will strengthen the behaviour, especially as there are very seldom any negative outcomes (accidents of any kind). Acknowledging the impact of age on driving performances, a one-item question on the age of the drivers was inserted.

Driving Experience

Using structural equation modelling, **Kontogianis (2006)** produced the effect of demographic variables (age, gender, mileage, and experience). The result revealed that driving experience had the most profound effect on accident rates followed by mileage. In this research, driving experience was measured by how long the drivers had held driving licence (from the first time they got their driver licence). Respondents were asked to indicate the number of years they had held driving licence in a discrete format.

Mileage

The link between driver stress and mileage has been investigated previously **(Oz, Ozkan & Lajunen, 2010).** Annual kilometre driven was found predicting accidents and penalties in their study. A single item question was inserted in the questionnaire battery about the distance generally covered per trip (one way). Respondents were asked to indicate the number of kilometres.

Monthly Income from Driving

Although no previous research was found (to the researcher's knowledge), studying linkages between monthly income with driver stress and incidences of near misses and accidents, the researcher conceptualised that income of the drivers mediates stress and henceforth indirectly led to the occurrence of near misses and accidents. Drivers simply had to state their average monthly income from driving.

Self-reported Near Misses

A measure consisting of a single-item question about self-reported near misses was developed in line with the measure adopted by **Strahan et al.(2008).** Regarding the questionnaire item, drivers were asked (to rate on a 5-point likert type scale) whether if they often experience near miss in the past 12 months. An explanation of near miss was given as 'an accident on the road that, under different circumstances, could have resulted in personal harm, property damage or other loses'. An example was further provided as 'needing to brake or take high turn suddenly to avoid hitting a vehicle you failed to notice it was slowing down or a pedestrian crossing or an animal/object you failed to notice it was there'.

Self-reported Accidents

A measure consisting of a single-item question about self reported traffic accident was generated reflecting recent developments in traffic accident literature. In this adaptation, accident was defined as any type of self-reported crash, but not recorded crashes. As for driving stress and its link with accidents, it could be that there is an artifactual consistency in reporting between the numbers of accidents respondents had been involved in and the stress related aberration they believe may have had an impact on their accident record. Thus, if this hypothesis is applied to *Driver Behaviour Inventory* (DBI), it can, for example, be predicted that associations between the factors of this scale and accidents will be stronger if the accidents are self-reported, than if they are retrieved from actual records. Regarding the questionnaire item, drivers were asked to rate (on a 5-point likert type scale) their involvement in traffic accident(s) caused by themselves while driving and not by others in the past 1 year.

Analyses

The data collected were first codified and then entered and processed using the Statistical Product and Service Solutions – Analysis of Moment Structure(IBM SPSS – AMOS Statistics), the English version 22.0. The proposed model was tested by employing the two-stage approach as suggested by **Anderson and Gerbing (1988).** In this approach, the first step involves testing a measurement model via confirmatory factor analysis.Researchers have used different statistical methods from which to derive DBI factors; however, principal components analysis with varimaxrotation seems to be the most common choice. Thus, in the present study, principal components analysis was selected for data reduction, with varimax rotation if more than one relevant component was extracted. The second step involves testing the hypothesized structural model.

Results

Factor Analysis of DBI Scale

Principal components analysis with varimax rotation was used to examine the factor structure of the Driver Behaviour Inventory (DBI). The varimax extractions through PCA were shown in Table 1. This analysis summarised the original development of DBI, a full account of which is in **(Matthews et al., 1999).** All the factors of the original DBI were retained and no other factors were added in this study. The scree plot also suggested a five factor solutions. The five factors altogether accounted for 60.91% of the variance in scores. The Kaiser-Meyer-Oklin (KMO) measure of sampling adequacy was 0.812, which showed that the samples were adequate to undergo factor analysis. The first factor accounted for 27.944% of the variance, and comprised of 6 items related with Driving Confidence (DC; item #9, #10, #16, #17, #18 and #19; alpha = 0.845). The second factor was in relation to General Overtaking (GO), which was composed of 6 items (item #1, #2, #3, #4, #6 and #12; alpha = 0.798) contributing 12.107% of the variance. The third factor accounted for 7.960% of the variance, and comprised of 3 items relating to Dislike of Driving (DD; item #11, #13 and #14; alpha = 0.527). Driving Alertness (DA) was the fourth factor containing 2 items (item #7 and #15; alpha = 0.451) and accounted for 6.882% of the variance. The fifth factor was composed of 2 items (item #5 and #8; alpha = 0.213), which accounted for 6.019% and was named Driving Aggression (DAG). Since the Cronbach's alpha of the subscales of the DBI ranged from 0.213 to 0.845, it meant that some of the subscales did not meet the criterion of acceptable reliability coefficient of 0.70 as **Nunnaly (1978;** cited in **Lim, 2013)** suggested, where the Driving Aggression factor was found to be the most problematic. Yet, depending on the size of the samples, value as low as 0.5 was also accepted **(Field, 2009).** However, **Clark and Watson (1995)** pointed out that Cronbach alpha is an ambiguous indicator of internal consistency because it depends on two parameters: number of items in a scale and mean items intercorrelations. As Dislike of Driving and Driving Alertness factors consist of only three and two items, this may bring down the alpha. Since Cronbach's alpha of all the subscales except Driving Aggression were over 0.5 or round about 0.5, were retained for further analysis. Thus, the four factors which were retained for further analysis accounted for 54.108% of the variance. Reliability test on the factors of DBI was shown in Table 2.

Table 1 Factor Loading of the Driver Behaviour Inventory

Items	**F1**	**F2**	**F3**	**F4**	**F5**
Factor 1: Driving Confidence					
I find it easy to control temper when driving	**.880**	.106		-.095	.055
I feel confident in my ability to avoid an accident	**.839**	.160	.078	-.080	
I feel in command of the situation when overtaking	**.756**			.304	.090
I am always ready to react to other's unexpected manoeuvres	**.704**	.282	.207		.094
Accidents can always happen due to others poor judgement	**.604**	.265	.170	.055	-.298
I increase concentration on unfamiliar roads to be on alert	**.542**		-.153	.457	-.066
Factor 2: General Overtaking					
In general, I mind being overtaken	.130	**.735**	.050	.113	
I tend to overtake vehicle whenever possible		**.715**		-.099	.127
It annoys me to drive behind slow-moving vehicles	.342	**.705**	.051	.196	.151
When I try, but fail to overtake, I am usually frustrated	.166	**.671**	.280	.193	.170
I become irritated during rush hour	.262	**.632**	.068	.417	.114
Driving usually makes me feel frustrated	-.123	**.467**	.445	-.057	-.263
Factor 3: Dislike of Driving					

In general, I do not enjoy driving		.069	**.745**	.076	.075
Driving usually does not make me happy	.119		**.727**		.063
In general, too much driving is a waste of time	.239	.431	**.454**	-.067	-.308
Factor 4: Driving Alertness					
I become tense and concentrate on heavy traffic		.101		**.838**	-.056
It worries me to drive in bad weather or heavy traffic	.089	.305	.389	**.536**	
Factor 5: Driving Aggression					
I usually make an effort to look for potential hazards		.089	-.065	-.168	**.709**
When irritated, I drive aggressively paying no proper attention		.253	.273	.214	**.647**

Sources: *Computed from Primary Data. Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.*[a.] [a] *Rotation coverged in 7 iteration*

Table 2 Reliability Test on the Factors Driver Behaviour Inventory

Factors	**Cronbach's Alpha**	**Mean**	**No. of Items**
Factor 1: Driving Confidence	0.845	2.577	6
Factor 2: General Overtaking	0.798	1.475	6
Factor 3: Dislike of Driving	0.527	1.561	3
Factor 4: Driving Alertness	0.451	1.868	2
Factor 5: Driving Aggression	0.213	1.297	2

Source:*Computed from Table 6.28*

Predictors of Near Misses and Accidents

Structural Analysis on the Proposed Model

Figure 3 showed the structural model predicting accident rates and near misses expressed in the form of standardized path coefficients for DBI factors (that is, driving confidence, general overtaking, dislike of driving and driving alertness) acting as proximal context, and the demographic and driving related factors (that is, age, experience, mileage and income) acting as distal context. The model fit of DBI yielded a not too good fit (NFI = 0.631, GFI = 0.284 CFI = 0.630, RMS = 83.535). Investigation of the structural path parameters vis-à-vis the regression weights (shown in Table 3)indicated that five out of sixteen possible paths from the distal context to proximal context were significant and also five out of eight possible paths from the proximal context to the outcomes were significant. While partially supporting expectations, as for the distal context predicting the proximal context, age negatively predicted driving confidence and general overtaking (path coefficient = -0.27 and -0.37 respectively); experience positively predicted driving confidence and general overtaking (path coefficient = 0.44 and 0.35 respectively); and mileage negatively predicted driving confidence (path coefficient = -0.46). Whereas, for the proximal context predicting near misses and accidents, driving confidence, general overtaking and dislike of driving positively predicted near misses (path coefficient = 0.34, 0.18 and 0.17 respectively); and driving confidence and dislike of driving negatively predicted accidents (path coefficient = 0.22 and 0.18 respectively). Neither the general overtaking factor nor the driving alertness factors predict accident involvement. Age negatively predicted driving confidence and general overtaking, explaining that driving confidence and general overtaking decreased at the rate of -0.27 and -0.37 correspondingly for each 1.00 unit increased in age. Age, experience and mileage had an indirect effect on both near misses and accidents via driving confidence, and an indirect effect of near misses but not accidents via general overtaking.

Table 3 Regression Weights of DBI: (Gruop number 1 – Default model)

	Estimates	**S. E**	**C. R**	**P**
Age --> Driving Confidence	-0.224	0.066	-3.407	***
Age --> General Overtaking	-0.168	0.039	-4.289	***
Age --> Dislike of Driving	-0.084	0.029	-2.904	0.004
Age --> Driving Alertness	-0.033	0.021	-1.590	0.112
Experience--> Driving Confidence	0.379	0.072	5.294	***
Experience --> General Overtaking	0.164	0.043	3.850	***
Experience --> Dislike of Driving	0.053	0.032	1.686	0.092
Experience --> Driving Alertness	0.037	0.023	1.642	0.101
Mileage --> Driving Confidence	-0.005	0.001	-8.512	***
Mileage --> General Overtaking	0.000	0.000	-1.324	0.186
Mileage --> Dislike of Driving	0.000	0.000	0.207	0.836
Mileage --> Driving Alertness	0.000	0.000	-0.282	0.778
Income --> Driving Confidence	0.000	0.000	0.737	0.461
Income --> General Overtaking	0.000	0.000	1.815	0.069
Income --> Dislike of Driving	0.000	0.000	2.937	0.003
Income --> Driving Alertness	0.000	0.000	2.279	0.023

Driving Confidence --> Near Misses	0.051	0.007	6.919	***
Driving Confidence --> Accidents	0.032	0.008	4.145	***
General Overtaking --> Near Misses	0.049	0.014	3.582	***
General Overtaking --> Accidents	0.025	0.014	1.804	0.071
Dislike of Driving --> Near Misses	0.063	0.019	3.388	***
Dislike of Driving --> Accidents	0.065	0.019	3.373	***
Driving Alertness --> Near Misses	-0.031	0.027	-1.119	0.263
Driving Alertness --> Accidents	-0.083	0.026	-3.152	0.002

Source: *Computed from Primary Data*

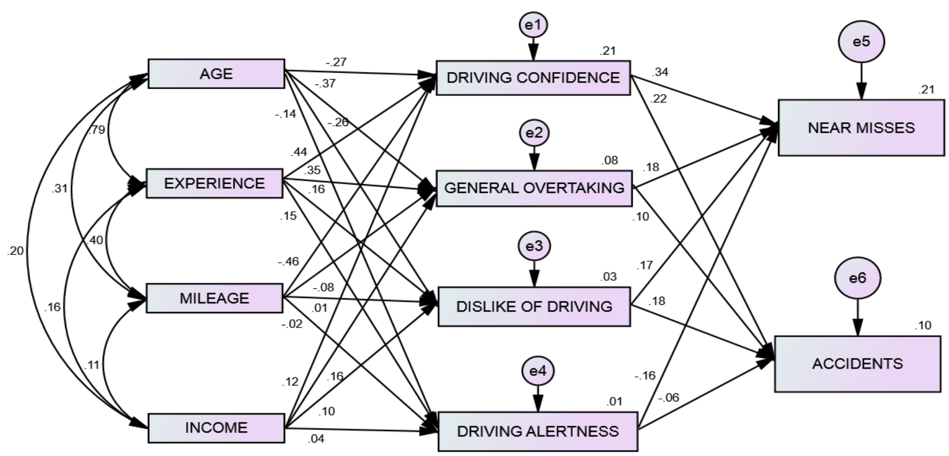

Figure 3: Standardised Graphic Output of DBI: Structural Model.

Discussions and Conclusion

The aim of this research was to investigate the relative impact of various sources of stress classified as distal and proximal on driving outcomes, that is, occurrence of near misses and accidents. The level of driving confidence and general overtaking decreased as drivers became older. In a similar pattern, drivers' driving confidence level decreased as their driving distance increased. Driving confidence level of the drivers as well as the general overtaking level increased as their years of driving experience increased. Whereas in the cases of the proximal variables predicting near misses and accidents, the occurrence of near misses was positively predicted by driving confidence, general overtaking and dislike of driving. Added to this, occurrence of major accidents also increased with an increased in the level of driving confidence and dislike of driving. Regarding the distal variables predicting near misses and accidents via the proximal factors, the variables age, experience and mileage indirectly predicts both near misses and accidents via driving confidence. Also, age, experience and mileage indirectly predicted near misses via general overtaking, but did not necessarily predict accidents. Despite the contributions of the present research it faced certain methodological limitations.Whileinterpreting the results of this study, it must be remembered that the driving stress measure used in this research was an overall measure, and that driving stress is both complex and multifaceted.As the present research used an overall measure of drivers' occupational stress, it was likely that it did not capture this complexity. Accordingly, future research could employ more sensitive measures of driver stress that taps specific aspects such asproblematic/environmental/situational related stressful situations faced by drivers of the particular study area and examine their impact on stress-related driver safety. Also, the present research limits to long distance male drivers of only buses and lorries, thus challenging its generalisability to other driving populations. Future research could address the limitations of the present research by, for instance, sampling drivers of other vehicle, both professional and non professional, and inclusion of female drivers. In addition, employing more and diverse methodologies will counter better the limitations noted in the present research. In summary, with current trends indicating drivers' increasing occupational stress levels, the present study provided important information and insight into a range of internal and external factors influencing drivers' occupational stress.

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