

**Associations between job characteristics,  
mental health and driving: A secondary  
analysis**

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**ABSTRACT**

**Background:** Human factors are widely acknowledged as major contributors in road traffic collision (RTC) involvement. The aim of the present study, using secondary data analysis was to analyse associations between job characteristics, mental health, personality, fatigue and driving behaviour and their potential connection to RTCs, as well as their potential links with some of the risk factors as outcome variables (driving behaviour, driver fatigue and risk-taking).

**Methodology:** This study used a cross-sectional approach, with 2856 clients of an insurance company completing an online survey in which they were asked about their driving and a range of other factors, such as personality, job characteristics and mental health.

**Results:** The results revealed that whereas the extant literature points to personality traits as directly causal of RTCs, they actually impact driving behaviour and risk-taking behaviour. In addition, an association was found between higher salary and risk-taking (the latter predictive of RTC involvement). Using the Demands, Resources and Individual Effects model (DRIVE) it was possible to examine associations between particular job characteristics and driving behaviour, driver fatigue, and risk-taking. Associations between poor levels of driving behaviour and high levels of decision making, perceived job stress, long working hours and issues of work-life balance were uncovered. Moreover, a combined effects approach revealed a 16.73-fold increase in driver fatigue for younger, single drivers who often drive in heavy traffic, on the motorway and in adverse weather, with stressful, noisy, pressurised jobs, lower in levels of respect (typical of the blue-collar worker).

**Conclusion:** Based on the current findings, further longitudinal research is recommended to assess causality.

**Keywords:** *Driving behaviour, driver fatigue, risk-taking, job characteristics, personality, mental health, work-life balance, RTC*

**1. INTRODUCTION**

Driving is a complex task, and it is perhaps unsurprising that human factors and their association with road traffic collisions (RTCs) have received considerable research attention. Factors such as personality, stress, fatigue, risk-taking, gender, age and marital status (to name but a few) have been studied extensively in the remit of their potential impact upon collision causality. Moreover, contemporarily emerging in the literature is the link between collisions and driving behaviour, as measured by the Driver Behaviour Questionnaire [1],

which has a three-factor structure, consisting of errors, lapses and violations, and crash involvement [2].

Demographic risk factors have also been identified, with age and gender repeatedly being associated with RTC risk. Younger, male drivers are acknowledged as being significantly more at risk than their older, female counterparts, and this increase in risk has been attributed to driving inexperience and propensity for risky driving behaviours [3, 4]. That said, the nature of such research requires that drivers disclose behaviours which are illegal, and as such, there is a potential for socially desirable responding which may lead to an underestimation of the magnitude of association between risky driving behaviours and RTC involvement. Similarly, differences in the measurement of risky driving make comparison between studies problematic. Marital status has also been found to have a bearing on the risk of driver injury; single drivers are estimated to be twice as likely to be involved in a RTC as their married counterparts. This again is thought to be associated with risk-taking behaviour, with single drivers adopting a 'nothing to lose' attitude to driving [5]. Moreover, risk-taking has also been related to unsafe road traffic behaviour, the assumption being that risk-taking attitudes correlate with risk-taking behaviour [6]. Whilst the connection between marital status and RTC involvement has been made, most studies do not factor in how much time participants spend behind the wheel; it must be acknowledged that exposure to the road also plays a role in the frequency of collisions, and this in turn may impact the observed variance. Perhaps unsurprisingly, fatigue has often been identified as causal of RTCs; a recent meta-analysis found a significant statistical association between driver fatigue and collision involvement [7]. In particular, shift workers and those working long hours, younger drivers, commercial drivers and those with undiagnosed sleep disorders such as obstructive sleep apnoea, [8] as well as frequent business travellers who may be prone to jet lag, spend too long driving and get too little sleep are at higher risk of RTCs due to fatigue.

There exists a considerable literature spanning many decades on the influence of personality on road traffic safety; the rationale being that particular facets of personality are associated with greater risk. Personality is a multifarious phenomenon, typically defined as the stable behavioural tendencies of individuals over time, or the psychological traits which create such behaviours [9]. Whilst many systems of personality measurement have been utilised over the years, there is now general agreement that personality and driving-related outcomes and behaviour can be measured according to the Five Factor Model (FFM): Neuroticism, Extraversion, Openness, Agreeableness and Conscientiousness, which translate well onto other systems [10]. In terms of the theoretical framework for personality and its association with road traffic safety, individuals high in extraversion tend toward risk-taking and poor diligence and, as a result, this trait has been associated with RTCs, traffic violations, traffic fatalities, and drink driving [11, 12, 13, 14]. Those high in neuroticism are said to be reactive to stress, easily distracted, and display a lower propensity to take control of the immediate environment. Thus, a dislike of driving, RTCs, aggressive driving and traffic fatalities have been associated with this trait [15, 16, 17]. Lower levels of agreeableness are connected with higher levels of aggression both from an emotional and behavioural perspective, which is thought to be causal of RTCs by increasing aggressive driving [18]. Higher levels of openness are associated with improvisation and experimentation, neither behaviour conducive with the necessity for adherence to routine and rules when driving [19]. Finally, conscientiousness has been found to be inversely related to RTCs overall, as well as 'at fault' RTCs [20]. As personality is a complex construct, it is worth noting that studies examining the links between the traits and driving have reported divergent findings; for example, conscientiousness has been found to be both negatively *and* positively significantly related to RTCs. This may be due in part to differences in the measurement instruments used, or, as suggested by some researchers, [20] the overrepresentation of younger, male drivers in many such studies.

The association between mental health and RTCs has been studied, most typically from the perspective of RTC involvement giving rise to psychological disorders such as post-traumatic stress disorder (PTSD) and acute stress disorder (ASD) [21]. What is less frequently studied is the causal impact of mental health issues such as anxiety and depression on driving and RTC involvement. In a recent systematic review, only sixteen studies concerning mental health disorders, such as depression and anxiety, and fitness to drive were sourced - this literature being somewhat disjointed due to small sample sizes and differing methodology [22]. Given the prevalence of depression and anxiety in the general population, with 19.7% of UK adults reporting symptoms of anxiety or depression in 2014 [23], an evaluation of the potential impact of such disorders on driving would be extremely useful.

Similarly, job characteristics, such as job demands and pressure, working hours and exposure to noise have not been extensively studied in the arena of the general public and driving. The literature is replete with factors associated with RTCs among professional drivers, the most emergent being fatigue caused by shift work/long working hours and the dangers of health issues brought about by the sedentary nature of driving for a profession [24]. However, given that the average worker spends the vast majority of their working life in the work environment, with many commuting to and from work by driving, it is reasonable to suggest that job characteristics may contribute to how an individual may drive and, by extension, to RTC causality. Recently, research addressed the issue of work-life balance and psychological work stressors on commuting behaviour, finding that over two time-points, work-family conflict and negative job characteristics (termed 'abusive supervision') were both positively related to unsafe driving during commuting [25]. Such insights afford fruitful lines of further inquiry, although the study authors acknowledge the necessity to examine the psychometric properties of the scale used to measure commuting norms in future research. While it is widely acknowledged that stressful job characteristics are implicated in stress-related physical and psychological issues, many of the current stress models by which this phenomenon is measured are either too broad and complex (e.g., Cognitive- Relational model [26]) resulting in a lack of predictive validity. Other models are too narrow in scope (e.g., the Effort-Reward Imbalance model [27]), and fail to account for individual differences. In recognition of this shortcoming, the Demands, Resources, and Individual Effects model (DRIVE) combines many of the features of existing stress models, by including work and individual demands and resources [28]. The model proposes that individual differences, work demands and resources have main effect relationships on health outcomes, such as anxiety and depression. Research suggests that these effects may be mediated through perceived stress and job satisfaction although the evidence for moderating effects is weak. The model is flexible in that it allows for the inclusion of new variables. This may provide more information on the relative importance of different variables in the prediction of outcomes and, perhaps more importantly, provide key information about the independence of different factors.

Staying with the impact of the work environment on driving and RTCs, accidents at work, as well as failures of cognition (defined as failures in perception, memory and motor functioning) [29] have previously been associated with crash involvement. Links were identified between cognitive failures and susceptibility to driving errors, the latter acknowledged as causal to RTCs. Similarly, associations were uncovered between minor accidents at work and cognitive failures; with cognitive failures being linked with both injuries in the workplace and fatigue, [30]. Nonetheless, given the connections already made, it was of interest to examine whether cognitive failures and accidents at work are associated with RTCs or poor driving behaviour, particularly in light of the ways in which driving error and behaviour are predictive of RTC involvement.

The purpose of the present study, using secondary data analysis from the recent work of Smith [31] in which poor driving behaviour, driver fatigue and risk-taking were found to predict RTCs, is to further analyse associations between job characteristics, mental health, personality, fatigue and driving behaviour, and their potential connection to RTCs, as well as their potential links with some of the risk factors (driving behaviour [DB], driver fatigue [DF] and risk-taking [RT]) as outcome variables. In particular, using the aforementioned DRIVE model [28] positive and negative job characteristics will be micro-analysed to ascertain which specific factors contribute to unsafe driving behaviour, driver fatigue, risk-taking and RTCs. For example, the parent study by Smith identified work hours and excessive noise at work together to be significant in RTC involvement and driver fatigue, whereas the proceeding analysis seeks to tease apart the variables to discover whether one factor over another is predictive of the outcome variables mentioned. It is acknowledged that the cross-sectional nature of the data makes attribution of causality problematic, however, it is suggested that finding preliminary associations may pave the way for further, longitudinal enquiry. Specifically, the research hypothesis is: the established predictors of RTC, DB, RT and DF will be evident, and can be statistically controlled for, which thus affords confidence in the novel analyses of mental health (anxiety and depression) and the DRIVE model variables (choice, reward, respect, pressure and decision making) in addition to work-life balance, work hours and noise, as well as accidents and cognitive failures at work.

## 2. MATERIAL AND METHODS

### 2.1 Participants

Clients of an insurance company (opportunity sample) [32] who were in current employment and had previously agreed to receive correspondence from the company were sent details about the study. Individuals who expressed an interest in participating were sent an online link to the study. Of the 3,000 participants sent links, 2856 (95.2%) completed the survey. The participants comprised 68% females, with an age range of 18-74 years ( $M = 34$ ). Further demographics of the final sample are detailed in Table 1.

Table 1.

*Final Sample Demographics*

Married/living with partner	61.2%
Education	55.5% degree/professional qualification 24.5% A level 20.4% GCSE
Salary	19.6% > £40,000 per annum 29.6% £25-40,000 per annum 38.8% £10-25,000 per annum 10.6% < £10,000 per annum
Full-time job	87.9%
Permanent job	89.3%
Job type	Self-employed 8% Manager 23.3% Supervisor 10.4% Employee 58.3%

### 2.2. MEASURES

The survey used in this study consisted of several sections, the full list of which is detailed in Appendix . The sections are described in the order in which they appear in the survey below.

### **2.2.1 Driving:**

Participants were asked to respond to questions relating to their driving behaviour, such as 'How often do you disregard the speed limit on a residential road?' and driver fatigue, such as 'How often do you have to drive when you are tired, using a five-point Likert scale (0 = never; 5 = very often) questions. In order to achieve an objective measure of driving skill, participants were asked 'How do others rate your driving skills?' (0 = not very good; 4 = very good).

### **2.2.2 Job Characteristics/Appraisals:**

Questions in this section pertained to the nature of the participant's job, using the DRIVE model [28]. The model conceptualises workplace and individual characteristics in terms of work demands and resources, as well as working hours and noise levels in the workplace.

The questionnaire possesses acceptable reliability, with the average alpha reliability of the multi-item measures reported by the authors as  $\alpha = .81$  [28]. Using single-item measurements, participants were asked to rate their employment (0 = never; 5 = very often) in terms of positive characteristics such as choice ('do you have a choice in what or how you do your job?'), decision making ('do you have a great deal of say in decisions at work?'), support ('do you have a lot of support at work?'), respect ('do you receive the respect you deserve from superiors and colleagues?'), reward ('do you feel your efforts and achievements at work are appropriately rewarded?') and negative characteristics, such as demand ('do you have a demanding job ('have to work fast, intensively etc.?'), and pressure ('do you have constant pressure due to a heavy workload?').

Job appraisals were assessed by way of the participants' subjective feelings about their job and encompass working hours ('do you work long or unsociable hours?'), noise in the workplace ('how often are you exposed to noise at work?'), job satisfaction ('are you satisfied with your job?'), and work/life balance ('does your job interfere with family life or other activities outside work?' /'do family matters (and other things outside work) interfere with your work?'). Perceived job stress was measured on a five-point Likert scale (0 = not at all stressful; 5 = very stressful). Accidents and cognitive failures in the workplace were assessed by single items. Participants were asked to indicate the number of accidents whilst at work that required medical attention in the last twelve months (none - more than six) and frequency of memory problems, attention, or action at work (0 = not at all; 4 = very frequently).

### **2.2.3 Mental Health:**

Mental health was measured using the hospital anxiety and depression scale (HADS) [33]. The fourteen item scale measures self-reported depression and anxiety. Originally developed for use in clinical settings, it also demonstrates appropriate validity in other populations [34]. Cronbach's alpha for the anxiety subscale (HADS-A) was .83, and the depression subscale (HADS-D) .82. Participants were asked to rate on a four-point Likert scale the extent to which they have been feeling fourteen mood-related descriptions (seven for anxiety, seven for depression) with responses ranging from 'not at all' to 'most of the time' (a score of 0 to 3, respectively). Scores are summed from items for the two sub-factors and range from 0-21.

### **2.2.4 Personality:**

Personality traits were assessed using the International Personality Item Pool (IPIP) [35], an instrument widely acknowledged to show good convergent and discriminant validity [36]. Each factor is assessed by 8 items rated from 0 (never) to 4 (very often) as to how accurately it describes the respondent. The first factor, extraversion ( $\alpha = .88$ ) assesses an individuals' active and social traits (e.g., am the life of the party). Conscientiousness ( $\alpha = .78$ ) is designed to assess one's traits of dependability and conscientiousness (e.g., I am always prepared). Agreeableness ( $\alpha = .71$ ) consists of items connected to one's warmth and interest toward others (e.g., I have a good word for everyone). Openness ( $\alpha = .76$ ), otherwise known as intellect, relates to traits of sophistication and creativity (e.g., I believe in the importance of art). Finally, neuroticism ( $\alpha = .70$ ) assesses an individuals' sensitivity to fluctuations in emotional experience and stress (e.g., I often feel blue).

### **2.2.5 Risk-Taking and RTCs:**

Participants' propensity toward risk-taking was measured by two items - risk-taking at work, and risk-taking outside of work - and measured on a six-point Likert scale (0 = not at all; 5 = very frequently; 6 = not applicable). RTCs were measured by asking participants how often, in the last twelve months they had been involved in traffic incidents that a) required medical attention and b) did not involve injuries between 0 and 6. Responses to both RTC questions were summed to give an overall RTC figure.

## **2.3 Design**

This cross-sectional study was presented as an online survey, administered using Survey Tracker software. Potential order-effects were alleviated by way of counterbalancing, using randomisation within the software. Median splits (high/low) were used for all variables to allow like for like comparison. Cross-tabular analyses were used to initially examine any associations among RTCs, RT, DF and DB. Binary logistic regressions were then carried out with demographics, job characteristics, job appraisals, personality, mental health and driving as covariates. Dose-response was examined by combining the effects of the risk factors identified in a further series of logistic regressions, achieved by way of adding the scores from the median splits and then splitting the combined scores into quartiles.

## **2.4 Procedure**

An information sheet outlining the aims and procedure of the study for participants to give informed consent to participate was provided prior to study commencement. Participants received the following information:

'Please read each question carefully and mark the response that BEST reflects your knowledge or feelings. Do not spend a lot of time on each one; your FIRST answer is usually the best. Please make sure you mark all answers in the space provided. If there are any questions you do not want to answer you may omit them'.

Participants who were in employment completed the job characteristics/appraisal measure, with the following instructions: 'We would like to ask you some questions about you and work. If you are not working, go to the next section'

With regard to mental health, they were presented with the following instructions:

'Please read each item and then tick the box next to the reply that comes closest to how you have been feeling in the past week. Try to give your first reaction. This will probably be more accurate than spending a long time thinking about an answer. Please answer all questions, and tick only ONE BOX per question'

The personality scale contained the instruction:  
 'Please use the rating scale to assess how accurately the statement describes you'.

At the end of the survey participants were thanked for their time and shown a debrief statement.

### 3. RESULTS

#### 3.1 Factor Analyses of Driving Questions

In line with the work of Smith [31], a factor analysis (with varimax rotation) of the driving questions revealed that these variables loaded on three separate factors, driving behaviour (DB), driver fatigue (DF) and risk-taking (RT) (see Table 2). Cumulative variance was 56.28%. The Cronbach  $\alpha$ s for the factors were .75, .78 and .72 respectively.

Table 2.

*Factor Analysis of Driving Questions*

	DB factor: Eigenvalue = 1.50 % variance = 13.62	DF factor: Eigenvalue = 3.36 % variance = 30.52	RT factor: Eigenvalue = 1.34 % variance = 12.14
Drive long periods		.734	
Drive after prolonged work		.774	
Drive late at night/post lunch		.774	
Drive when tired		.638	
Drive with a cold		.470	
Lapses of concentration	.794		
Speeding	.747		
Miss warning signs	.687		
Indicate hostility to others	.454		
Take risks at work			.865
Take risks outside work			.860

*Note.* Loadings <.04 not shown.

#### 3.2 Derived scores

The factor scores detailed above were dichotomised at median split, whereas the job characteristics/appraisal, personality, mental health and driving variables were dichotomised at the scale score median split. All variables were categorised into 'high/low', with the exception of others' rating of driving, categorised into 'good/bad' for ease of interpretation.

### 3.3 Univariate Analyses

To initially examine potential associations between the variables, cross-tabular analyses were conducted, with the outcome variables as RTCs, DB, DF and RT and demographic, personality, mental health, job characteristics, job appraisal, driving behaviour, driver fatigue and risk-taking as predictor variables. Marital status was dichotomised into 'Married/separated/divorced' versus 'Single' as chi-squares yielded significant effects between these groups for each of the outcome variables ( $P = .05$ ).

### 3.4 Logistic Regression

Logistic regression analyses (using the ENTER method) were performed with RTCs, driving behaviour, driver fatigue and risk-taking as the dependent variables, and demographics (marital status, age, gender, education and salary), job characteristics (demand, pressure, choice, decision making, support, reward and respect), job appraisals (work-life balance problems, job satisfaction, job stress, work hours, noise levels), personality (conscientiousness, agreeableness, extraversion, neuroticism and openness), mental health (depression/anxiety) and driving variables (driving in bad weather, motorway driving, driving in heavy traffic, driver fatigue, driving behaviour and others' ratings of the drivers' ability) as predictor variables. Marital status and age were entered into the regression as single (risk group; 2) and married (control; 1), younger (risk group; 2) older (1; control group). A total of 2856 cases were analysed.

### 3.5 Road Traffic Collisions

The univariate analyses showed that the following were risk factors for being involved in an RTC:

- Being single
- Being younger
- Having pressure at work
- Having low respect at work
- High stress at work
- Working long hours
- Having an accident at work
- High cognitive failures at work
- Being rated by others as a bad driver
- High frequency of driving when fatigued
- Inappropriate driving behavior
- Frequently taking risks

These effects are shown in Table 3.

Table 3.

*Percentage of participants in the RTC, bad driver behaviour, frequently driving while fatigued and high-risk taking groups.*

	RTC	DB	DF	RT
<b>Demographics</b>				

Married/Separated/Divorced		9.9%	10.7%	46.4%	45.2
Single		14.7%	17.9%	52.2%	58.8
Male					
Female					
Older driver		9.3%	47.4%	46.3%	
Younger driver		13.5%	52.1%	53.0%	
Salary	High				58.4%
	Low				48.6%
<b>Job Characteristics</b>					
Demand	High				55.4%
	Low				44.5%
Pressure	High	12.3%			
	Low	10.8%			
Choice	High			57.6%	57.9%
	Low			44.0%	44.0%
Decision making	High		45.3%		56.7%
	Low		56.2%		43.7%
Support	High				
	Low				
Reward	High				
	Low				
Respect	High	10.4%			
	Low	12.7%			
<b>Job Appraisal</b>					
Job satisfaction	High			36.5%	
	Low			45.7%	
Job stress	High	12.6%	52.5%	55.8%	55.3%
	Low	9.7%	46.3%	41.5%	42.2%
Work hours	High	13.3%	50.8%		55.5%
	Low	10.3%	48.7%		46.6%
Noise Levels	High	47.8%	51.3%	56.0%	
	Low	35.9%	49.2%	46.0%	
Work/Life balance problems	High		55.2%		52.7%
	Low		44.6%		47.3%
Accidents at work	High	24.1%	39.9%	73.0%	58.4%
	Low	10.8%	30.6%	48.7%	49.3%
Cognitive failures at work	High	13.6%	67.3%	55.2%	56.5%
	Low	10.5%	41.8%	48.0%	46.9%
<b>Personality</b>					
Openness	High				50.5%
	Low				49.5%
Conscientiousness	High		41.2%		52.7%
	Low		59.7%		52.7%
Extraversion	High				52.6%
	Low				47.3%

Neuroticism	High		60.4%		58.9%
	Low		40.0%		51.0%
Agreeableness	High		41.8%		45.7%
	Low		58.2%		54.3%
<b>Mental Health</b>					
Anxiety	High		40.5%		52.1%
	Low		59.8%		47.9%
Depression	High				51.0%
	Low				49.1%
<b>Driving</b>					
Driving in heavy traffic	High			68.2%	
	Low			30.8%	
Motorway driving	High			71.0%	
	Low			34.3%	
Driving in bad weather	High			80.5%	54.5%
	Low			38.8%	47.8%
Others' rating of driving	Bad	14.1%	60.5%		
	Good	9.7%	42.3%		
Driver fatigue	High	13.9%	66.6%	-	49.9%
	Low	9.0%	51.9%	-	50.1%
Driving behaviour	High	13.4%	-		53.2%
	Low	9.5%	-		46.8%
Risk taking	High	14.7%	53.6%		-
	Low	10.5%	48.5%		-

Note. Outcome variable data is displayed at 'high' level.

A logistic regression was then conducted. The full model significantly predicted RTCs (omnibus  $\chi^2 = 84.88$ ,  $df = 8$ ,  $P = .001$ ). The model accounted for between 34% and 68% of the variance in RTCs. The Hosmer and Lemeshow test indicated a good model fit:  $P = .803$ . Analysis of the demographic, job, personality, mental health and driving variables revealed that the following were risk factors for RTCs:

- Being single
- Being a younger driver
- Having a job with high levels of noise
- Working long hours
- Low levels of respect at work
- Having pressure at work
- Having an accident at work
- Frequently driving when fatigued
- Inappropriate driving behavior
- Higher levels of risk taking
- Being rated by others as a bad driver

Table 4 gives the coefficient, Wald statistics and probability values for each of the predictor variables.

Table 4.

Logistic Regression of RTCs

	B	Std. Error	Wald Statistic	Odds Ratio Exp (β)	95 % Confidence Interval for Exp (β)	
					Lower	Upper
<b>Demographics</b>						
Being Single	.358*	.139	6.66	1.43	1.09	1.88
Being Younger	.392*	.145	7.31	1.48	1.11	1.97
Education	-.327	.137	5.69	.721	.551	.943
Salary	.231	.147	2.47	1.26	.945	1.68
Gender	.010	.155	.004	1.01	.745	1.37
<b>Job Characteristics</b>						
Low Choice	-.108	.095	1.25	.921	.765	1.16
High Demand	-.126	.158	.629	.882	.647	1.20
High Pressure	.010*	.156	.004	1.20	1.02	1.41
Less Control Over Decision Making	-.029	.153	.037	.971	.719	1.31
Low Support	.037	.151	.061	1.04	.771	1.40
High Reward	.170	.155	1.19	1.19	.874	1.61
Low Respect	.290*	.163	3.14	1.41	1.39	1.03
Long Work Hours	.291*	.144	4.06	1.34	1.01	1.77
High Noise Levels	.304*	.152	3.99	1.36	1.01	1.83
<b>Job Appraisal</b>						
Low Job Satisfaction	-.018	.157	.014	.982	.722	1.34
High Job Stress	.168*	.143	1.37	1.03	1.18	1.39
High Work/Life Balance Problems	-.058	.147	.155	.944	.708	1.26
<b>Accidents/Cog Failures</b>						
Having an Accident at Work	.840***	.241	12.16	2.32	1.45	3.71
Cognitive Failures at Work	.250	.145	2.97	1.28	.966	1.71
<b>Personality</b>						
High Openness	-.012	.129	.009	.988	.768	1.27
Low Conscientiousness	.071	.137	.264	1.07	.820	1.40
High Extraversion	.219	.137	2.55	1.25	.952	1.63
Low Agreeableness	.025	.135	.035	1.03	.787	1.34
High Neuroticism	.069	.152	.204	1.07	.795	1.44
<b>Mental Health</b>						
High Anxiety	-.263	.151	3.01	.769	.571	1.04
High Depression	.084	.149	.319	1.09	.812	1.46
<b>Driving/Risk Taking</b>						
Driving in Heavy Traffic	.025	.149	.028	1.03	.765	1.37
Motorway Driving	.012	.149	.006	1.01	.755	1.36
Driving in Bad Weather	.020	.156	.016	1.02	.751	1.39
Others' Rating of Driving (Bad)	.448**	.132	11.57	1.59	1.23	2.04
Frequent Driving when Fatigued	.337*	.149	5.08	1.40	1.05	1.89

Bad Driving Behaviour	.356*	.138	6.68	1.43	1.09	1.87
High Risk Taking	.233*	.132	3.13	1.26	1.15	1.64

Note.  $N = 2856$ ; \* $P = 0.05$ , \*\* $P = 0.01$ .

### 3.6 Driving Behaviour

The univariate analyses showed that bad driving behaviour was associated with:

- Being single
- Being younger
- Higher levels of stress at work
- High noise exposure at work
- Work-life-balance problems
- Cognitive failures at work
- Having an accident at work
- Low levels of conscientiousness
- High levels of neuroticism
- Low levels of agreeableness
- Low levels of anxiety
- Lower control over decision making at work
- Frequently working long hours
- Higher levels of risk taking
- Lower levels of driving skill ratings (by others)

The full logistic regression model significantly predicted driving behaviour (omnibus  $\chi^2 = 348.00$ ,  $df = 6$ ,  $P < .001$ ) and accounted for between 15% and 21% of the variance in driving behaviour, with lower levels of poor driving behaviour correctly predicted in 66% of cases; higher levels of poor driving behaviour correctly predicted in 67.8% of cases, giving an overall percentage of 66.9% – a 10% increase on the intercept model. The Hosmer and Lemeshow test indicated a good overall fit for the model,  $P = .752$ . Poor driving behavior was found to be associated with:

- Younger drivers
- Less control over decision making at work
- High work/life balance problems
- High perceived stress at work
- Long working hours
- Higher levels of cognitive failure at work
- Low levels of conscientiousness and agreeableness
- High levels of neuroticism
- Low levels of anxiety

- Higher levels of risk taking
- Frequently driving whilst fatigued
- Others' rating the driver badly

Table 5 gives the coefficient, Wald statistics and probability values for each of the predictor variables.

Table 5. *Logistic Regression of Driving Behaviour*

	$\beta$	Std. Error	Wald Statistic	Odds Ratio Exp ( $\beta$ )	95 % Confidence Interval for Exp ( $\beta$ )	
					Lower	Upper
<b>Demographics</b>						
Being Single	.024	.096	.064	1.03	.849	1.24
Being Younger	-.016*	.094	.030	1.43	1.20	1.68
Education	-.074	.092	.653	.928	.775	1.12
High Salary	-.080	.099	.664	.923	.761	1.12
Gender	-.471	.110	18.50	.624	.504	.774
<b>Job Characteristics</b>						
High Demand	-.045	.106	.180	.956	.776	1.18
High Pressure	-.144	.106	1.84	.866	.704	1.07
Low Choice	-.044	.093	.220	.957	.798	1.15
Less control over decision making	.199*	.100	4.00	1.22	1.00	1.48
Low Support	-.060	.098	.372	.942	.777	1.14
Low Reward	-.018	.099	.031	.983	.809	1.19
Low Respect	-0.13	.105	.015	.987	.803	1.21
Long Work Hours	.118*	.098	1.45	1.23	1.05	1.36
High Noise Levels	-.020	.095	.043	.981	.815	1.18
<b>Job Appraisal</b>						
Low Job satisfaction	-.049	.105	.217	.952	.775	1.17
High Job Stress	.218*	.107	5.13	1.24	1.02	1.51
High Work/Life Balance Problems	.384***	.086	19.97	1.47	1.24	1.74
<b>Accidents/Cog Failures</b>						
Having an Accident at Work	-.817	.100	67.32	1.02	.836	3.01
Cognitive Failures at Work	.206*	.251	.674	1.26	1.05	1.33
<b>Personality</b>						
High Openness	.046	.086	.282	1.05	.775	1.17
Low Conscientiousness	.570***	.090	40.09	1.77	1.48	2.11
High Extraversion	.104	.091	1.30	.901	.753	1.08
Low Agreeableness	.518***	.089	33.53	1.67	1.41	1.99
High Neuroticism	.286*	.099	8.27	1.59	1.23	2.04
<b>Mental Health</b>						
Low Anxiety	.347*	.098	12.49	1.46	1.24	1.69

High Depression	-.161	.098	1.46	.851	.702	1.03
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### Driving

Driving in Heavy Traffic	-.065	.100	.418	.937	.770	1.14
Motorway Driving	-.139	.101	1.91	.870	.714	1.06
Driving in Bad Weather	.356	.101	12.44	1.43	1.17	1.74
Others' Rating of Driving (Bad)	.188***	.088	56.51	1.94	1.63	2.31
High Risk Taking	.663***	.088	19.99	1.48	1.25	1.76
Frequent Driving When Fatigued	.394***	.100	3.51	1.21	.991	1.47

Note.  $N = 2856$ ; \* $P = 0.05$ , \*\*\* $P = 0.01$

### 3.7 Driver Fatigue

The univariate analyses indicated that frequent driving when fatigued was associated with:

- Being single
- Being a younger driver
- Having pressure at work
- High stress at work
- Exposure to high noise levels
- Lower levels of job satisfaction
- High incidences of accidents and cognitive failures at work
- More frequent driving in heavy traffic
- Frequent motorway driving
- Frequent driving in bad weather

The full logistic regression model significantly predicted driver fatigue (omnibus  $\chi^2 = 820.68$ ,  $df = 6$ ,  $P < .001$ ), and accounted for between 28% and 38% of the variance in driving fatigue, with lower levels of driver fatigue correctly predicted in 76.5% of cases; higher levels of driver fatigue correctly predicted in 71% of cases, giving an overall percentage of 70.2% – a 20.2% increase on the model without predictors. The Hosmer Lemeshow test yielded  $P = .733$ , suggesting a good model fit. The regression revealed that the risk factors significantly associated with driver fatigue are:

- Being single
- Being a younger driver
- High levels of pressure in the workplace
- Lower levels of job satisfaction
- High levels of stress at work
- Exposure to high noise levels at work
- Higher levels of reported failures of cognition and accidents in the workplace
- Frequently driving in heavy traffic

- Frequently driving on the motorway
- Frequently driving in adverse weather conditions

Table 6 gives coefficient, Wald statistics and probability values for each of the predictor variables.

Table 6.  
*Logistic Regression of Driver Fatigue*

	$\beta$	Std. Error	Wald Statistic	Odds Ratio Exp ( $\beta$ )	95 % Confidence Interval for Exp ( $\beta$ )	
					Lower	Upper
<b>Demographics</b>						
Being Single	.298*	.107	7.79	1.27	1.03	1.55
Being Younger	.344**	.101	11.57	1.41	1.16	1.72
Education	.094	.099	.889	1.10	.904	1.33
Salary	.131	.101	1.67	1.14	.934	1.39
Gender	-.323	.114	7.97	.724	.579	.906
<b>Job Characteristics</b>						
High Demand	-.064	.118	.297	.938	.745	1.18
High Pressure	.256***	.087	8.72	1.29	1.09	1.53
Low Choice	.106	.104	1.05	1.11	.907	1.36
Less Control Over Decision Making	.003	.112	.001	1.00	.805	1.25
Low Support	.001	.111	.000	1.00	.804	1.24
Low Reward	.190	.113	2.80	1.21	.968	1.51
Low Respect	-.188	.121	2.43	.828	.654	1.05
Long Work Hours	.190	.113	2.84	1.25	1.01	1.45
High Noise Levels	.214*	.085	11.47	1.33	1.13	1.58
<b>Job Appraisal</b>						
Lower Job Satisfaction	.698***	.093	56.36	2.01	1.68	2.41
High Job Stress	.265*	.112	5.63	1.21	1.09	1.47
High Work/Life Balance Problems	-.095	.096	.996	.909	.754	1.10
<b>Accidents/Cog Failures</b>						
Having an Accident at Work	.561*	.247	5.14	1.19	1.06	1.29
Cognitive Failures at Work	.235*	.109	4.61	1.34	1.18	1.44
<b>Personality</b>						
High Openness	-.123	.093	1.74	.884	.737	1.06
Low Conscientiousness	0.44	.098	.205	1.05	.863	1.27
High Extraversion	.123	.098	1.56	1.13	.933	1.37
Low Agreeableness	.032	.096	.114	1.03	.856	1.25
High Neuroticism	.134	.109	1.51	1.14	.923	1.42
<b>Mental Health</b>						

High Anxiety	.047	.107	.195	1.05	.850	1.29
High Depression	.114	.107	1.13	1.12	.908	1.38
<b>Driving</b>						
Driving in Heavy Traffic	1.01***	.099	103.82	2.74	2.26	3.32
Motorway Driving	.987***	.101	95.76	2.68	2.20	3.27
Driving in bad weather	1.39***	.116	142.76	3.99	3.18	5.01
Others rating of driving (bad)	.079	.095	.698	1.08	.899	1.30
Bad driving behaviour	.073	.100	.536	1.06	.885	1.31
High risk taking	.055	.104	.277	.947	.773	1.16

Note.  $N = 2856$  ; \* $P = 0.05$ , \*\*\*  $P = 0.01$

### 3.8 Risk-Taking

The univariate analyses showed that more frequent risk-taking was associated with:

- Being single
- Having a higher salary
- High job demands
- High control over decision making
- High levels of choice at work
- Higher job stress
- Long working hours
- More work-life-balance problems
- More accidents and cognitive failures at work
- Greater openness, neuroticism and extraversion
- Lower conscientiousness and agreeableness
- Higher anxiety and depression
- More likely to drive in bad weather
- Less frequent driving when fatigued
- Higher levels of poor driving behaviour

The full logistic regression model significantly predicted risk-taking (omnibus  $\chi^2 = 158.25$ ,  $df = 6$ ,  $P < .001$ ) and accounted for between 58% and 77% of the variance in risk-taking, with lower levels of risk taking correctly predicted in 65.5% of cases; higher levels of risk-taking correctly predicted in 61.7% of cases, giving an overall percentage of 63.6% – a 6.1% increase on the model without predictors. The Hosmer and Lemeshow test indicated a good fit for the overall model -  $P = .656$ . Risk-taking was found to be significantly associated with:

- Being single
- Earning a higher salary
- High levels of demand at work
- High job stress

- Long working hours
- Higher reports of accidents and cognitive failures at work
- Higher levels of choice and decision-making at work
- High levels of openness and extraversion
- Lower conscientiousness and agreeableness
- Frequently driving in bad weather
- Less frequently driving while fatigued
- High levels of poor driving behaviour

Table 7 shows the coefficient, Wald statistics and probability values for each of the predictor variables.

Table 7.  
*Logistic Regression of Risk-Taking*

	$\beta$	Std. Error	Wald Statistic	Odds Ratio Exp ( $\beta$ )	95 % Confidence Interval for Exp ( $\beta$ )	
					Lower	Upper
<b>Demographics</b>						
Being Single	.206*	.091	5.11	1.23	1.03	1.47
Being Younger	.162	.088	3.39	1.18	.990	1.40
Education	.083	.086	.932	1.09	.918	1.29
Higher Salary	.508***	.088	32.97	1.66	1.39	1.98
Gender	.077	.093	.680	1.08	.899	1.29
<b>Job Characteristics</b>						
High Levels of Demand	.288**	.085	4.98	1.33	1.13	1.58
High Pressure	-.056	.103	.299	.945	.772	1.16
High Levels of Choice	.134*	.091	2.16	1.30	1.11	1.56
High Levels of Decision Making	.364*	.098	13.89	1.20	1.07	1.46
Low Support	-0.10	.098	.010	.990	.817	1.20
Low Reward	.183	.100	3.35	.695	.578	.581
Low Respect	-.104	.106	.968	.901	.732	1.11
Long Work Hours	.256*	.081	9.99	1.29	1.10	1.51
High Noise Levels	-.060	0.92	.426	.942	.786	1.13
<b>Job Appraisal</b>						
Job Satisfaction	-.012	.103	.015	.988	.807	1.21
High Job Stress	.339***	.097	12.14	1.40	1.21	1.72
High Work/Life Balance Problems	.132	.083	2.51	1.14	.969	1.34
<b>Accidents/Cog Failures</b>						
Having an Accident at Work	.121*	.202	.360	1.19	1.05	1.68
Cognitive Failures at Work	.279*	.095	8.56	1.32	1.10	1.60
<b>Personality</b>						
High Openness	0.72*	.081	.789	1.08	1.02	1.26
High Conscientiousness	-.261*	.089	8.58	1.30	1.09	1.55

High Extraversion	.267*	.086	9.08	1.24	1.05	1.47
High Agreeableness	-.401***	.087	21.46	1.49	1.26	1.77
High Neuroticism	-.167	.095	3.05	.847	.702	1.02
<b>Mental Health</b>						
High Anxiety	.137	.094	2.10	1.15	.953	1.38
High Depression	.034	.093	.104	1.03	.859	1.24
<b>Driving</b>						
Driving in Heavy Traffic	.024	.097	.063	1.03	.847	1.24
Motorway Driving	-.099	.098	1.03	.906	.748	1.10
Driving in Bad Weather	.234*	.098	5.724	1.26	1.04	1.53
Others rating of driving (bad)	.009	.087	.011	1.01	.852	1.20
Less Driving when Fatigued	.420***	.098	18.54	1.52	1.26	1.84
Poor Driving Behaviour	.392***	.088	19.79	1.48	1.25	1.76

Note.  $N = 2856$ ; \* $P = 0.05$ , \*\* $P = 0.01$ , \*\*\* $P = 0.001$ .

### 3.9 Combined effects approach

A combined effects approach, similar to that employed in the parent study [31] was used to examine the impact of individual risk factors in combination with other risks. The risk factors identified in the analysis were combined and then split into quartiles. Logistic regressions were used to achieve the cumulative odds ratios.

#### 3.9.1 RTCs

The combined effects analysis revealed that younger, single drivers working long hours in high pressured, noisy environments with low levels of respect, reporting a high level of accidents in the workplace who often drive when fatigued, exhibit higher levels risk-taking and poor driving behaviour and rated as a bad driver by others were cumulatively 2.90 times more likely to be involved in an RTC. The quartile values are presented in Table 8.

Table 8.

*Quartiles Displaying Cumulative Odds Ratios for RTCs*

	$\beta$	Std Error	Wald Statistic	Exp ( $\beta$ )	95% Confidence Interval for EXP( $\beta$ )	
					Lower	Upper
Quartile 1	.572***	.168	11.59	1.77	1.28	2.46
Quartile 2	.785***	.173	20.46	2.19	1.56	3.08
Quartile 3	1.07***	.175	37.24	2.90	2.06	4.09

Note.  $N = 2856$  \* $P < .001$

#### 3.9.2 Driving Behaviour

Combined effects revealed that for the risk factors identified - being younger, high levels of work/life balance problems, high perceived stress at work, long working hours and high

incidences of cognitive failures at work and less control over decision making at work, coupled with high levels of neuroticism, low levels of conscientiousness agreeableness and anxiety, higher propensity toward risk taking, more frequently driving whilst fatigued and others rating the driver badly were 1.42 times more likely to engage in poor driving behaviour. The quartile values are displayed in Table 9.

Table 9.

*Quartiles Displaying Cumulative Odds Ratios for Poor Driving Behaviour*

	$\beta$	Std Error	Wald Statistic	Exp( $\beta$ )	95% Confidence Interval for EXP ( $\beta$ )	
					Lower	Upper
Quartile 1	.222*	.113	3.87	1.25	1.00	1.56
Quartile 2	.132	.112	1.38	1.14	.916	1.42
Quartile 3	.35*	.101	12.09	1.42	1.16	1.73

Note.  $N = 2856$  \* $P = 0.05$

### 3.9.3 Driver Fatigue

The combined risk factors for driver fatigue, namely being single, a younger driver, in a job with high levels of stress, pressure, noise and higher levels of reported cognitive failures and accidents in the workplace, as well as frequently driving in heavy traffic on the motorway and in adverse weather conditions yielded a 16.73-fold increase in driver fatigue. The quartile values are presented in Table 10.

Table 10.

*Quartiles Displaying Cumulative Odds Ratios for Driver Fatigue*

	$\beta$	Std Error	Wald Statistic	Exp ( $\beta$ )	95% Confidence Interval for EXP ( $\beta$ )	
					Lower	Upper
Quartile 1	1.20*	.141	72.53	3.334	2.523	4.40
Quartile 2	1.89*	.159	142.81	6.59	4.834	8.98
Quartile 3	2.82*	.156	332.37	16.73	12.36	22.65

Note.  $N = 2856$  \* $P = 0.05$

### 3.9.4 Risk-Taking

The additive effects of risk-taking; being single, earning a higher salary in a demanding job, with high levels of stress, long working hours with higher levels of choice and decision making and high incidences of cognitive failures and accidents at work, with low levels of conscientiousness and agreeableness but higher levels of extraversion and openness, coupled with less frequently driving when fatigued, frequently driving in bad weather and engaging with higher levels of poor driving behaviour result in a 2.06-fold increase in risk-taking behaviours. The quartile values are presented in Table 11.

Table 11.

*Quartiles Displaying Cumulative Odds Ratios for Risk-Taking*

	$\beta$	Std	Wald	Exp( $\beta$ )	95% Confidence Interval for EXP ( $\beta$ )	
					( $\beta$ )	( $\beta$ )

		Error	Statistic		Lower	Upper
Quartile 1	.269*	.125	4.59	1.31	1.02	1.67
Quartile2	.631**	.101	38.97	1.88	1.54	2.29
Quartile 3	.724**	.110	43.55	2.06	1.66	2.56

Note.  $N = 2856$ ; \* $P = .0.05$  \*\* $P < .001$

#### 4. DISCUSSION

The aim of the present study was to examine potential associations between RTCs, driving behaviour, driving fatigue and risk-taking with demographics, mental health, personality, job characteristics and accident/cognitive failures at work. In line with the research hypothesis, the established predictors were evident, affording greater confidence in the novel variables examined. Given that humans are complex and likely to possess multiple variations of the predictors (such as personality traits and job characteristics) it is of utility to appraise how the predictors in combination increase the chances of RTCs, poor driving behaviour, driver fatigue and risk-taking. To address this, a combined-effects approach was used, whereby the additive effects of the significant predictors reveal cumulative odds ratios of the outcome variables. This revealed a staggering 16.73-fold increase of driver fatigue when drivers are single, younger, drive often in heavy traffic, on the motorway and in adverse weather conditions and engage in employment which is low in job satisfaction but higher in stress, pressure and noise, and report more incidences cognitive failures and accidents during working hours. Arguably, such conditions may be typical of many blue-collar roles. In addition, the outcome variables were included as predictor variables in a series of analyses, such that the potential mechanisms underpinning unsafe driving may be unpicked. For example, much of the extant literature points to personality traits such as extraversion [12] neuroticism, [15] agreeableness, [18] openness [19] and conscientiousness [20] as being predictive of RTCs; whereas the present analysis found that such traits do not *directly* influence RTCs, but rather, they impact driving behaviour and risk-taking - both predictors of RTCs. Such insights afford valuable information on potential causality, enabling more tailored interventions for drivers. By way of illustration, if certain personality traits are involved in risk-taking and poor driving behaviour, the identification of such traits in the learner driver, or drivers attending National Driver Offender Retraining courses could stimulate educational instruction designed to mitigate poor driving and risk-taking behaviour.

Demographics feature heavily in the literature in terms of the connection between age and marital status and RTC causation [5]. The current analysis bears this out, as well as identifying that both demographics are associated with driver fatigue. Surprisingly, an association between salary and risk-taking emerged, in that the higher the salary, the higher the propensity to engage in risk-taking behaviour. This is somewhat demonstrated in studies of entrepreneurs who tend toward higher earnings [37] (although this is not exclusive), notably due to the risk-taking nature of owning one's own business. More research into this finding would be of interest to ascertain whether this association might be explained by entrepreneurship as is suggested here, or whether there are certain forms of employment which, as well as attracting higher salaries, also have characteristics which lend themselves to risk-taking behaviours.

Of the driving variables examined, consistent with the existing literature, RTCs were found to be associated with fatigue and poor driving behaviour, whilst poor driving behaviour was linked with risk-taking behaviour. Both RTCs and poor driving behaviour were related with the subjective measure of others' rating of the driver. Put simply, if other people believe you to be a poor driver, then you probably are. Both driver fatigue and risk-taking were associated with driving in poor weather; driver fatigue, perhaps understandably also linked to motorway driving, driving in heavy traffic and in adverse weather - endeavours acknowledged as both mentally and physically taxing [38].

Mental health, specifically anxiety and depression have not been studied extensively with regard to RTC, driving behaviour, driver fatigue or risk-taking. The current study did not find associations in this remit, with the exception of anxiety and driving behaviour, which were found to be negatively associated. This may be explained by anxiety causing an individual to drive more carefully due to anxieties surrounding mortality as well as heightened states of vigilance – often features of the disorder [39].

Changing focus, the present analysis sought to further analyse the potential impact of accidents and cognitive failures at work. Previously, these have been found to be strongly predictive of driving errors, with such errors being acknowledged as causal of RTCs. Here, we identified that cognitive failure is also predictive of poor driving behaviour. In light of this, it is tentatively suggested that the development of a driving-oriented cognitive failure scale - possibly an amalgam of the DBQ [1] and a cognitive scale such as the Cognitive Failures Questionnaire [40] may be of use in the identification of drivers prone to errors and violations before RTC involvement occurs.

Remaining with the impact of employment upon driving, perhaps the most enlightening findings in the current study are those connected with job characteristics and appraisals. Whilst there is a dearth of research focusing on the general public and the impact of work environment on driving, issues with work-life balance, as well as a negative work environment have been implicated in unsafe commuting behaviour [25]. The present study found that just as with professional drivers, long work hours and high noise levels, as well as lower levels of choice and respect in the workplace and high levels of pressure (typically indicative of the aforementioned blue-collar type employment) were associated with RTCs. Driver fatigue was predicted by jobs with high levels of pressure, low levels of job satisfaction, high levels of perceived job stress as well as high levels of noise and incidences of accidents and cognitive failures in the workplace. Previous studies, such as that of Smith [31] uncovered an association between long work hours and noise in combination as being predictive of driver fatigue - here we have teased apart the variables and found that, perhaps counter-intuitively, high levels of noise in the workplace predict fatigue, as opposed to long working hours. Perhaps most interesting are the findings connected to job appraisals/characteristics and driving behaviour. Driving behaviour is defined as the way a person *chooses* to drive, with this perceivably underpinned by attitudinal dynamics [1]. The current findings bear this notion out. High levels of decision making (also referred to as job control), perceived job stress, issues of work-life balance and long working hours were significant predictors of poor driving behaviour. It is proposed that high levels of decision making at work may lend themselves toward a more blasé attitude toward following the 'rules of the road' and thus contribute to the types of poor driving behaviour, such as indicating hostility to other drivers and speeding. Similarly, working long hours may create a sense of frustration and urgency in drivers to reach their destination, leading to similar violations on the roads. Of the appraisals, perceived job stress and work-life balance appear to be associated with poor driving behaviour. Taken together, it may be argued that these predictors change the attitudinal dynamics of drivers, supportive of the assertions of Reason

et al. [1]. If this is the case, just as with professional drivers, in-depth, longitudinal inquiry into the impact of work environment on driving behaviour is warranted.

#### **4.1 CONCLUSION**

The current study has found evidence of the established predictors of RTCs, driving behaviour, risk-taking and driver fatigue, as well as identified novel factors which may lead to a greater appreciation of the complex machinations underpinning RTC involvement. Notably, the findings relating to job characteristics/appraisals and driving behaviour are of particular interest and should form the basis of future longitudinal research.

#### **4.2 LIMITATIONS AND FUTURE DIRECTIONS**

It should be noted that the present study has a number of methodological and analytical limitations. The first limitation is the cross-sectional nature of the research, which makes attribution of causality problematic. Secondly, the analysis did not consider the effect of interactions between the variables, interpreting the models as additive rather than potentially multiplicative. Third, criticisms have been levelled at self-report questionnaires as measures of driving behaviour in relation to possible issues with external validity and reliability due to this method of data collection being vulnerable to social desirability bias in comparison to other methods, such as behavioural observation [41]. Finally, the participants were recruited on the basis of an opportunity sample, with females overrepresented (68% of sample). Whilst the sample size was reasonably large, it would be of benefit to observe how the current findings may differ from those of a sample drawn randomly from the entire population. These limitations form the basis for suggested future directions; future studies should be longitudinal in nature, using random sampling (if practicable) with logistic regression models tested for interactive effects. In addition, the incorporation of a 'lie scale' relevant to driving, such as Driver Social Desirability Scale [42] ought to address issues surrounding social desirability bias and self-report measures of driving behaviour.

#### **ETHICAL APPROVAL**

The study was carried out with the approval of the ethics committee, School of Psychology, Cardiff University (EC.16.6.06) as well as the informed consent of the participants.

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## APPENDIX

### Driving Survey

#### Section 1: Driving

**1.1 How often do you drive in heavy traffic ?**

Never	Rarely	Some- times	Often	Very often
၈၀ <sub>၀</sub>	၈၀ <sub>၁</sub>	၈၀ <sub>၂</sub>	၈၀ <sub>၃</sub>	၈၀ <sub>၄</sub>

**1.2 How often do you drive on the motorway ?**

Never	Rarely	Some- times	Often	Very often
၈၀ <sub>၀</sub>	၈၀ <sub>၁</sub>	၈၀ <sub>၂</sub>	၈၀ <sub>၃</sub>	၈၀ <sub>၄</sub>

**1.3 How often do you have to drive when you are tired?**

Never	Rarely	Some- times	Often	Very often
၈၀ <sub>၀</sub>	၈၀ <sub>၁</sub>	၈၀ <sub>၂</sub>	၈၀ <sub>၃</sub>	၈၀ <sub>၄</sub>

**1.4 How often do you drive when you have a minor illness like a cold ?**

Never	Rarely	Some- times	Often	Very often
၈၀ <sub>၀</sub>	၈၀ <sub>၁</sub>	၈၀ <sub>၂</sub>	၈၀ <sub>၃</sub>	၈၀ <sub>၄</sub>

**1.5 How often do you have to drive late at night, in the early morning or the post-lunch period?**

Never	Rarely	Some- times	Often	<b>Very often</b>
၈၀ <sub>၀</sub>	၈၀ <sub>၁</sub>	၈၀ <sub>၂</sub>	၈၀ <sub>၃</sub>	၈၀ <sub>၄</sub>

**1.6 How often do you have to drive for long periods?**

Never	Rarely	Some- times	Often	<b>Very often</b>
၈၀ <sub>၀</sub>	၈၀ <sub>၁</sub>	၈၀ <sub>၂</sub>	၈၀ <sub>၃</sub>	၈၀ <sub>၄</sub>

**1.7 How often do you have to drive after prolonged work?**

Never	Rarely	Some- times	Often	<b>Very often</b>
၀၀	၀၁	၀၂	၀၃	၀၄

UNDER PEER REVIEW

1.8 How often do you feel you are distracted when you drive?

Never	Rarely	Sometimes	Often	<b>Very often</b>
၈၀၀	၈၀၁	၈၀၂	၈၀၃	၈၀၄

1.9 How often do you listen to the radio or other forms of in-car entertainment when you drive?

Never	Rarely	Sometimes	Often	<b>Very often</b>
၈၀၀	၈၀၁	၈၀၂	၈၀၃	၈၀၄

1.10 How often do you have conversations with passengers when you drive?

Never	Rarely	Sometimes	Often	<b>Very often</b>
၈၀၀	၈၀၁	၈၀၂	၈၀၃	၈၀၄

1.11 How do you rate your driving skills?

Not very good	Below average	Average	Above average	<b>Very good</b>
၈၀၀	၈၀၁	၈၀၂	၈၀၃	၈၀၄

1.12 How do others rate your driving skills?

Not very good	Below average	Average	Above average	<b>Very good</b>
---------------	---------------	---------	---------------	------------------

၈၀၀                      ၈၀၁                      ၈၀၂                      ၈၀၃                      ၈၀၄

1.13 How often do you have to drive in bad weather conditions?

Never                      Rarely                      Some-  
times                      Often                      **Very often**

၈၀၀                      ၈၀၁                      ၈၀၂                      ၈၀၃                      ၈၀၄

1.14 How often do you drive over the speed limit?

Never                      Rarely                      Some-  
times                      Often                      **Very often**

၈၀၀                      ၈၀၁                      ၈၀၂                      ၈၀၃                      ၈၀၄

1.15 How often do you indicate hostility to other drivers?

Never                      Rarely                      Some-  
times                      Often                      **Very often**

၈၀၀                      ၈၀၁                      ၈၀၂                      ၈၀၃                      ၈၀၄

1.16 How often do you have lapses of concentration when driving?

Never                      Rarely                      Some-  
times                      Often                      **Very often**

၈၀၀                      ၈၀၁                      ၈၀၂                      ၈၀၃                      ၈၀၄

1.17 How often do you use your mobile phone when driving?

Never

Rarely

Some-  
times

Often

**Very often**

၈၀၀

၈၀၁

၈၀၂

၈၀၃

၈၀၄

UNDER PEER REVIEW

## SECTION 2: YOUR JOB

We would like to ask you some questions about you and work. If you are not working go to the next section.

### 2.1 a) What is your job title?

---

b) Is the job full-time or part-time? (Full-time: 30 hours per week or more, Part time: up to 30 hours per week)

Please tick ONE box.

Full-time	<input type="checkbox"/>
Part-time	<input type="checkbox"/>

c) Is your job permanent, temporary/casual, or fixed contract? Please tick ONE box.

Permanent	<input type="checkbox"/>
Temporary/casual	<input type="checkbox"/>
Fixed contract	<input type="checkbox"/>

d) Which one of the following best describes your current position at work.

Please tick one box.

Self-employed (25+ employees*)	<input type="checkbox"/>	Manager (25+ employees*)	<input type="checkbox"/>
Self-employed (less than 25 employees*)	<input type="checkbox"/>	Manager (less than 25 employees*)	<input type="checkbox"/>
Self-employed (no employees*)	<input type="checkbox"/>	Supervisor	<input type="checkbox"/>
		Employee	<input type="checkbox"/>

(\* Total number in Company, not just those of whom you are in charge).

e) In this job, how many hours per week do you work on average? \_\_\_\_\_

f) What is your work pattern?

Fixed hours	<input type="checkbox"/>
Flexi-time	<input type="checkbox"/>
Shift work	<input type="checkbox"/>

### SHIFTWORKERS ONLY

g) What is the length of your current shift?

6hrs	80
8hrs	81
12hrs	82
Other	

UNDER PEER REVIEW

The following questions are designed to give a quick overview of your job characteristics.

Please tick the appropriate box.

**2.2 Do you work long or unsociable hours (shiftwork, at night, on call, unpredictable hours)?**

Never	Rarely	Some- times	Often	<b>Very often</b>
-------	--------	----------------	-------	-------------------

၈၀၀	၈၀၁	၈၀၂	၈၀၃	၈၀၄
-----	-----	-----	-----	-----

**2.3 How often are you exposed to noise at work ?**

Never	Rarely	Some- times	Often	<b>Very often</b>
-------	--------	----------------	-------	-------------------

၈၀၀	၈၀၁	၈၀၂	၈၀၃	၈၀၄
-----	-----	-----	-----	-----

**2.4 Do you have a demanding job (have to work fast, intensively etc)?**

Never	Rarely	Some- times	Often	<b>Very often</b>
-------	--------	----------------	-------	-------------------

၈၀၀	၈၀၁	၈၀၂	၈၀၃	၈၀၄
-----	-----	-----	-----	-----

**2.5 Do you have a choice in what you do or how you do your job?**

Never	Rarely	Some- times	Often	<b>Very often</b>
-------	--------	----------------	-------	-------------------

၈၀၀	၈၀၁	၈၀၂	၈၀၃	၈၀၄
-----	-----	-----	-----	-----

**2.6 Do you have a great deal of say in decisions at work?**

Never	Rarely	Some- times	Often	<b>Very often</b>
-------	--------	----------------	-------	-------------------

၈၀၀	၈၀၁	၈၀၂	၈၀၃	၈၀၄
-----	-----	-----	-----	-----

**2.7 Do you have a lot of support at work (from colleagues and superiors)?**

Never	Rarely	Some- times	Often	<b>Very often</b>
-------	--------	----------------	-------	-------------------

၈၀၀	၈၀၁	၈၀၂	၈၀၃	၈၀၄
-----	-----	-----	-----	-----

**2.8 Do you have constant pressure due to a heavy workload ?**

Never	Rarely	Some- times	Often	<b>Very often</b>
၈၀	၈၁	၈၂	၈၃	၈၄

**2.9 Work rarely lets me go, it is still on my mind when I go home**

Never	Rarely	Some- times	Often	<b>Very often</b>
၈၀	၈၁	၈၂	၈၃	၈၄

**2.10 Do you receive the respect you deserve from superiors and colleagues?**

Never	Rarely	Some- times	Often	<b>Very often</b>
၈၀	၈၁	၈၂	၈၃	၈၄

**2.11 Do you feel your efforts and achievements at work are appropriately rewarded?**

Never	Rarely	Some- times	Often	<b>Very often</b>
၈၀	၈၁	၈၂	၈၃	၈၄

**2.12 Are you satisfied with your job?**

Never	Rarely	Some- times	Often	<b>Very often</b>
၈၀	၈၁	၈၂	၈၃	၈၄

**2.13 Do family matters (and other things outside work) interfere with your work?**

Never	Rarely	Some- times	Often	<b>Very often</b>
၈၀	၈၁	၈၂	၈၃	၈၄

**2.14 Does your job interfere with family life or other activities outside work?**

Never	Rarely	Some- times	Often	<b>Very often</b>
၈၀	၈၁	၈၂	၈၃	၈၄

**2.15 In general, how do you find your job?**

Not at all stressful	Mildly stressful	Moderately stressful	Very stressful	Extremely stressful
$\mathcal{D}_0$	$\mathcal{D}_1$	$\mathcal{D}_2$	$\mathcal{D}_3$	$\mathcal{D}_4$

UNDER PEER REVIEW

SECTION 3: YOUR GENERAL WELL-BEING

Please read each item and then tick the box next to the reply that comes closest to how you have been feeling in the past week. Try to give your first reaction. This will probably be more accurate than spending a long time thinking about an answer. Please answer all questions, and tick only ONE BOX per question.

- |  |  |
|--|--|
| <p><b>a) I feel tense or wound up</b></p> <p>Most of the time <input type="checkbox"/></p> <p><b>☐<sub>0</sub></b></p> <p>A lot of the time <input type="checkbox"/></p> <p><b>☐<sub>1</sub></b></p> <p>From time to time, occasionally <input type="checkbox"/></p> <p><b>☐<sub>2</sub></b></p> <p>Not at all <input type="checkbox"/></p> <p><b>☐<sub>3</sub></b></p>  | <p><b>b) I feel as if I am slowed down</b></p> <p>Nearly all the time <input type="checkbox"/></p> <p><b>☐<sub>0</sub></b></p> <p>Very often <input type="checkbox"/></p> <p><b>☐<sub>1</sub></b></p> <p>Sometimes <input type="checkbox"/></p> <p><b>☐<sub>2</sub></b></p> <p>Not at all <input type="checkbox"/></p> <p><b>☐<sub>3</sub></b></p>   |
| <p><b>c) I still enjoy the things I used to enjoy</b></p> <p>Definitely as much <input type="checkbox"/></p> <p><b>☐<sub>0</sub></b></p> <p>Not quite so much <input type="checkbox"/></p> <p><b>☐<sub>1</sub></b></p> <p>Only a little <input type="checkbox"/></p> <p><b>☐<sub>2</sub></b></p> <p>Hardly at all <input type="checkbox"/></p> <p><b>☐<sub>3</sub></b></p>   | <p><b>d) I get a sort of frightened feeling like “butterflies” in the stomach</b></p> <p>Not at all <input type="checkbox"/></p> <p><b>☐<sub>0</sub></b></p> <p>Occasionally <input type="checkbox"/></p> <p><b>☐<sub>1</sub></b></p> <p>Quite often <input type="checkbox"/></p> <p><b>☐<sub>2</sub></b></p> <p>Very often <input type="checkbox"/></p> <p><b>☐<sub>3</sub></b></p>                                       |
| <p><b>e) I get a sort of frightened feeling as if something awful is about to happen</b></p> <p><input type="checkbox"/></p> <p><b>☐<sub>0</sub></b></p> <p>Very definitely and quite badly <input type="checkbox"/></p> <p><b>☐<sub>1</sub></b></p> <p>Yes, but not too badly <input type="checkbox"/></p> <p><b>☐<sub>1</sub></b></p> <p>A little, but it doesn't worry me <input type="checkbox"/></p> <p><b>☐<sub>2</sub></b></p> <p>Not at all <input type="checkbox"/></p> <p><b>☐<sub>3</sub></b></p> | <p><b>f) I have lost interest in my appearance</b></p> <p>Definitely <input type="checkbox"/></p> <p><b>☐<sub>0</sub></b></p> <p>I don't take as much care as I should <input type="checkbox"/></p> <p><b>☐<sub>1</sub></b></p> <p>I may not take quite as much care <input type="checkbox"/></p> <p><b>☐<sub>2</sub></b></p> <p>I take just as much care as ever <input type="checkbox"/></p> <p><b>☐<sub>3</sub></b></p> |
| <p><b>g) I can laugh and see the funny side of things</b></p> <p>As much as I always could <input type="checkbox"/></p> <p><b>☐<sub>0</sub></b></p> <p>Not quite so much now <input type="checkbox"/></p> <p><b>☐<sub>1</sub></b></p>  | <p><b>h) I feel restless as if I have to be on the move</b></p> <p>Very much indeed <input type="checkbox"/></p> <p><b>☐<sub>0</sub></b></p> <p>Quite a lot <input type="checkbox"/></p> <p><b>☐<sub>1</sub></b></p>   |

Definitely not so much now ☐ <sub>2</sub>	☐ <sub>2</sub>	Not very much
Not at all ☐ <sub>3</sub>	☐ <sub>3</sub>	Not at all
<b>i) Worrying thoughts go through my head</b>		<b>j) I look forward with enjoyment to things</b>
A great deal of the time ☐ <sub>0</sub>	☐ <sub>0</sub>	As much as I ever did
A lot of the time ☐ <sub>1</sub>	☐ <sub>1</sub>	Rather less than I used to
From time to time but not too often ☐ <sub>2</sub>	☐ <sub>2</sub>	Definitely less than I used to
Only occasionally ☐ <sub>3</sub>	☐ <sub>3</sub>	Hardly at all
<b>k) I feel cheerful</b>		<b>l) I get sudden feelings of panic</b>
Not at all ☐ <sub>0</sub>	☐ <sub>0</sub>	Very often indeed
Not often ☐ <sub>1</sub>	☐ <sub>1</sub>	Quite often
Sometimes ☐ <sub>2</sub>	☐ <sub>2</sub>	Not very often
Most of the time ☐ <sub>3</sub>	☐ <sub>3</sub>	Not at all
<b>m) I can sit at ease and feel relaxed</b>		<b>n) I can enjoy a good book or radio or TV programme</b>
Definitely ☐ <sub>0</sub>	☐ <sub>0</sub>	Often
Usually ☐ <sub>1</sub>	☐ <sub>1</sub>	Sometimes
Not often ☐ <sub>2</sub>	☐ <sub>2</sub>	Not often
Not at all ☐ <sub>3</sub>	☐ <sub>3</sub>	Very seldom

**3.2 Over the past 12 months, how would you say your health in general has been?**

Very good	Good	Fair	Bad	Very bad
☐ <sub>0</sub>	☐ <sub>1</sub>	☐ <sub>2</sub>	☐ <sub>3</sub>	☐ <sub>4</sub>

**3.3 How do you find life in general? Please tick one box only.**

Not at all stressful	Mildly stressful	Moderately stressful	Very stressful	Extremely stressful
၈၀၀	၈၀၁	၈၀၂	၈၀၃	၈၀၄

SECTION 4: ACCIDENTS AND INJURIES

4.1 Thinking about the last 12 months, have you had any accidents WHILE YOU WERE WORKING that required medical attention from someone else (e.g. a first aider, GP, nurse or hospital doctor)?

None	1	2	3	4	5	6	More than 6
၈၀၀	၈၀၁	၈၀၂	၈၀၃	၈၀၄	၈၀၅	၈၀၆	၈၀၇
							Please specify

4.2 How many accidents requiring medical attention have you had OUTSIDE work in the last 12 months?

None	1	2	3	4	5	6	More than 6
၈၀၀	၈၀၁	၈၀၂	၈၀၃	၈၀၄	၈၀၅	၈၀၆	၈၀၇
							Please specify

4.3 In the last 12 months how frequently have you had minor injuries that did not require medical attention?

a) at work

Not at all	Rarely	Occasionally	Quite frequently	Very frequently
၈၀၀	၈၀၁	၈၀၂	၈၀၃	၈၀၄

b) outside of work

Not at all	Rarely	Occasionally	Quite frequently	Very frequently
☐ <sub>0</sub>	☐ <sub>1</sub>	☐ <sub>2</sub>	☐ <sub>3</sub>	☐ <sub>4</sub>

4.4 How frequently do you find that you have problems of memory (e.g. forgetting where you put things), attention (e.g. failures of concentration), or action (e.g. doing the wrong thing)?

a) at work

Not at all	Rarely	Occasionally	Quite frequently	Very frequently
☐ <sub>0</sub>	☐ <sub>1</sub>	☐ <sub>2</sub>	☐ <sub>3</sub>	☐ <sub>4</sub>

b) outside of work

Not at all	Rarely	Occasionally	Quite frequently	Very frequently
☐ <sub>0</sub>	☐ <sub>1</sub>	☐ <sub>2</sub>	☐ <sub>3</sub>	☐ <sub>4</sub>

4.5 Thinking about the last 12 months, have you been involved in any traffic accidents resulting in injuries that required medical attention from someone else (e.g. a first aider, GP, nurse or hospital doctor)?

None	1	2	3	4	5	6	More than 6
☐ <sub>0</sub>	☐ <sub>1</sub>	☐ <sub>2</sub>	☐ <sub>3</sub>	☐ <sub>4</sub>	☐ <sub>5</sub>	☐ <sub>6</sub>	☐ <sub>7</sub>

4.6 Thinking about the last 12 months, have you been involved in any traffic accidents not involving injuries?

None	1	2	3	4	5	6	More than 6
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$\theta_0$     $\theta_1$     $\theta_2$     $\theta_3$     $\theta_4$     $\theta_5$     $\theta_6$     $\theta_7$    6

UNDER PEER REVIEW