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Identifying an Appropriate Driving Behaviour Scale for the Occupational Driving Context:

The DBQ vs the ODBQ

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## Abstract

Self reported driving behaviour in the occupational driving context has typically been measured through scales adapted from the general driving population [i.e., the Manchester Driver Behaviour Questionnaire, (DBQ), Reason et al., 1990]. However, research suggests that occupational driving is influenced by unique factors operating within the workplace environment, and thus, a behavioural scale should reflect those behaviours prevalent and unique within the driving context. To overcome this limitation, Newnam et al. (in press) developed the Occupational Driver Behaviour Questionnaire [(ODBQ), Newnam et al., in press] which utilises a relevant theoretical model to assess the impact of the broader workplace context on driving behaviour. Although the theoretical argument has been established, research is yet to examine whether the ODBQ or the DBQ is a more sensitive measure of the workplace context. As such, this paper identifies selected organisational factors (i.e., safety climate and role overload) as predictors of the DBQ and the ODBQ and compares the relative predictive value in both models. In undertaking this task, 248 occupational drivers were recruited from a community-oriented nursing population. As predicted, hierarchical regression analyses revealed that the organisational factors accounted for a significantly greater proportion of variance in the ODBQ than the DBQ. These findings offer a number of practical and theoretical applications for occupational driving practice and future research.

## Identifying an Appropriate Driving Behaviour Scale for the Occupational Driving Context:

## The DBQ vs the ODBQ

**1. Introduction**

Occupational driving accidents are the most common cause of death and injury in the workplace (Haworth, Tingvall, & Kowadlo, 2000; Newnam & Watson, 2011; Murray et al., 2003). According to the Australian Safety and Compensation Council (2006), over one quarter (29%) of occupational fatalities occur whilst driving. Similar results have also been reported in other countries. For example, in the United States, from a total of 5071 work fatalities, 1433 were due to traffic crashes (Bureau of Labour Statistics, 2009). Driver safety is thus, a growing concern that needs to be addressed by all organisations that employ occupational drivers.

Given the extent of the occupational driving problem, attention has focused on identifying the organisational-level antecedents influencing driving behaviour. Particular attention has been given to investigating organisational level constructs, such as safety climate (e.g., Newnam, Watson, & Murray, 2002; 2004; Wills, Watson, & Biggs, 2009) and role overload (Wills, Watson, & Biggs, 2006). Past research has found a relationship between employee's perceptions of the value given to safe driving practices, experience of work pressure and driving behaviour. Specifically, Wills et al. (2009) found that safety climate emerged as the primary predictor of occupational driving behaviour, over situational factors and person-related factors including attitudes and perceived behavioural control. Furthermore, Wills et al., (2006) found that work pressure had a significant relationship to driving while distracted.

Although these studies demonstrate the role of the organisational context in influencing occupational driver behaviour, there are limitations associated with the behavioural measures utilised within these studies. Specifically, Wills et al (2006, 2009) utilised the Manchester Driver Behaviour Questionnaire (DBQ; Lawton, Parker, Manstead & Stradling, 1997) to assess occupational driving behaviour. Although this application of the

DBQ has been well established in the general driving population, Newnam et al. (in press) identified three limitations in utilising the DBQ within the occupational driving context.

First, past research has utilised various versions of the DBQ and, thus, no clear factor structure has emerged. For instance, research utilising the 28-item version of the DBQ within a sample of 378 professional New Zealand truck drivers found that DBQ items fell on four factors (errors, lapses, violations and aggressive violations) (Sullman et al., 2002); whilst a six factor solution (errors, aggressive violations, speeding violations, action slips, inattention lapses, under pressure) emerged in a study assessing the aberrant driving behaviours of 400 company vehicle drivers (Dimmer & Parker, 1999). Davey et al. (2007) attempted to overcome this limitation by utilising the complete DBQ (i.e., Lawnton et al., 1997); however, interpretation of the factors was difficult as several items were identified with cross loadings above the recommended .4 cut-off. Establishing a clear factor structure is important as it provides an understanding of those behaviours unique and prevalent within the driving context and promotes consistency in the comparison of driving behaviours across studies.

A second limitation associated with utilising the DBQ in the occupational driving context relates to identifying context-specific behaviours. Specifically, the DBQ does not incorporate items specifically designed to address behavior prevalent to the occupational driving context. For example, the DBQ does not include cognitive behaviours such as inattention due to thinking of work tasks. Third, some of the behaviors included in adapted DBQ scales lack conceptual clarity when utilized in the occupational safety setting, in so far as they include reference to safety outcomes such as near misses.

To overcome these limitations, the Occupational Driver Behaviour Questionnaire (ODBQ, Newnam et al., in press) was developed. The ODBQ assesses four driving dimensions including speeding, inattention, rule violation and tiredness while driving. Although many of the items included in the ODBQ are also assessed in the DBQ (i.e., deliberate speeding, tiredness while driving, rule violations), the ODBQ was designed to identify those behaviours unique and prevalent within the occupational driving context. The

ODBQ also includes new items related to inattention while driving, which has been found to have a direct and negative impact on occupational safety outcomes (Salminen & Lahdeniemi, 2002).

In this paper, we aim to establish further support for the ODBQ as an appropriate behavioural assessment scale for the occupational driving context by comparing its ability to predict organisational factors with the DBQ. It is argued that the identification of an appropriate behavioural scale for the occupational driving context will not only inform the theoretical application of driving behaviour scales, it will also assist in the development of interventions designed to improve safety outcomes. The following review will develop this argument and provide a foundation for the use of context-specific behavioural assessment scales.

### *1.1 The ODBQ*

The ODBQ was developed to overcome the limitations of adapting driving behaviour scales from a population (ie., general driving population) with different goal perspectives. Although the authors of the ODBQ did not dispute the fact that the fundamental task of driving a car is the same regardless of the purpose of journey (work or personal), they did argue that the workplace is unique and that a behavioral taxonomy should identify those behaviors prevalent and relevant to the workplace context. To identify the driving behaviours, the ODBQ was developed utilising a relevant theoretical framework to determine the kinds of behavior that are likely to be prevalent at work. The authors utilised Hockey's (1997) cognitive energetical theory which considers the effect of workplace conditions, stress and job demands on behaviour at work.

This theory postulates that when individuals are faced with role overload and competing task demands, they attempt to maintain high priority goals via regulatory strategies (Hockey, 1997). The regulatory strategies identified within Hockey's model include strategic adjustment, subsidiary task failure, and compensatory costs. Strategic adjustment is defined as a shift to less effortful modes of processing under stress. Subsidiary task failure involves a narrowing of attention to primary job tasks while neglecting secondary tasks and compensatory

costs occur when individuals maintain primary performance by increasing effort above their subjective limits for maximum effort expenditure.

Newnam et al. (in press) adopted this theory to further understand the occupational driving task. The authors argued that in situations of stress and work overload elements of the driver task will be protected via these regulatory strategies. However, these strategies are associated with latent cognitive and behavioral costs, including fatigue and strain, the use of less complex information management strategies, and decrements in secondary task performance. As such, to maintain the primary task of driving, the driver may take short-cuts or engage in strategies that reduce the load on driving, which subsequently results in unsafe driver behavior. Newnam et al. argued that under conditions of role overload, productivity would be maintained as drivers adopt regulatory strategies which result in driving decrements including rule violation and speeding (strategic adjustment), inattention (subsidiary task failure) and driving while tired (compensatory costs). These four behaviours comprise the ODBQ.

The strength of the ODBQ is that, through utilising a strong theoretical foundation in the test construction phase, the authors were able to identify those behaviours prevalent and unique to the occupational driving context. In regards to the psychometric properties of the scale, the factorial structure of the ODBQ was supported and the scale was shown to have good reliability and validity (construct and criterion) across three samples of occupational drivers. In addition to the original scale development paper, other research has demonstrated support for the ODBQ subscales, with reliability analyses showing Cronbach alpha coefficients greater than .70 (Newnam & Watson, 2011a). As such, the theoretically derived and psychometrically sound ODBQ presents a possible alternative to the DBQ in studies examining the influence of organisational factors on unsafe driving behaviour.

In summary, we argue that driving behaviour scales should be context specific and designed to incorporate those behaviours prevalent and unique to the driving task. Based on the fact that the DBQ was developed on a model of human error and individual differences, the underlying structure of the DBQ may not necessarily be relevant to the occupational driving context. In contrast, the ODBQ has overcome some of the limitations associated with

utilising the DBQ, through considering the impact of workplace conditions on driver behaviour. Given that past research has focused on identifying the organisational antecedents of occupational driving performance, this study assesses whether organisational factors are better predictors of the ODBQ than the DBQ. Specifically, this study identifies safety climate and role overload as the organisational antecedents of occupational driving behaviour. A review of the evidence for including each of these constructs is provided below.

### *1.2 Safety Climate*

An organisational climate is formed when perceptions are shared by members of the organisation (Reichers & Schneider, 1990), and these perceptions can be studied at multiple levels of the organisation (e.g., individual, group, organisational). This study will be focusing on the psychological climate, which is conceptualised as an individual level construct as it refers to a process whereby individuals attribute meaning and value to features of their work environment (James & James, 1989). In an organisational setting, there are specific types of climates which reflect aspects of the work environment, including service (Schneider et al., 1998), innovation (Anderson & West, 1998), and safety (Zohar, 1980).

An individual's perception of the organisational safety climate has been defined as employees' perceptions of the priority given to safety over competing task demands (Griffin & Neal, 2000; Zohar, 1980). Based on these perceptions of safety, individuals evaluate the priority given to safety within the organisation, which in turn, informs behaviour-outcome expectancies (Zohar, 2010). Past research has found support for the relationship between safety climate and outcome measures such as, accident rates (Zohar, 2000), self-reported accident involvement (Mearns, Whittaker, & Flin, 2003), self-reported safety behaviours (e.g., Hofmann & Stetzer, 1996, Griffin & Neal, 2000), and frequency of compensation claims (O'Toole, 2002). Furthermore, past research in the occupational driving context has established the role of safety climate perceptions as an important antecedent to driving behaviour (Will et al., 2006; Wills et al., 2009) and self-reported crashes (Newnam, Griffin, &



Mason, 2008). Based on these investigations, the present study considered safety climate an important antecedent of occupational driving behaviour.

### *1.3 Role overload*

Role overload occurs when work demands exceed workers perceived capabilities or available resources (Kahn et al., 1964). For example, an employee may experience overload if a task is perceived too difficult to achieve, or when there are too many tasks to complete, and not enough time for task completion. Kahneman & Tversky (1973) proposed that when workers experience overload, resources are likely to be allocated to priority tasks, such as productivity and this, in turn, can result in decreased attention to extra-role responsibilities, such as safety. Support for this notion was found by Turner, Chmiel and Walls (2005) who discovered that employees who experienced greater job pressure were less likely to regard safety as part of their work role. Further, Paoli and Merllie (2001) surveyed a range of work environments within the European Union and demonstrated a relationship between work pressure and workplace accidents. Specifically, employees who reported conditions of role overload and excessive job pressure reported less safe work practices and more absences resulting from work accidents.

The relationship between role overload and workplace accidents has also been demonstrated in the occupational driving field. As productivity demands often result in unrealistic work schedules and lack of sufficient time for task completion (Stradling, Meadows & Beatty, 2000), drivers under conditions of overload may, therefore, employ unsafe driving practices such as speeding and rule violation in order to successfully complete competing job demands. One explanation for this finding is that employees may place more importance on getting to work on time, or completing a 'necessary' task urgently, than on obeying speed limits. Other research has also suggested that role overload has deleterious effects on attention (Downs et al., 1999; Salminen & Lahdeniemi, 2002) and fatigue (Harrison, Mandryk & Frommer, 1993; Haworth et al., 2000; Legree et al., 2003). Thus, excessive work demands seem to impact significantly on employees driving behaviour, which

may contribute to the greater accident risk experienced in the occupational driving population. As such, this study will examine role overload as an organisational factor influencing occupational driving behaviour.

#### *1.4 Research Hypotheses*

In summary, given the DBQ and ODBQ were conceptualised on different theoretical frameworks and goal perspectives, this paper argues that these behaviour scales are designed for their predetermined driving context, namely the general and occupational driving contexts. Specifically, as the ODBQ was conceptualised in a framework of workplace performance, it is argued that this scale is more applicable to the workplace context than the DBQ. As such, this paper aims to test this assumption through comparing whether the workplace effects of safety climate and role overload explain more variance in the ODBQ or the DBQ. Thus, it is hypothesised that:

*Hypothesis 1:* Organisational factors, including safety climate and role overload will account for a significantly higher proportion of the variance in the ODBQ than the DBQ.

#### *1.5 Control Measures*

The following variables were included as controls in this study; kilometres driver per week for occupational purposes (mileage) and age. Research has found that on average occupational drivers attain higher mileage than motorists in the general driving population (Griffiths, 1997), which has been suggested as one possible reason for their increased crash risk (Downs et al., 1999). Research also suggests that younger drivers are more frequently involved in accidents than older and more experienced drivers (Caird & Kline, 2004). As such, kilometres driven and age were included as controls in this study.

## **2. Method**

### *2.1 Participants*

A total of 248 drivers from a community based nursing organisation in Australia volunteered to participate in this study. Of these drivers, 10% were male and 90% were

female which is representative of the nursing industry (Australian Institute of Health and Welfare, 2009). Participants' ages ranged from 20-72 years ( $SD = 9.51$ ), with an average age of 50 years. Finally, participants drove an average of 268 km's per week ( $SD = 230.03$ ; range = 5 to 1300 km/week) and 19.4 hours ( $SD = 36.69$ ; range = 1 to 30 hours/week). To be included in the study individuals had to drive at least once per week for occupational purposes.

## 2.2 Procedure

Driver names were obtained through the Human Resource department within the participating organisation. After obtaining ethical clearance through the participating university, a self-report questionnaire was distributed to drivers via the organisations internal mail system. Participation was voluntary and drivers were informed via the information sheet that responses would remain confidential. Reply-paid envelopes were provided to participants so that they could return the completed questionnaires anonymously. In total, 829 questionnaires were distributed and 248 were returned, thus representing an overall response rate of 29%. Although the response rate was relatively low, it is similar to that of other occupational driving studies that utilised self-report questionnaires (i.e. Davey et al., 2007; Rowden, Watson, & Biggs, 2006; Strahan, Watson, & Lennon, 2008).

## 2.3 Measures

*Driver Behaviour Questionnaire.* An extended, 20-item version of the Manchester Driver Behaviour Questionnaire (Lawnton et al., 1997; Reason et al., 1980) was utilised. This version of the DBQ was most commonly employed in recent occupational driving studies (Davey et al., 2006; Freeman et al., 2008; Newnam et al., 2002; Salminen & Lahdeniemi, 2002; Wills et al., 2006). This version of the questionnaire consisted of three subscales: errors (8 items), ordinary violations (8 items) and aggressive violations (4 items). Minor modifications were made in these studies to adapt the questionnaire to the occupational setting. Items were measured on a Likert scale from *never* (1) to *nearly all the time* (5).

*Occupational Driver Behaviour Questionnaire.* The newly developed ODBQ (Newnam et al., in press) was utilised in this study. The ODBQ consists of a twelve item scale that contains four subdimensions: speeding, inattention, rule violation and driving while tired. The list of items included in the ODBQ is included in the Appendix. Items were measured on a 5-point Likert scale, ranging from *rarely or never* (1) to *very often* (5).

*Safety Climate.* Drivers' perceptions of their supervisor's safety values were measured using three items from the managerial values dimensions of Griffin and Neal's (2000) Safety Climate Scale. Items included were "My supervisor places a strong emphasis on motor vehicle safety", "Motor vehicle safety is given a high priority by my supervisor" and "My supervisor considers motor vehicle safety to be important". All items were measured on a 5-point Likert scale of *strongly disagree* (1) to *strongly agree* (5).

*Role overload.* Role overload was assessed using four items from Caplan et al., (1980). Items included were "How often does your job require you to work very fast?", "How often do your work duties require you to work very hard?", "How often is there a great deal of work/duties to be done?", "How often do your work duties leave you with little time to get things done?" Items were measured on a 5-point Likert scale from *rarely or never* (1) to *very often* (5).

*Control Measures.* Participants were asked to indicate their age and how many kilometres they drive per week for occupational purposes. Spaces were provided for participants to report their age and mileage.

### **Table 1 and 2 here**

#### *2.4 Analysis*

To assess the hypothesis, two stepwise hierarchical regression analyses were conducted to explore the profile of factors that predict the DBQ and the ODBQ. Organisational variables (safety climate and role overload) were entered at step 2 in separate regression analyses with either the DBQ or the ODBQ as the DV. In all the analyses, age and mileage were entered as control variables in step 1, and a significance level of  $p = .05$  was used.

### 3. Results

#### 3.1 Data Cleaning

The data were analysed using SPSS version 18. Prior to conducting analyses, the data file was examined for accuracy of data entry, missing values and outliers. Two cases were deleted from the analysis as they contained over 90% missing data, resulting in a final sample size of 246. Missing values analysis revealed that a further 5% of cases had missing data; however no data imputations were performed as Little's MCAR test indicated that data were missing completely at random ( $\chi^2 = 2167.45$ ,  $df = 2355$ ,  $p = .99$ ). As the large sample size ( $N = 246$ ) provided adequate power, the remaining cases with missing values were deleted via listwise deletion. Multivariate outliers were also examined through Mahalanobis distance. One outlier was identified which had a significant impact on results (Std. residual = 4.99). After the deletion of this outlier, the final sample size was 235.

#### 3.2 Measurement properties

Composite variables for the ODBQ and DBQ were computed by averaging item scores. However, given that there were multiple sub-dimensions of driving behaviour within the ODBQ and the DBQ, this study sought to establish a higher order factor structure to justify the use of creating composite variables for these scales. Given that the ODBQ and the DBQ both assess a similar higher order construct (unsafe driving behaviour) there was potentially high overlap between the sub-dimensions. As such, two separate exploratory factor analyses were conducted, one using the ODBQ dimensions speeding, rule violations, inattention and driving while tired, and another on the DBQ dimensions, errors, violations and aggressive violations. Principle components analysis revealed a one factor solution within the analyses, and both models accounting for 51% of the variance in the data. The factor was extracted using the criterion of eigenvalues greater than 1. The eigenvalue for the DBQ factor was 1.58 and the eigenvalue for the ODBQ factor was 2.01. We then conducted principal axis factoring on each one factor structure to obtain the factor matrix loadings (see Table 1 and Table

2). The one factor solutions indicated that composite measures of the ODBQ and the DBQ could be used to assess the relationship between organisational factors and driving behaviours.

### 3.3 Descriptive Statistics

Table 3 presents the means, standard deviations, Cronbach alphas and bivariate correlations for the study variables. Cronbach alphas demonstrated that all scales exhibited sound reliability (Cronbach alpha > .74). Descriptive statistics revealed that participants reported low to moderate levels of unsafe driving behaviour (as indicated by mean scores on the DBQ and ODBQ). Further, bivariate correlations demonstrated several significant relationships between the organisational factors, and the ODBQ and the DBQ. Specifically, role overload demonstrated a moderate and positive correlation with the ODBQ ( $r = .35, p < .001$ ) and DBQ ( $r = .19, p < .001$ ) which suggests that drivers are more likely to report unsafe driving behaviour on both the ODBQ and DBQ, under conditions of high workload. Moderate negative relationships were also identified for safety climate and the ODBQ ( $r = -.20, p < .05$ ) and the DBQ ( $r = -.24, p < .001$ ). These findings suggest that drivers who perceived a high safety climate were more likely to report safer driving behaviour on both the ODBQ and DBQ.

**Table 3 here**

### 3.4 Hypothesis Testing

To examine whether the organisational factors (safety climate and role overload) would predict a greater proportion of the variance in the ODBQ than the DBQ, over and above demographic variables and kilometres driven, two hierarchical regression analyses were conducted. Table 4 displays the results of the regression analysis with the ODBQ as the dependent variable, and Table 5 presents the results for the regression with the DBQ as the dependent variable.

**Tables 4 and 5 here**

Overall, the organisational factors and control variables accounted for 18% ( $R^2_{adj} = .16, R = .42$ ) of the variance in the ODBQ,  $F(4, 230) = 12.49, p < .001, \eta = .19$ . Step one

revealed that the control variables accounted for 7% ( $R^2_{adj} = .06$ ) of this variance, with mileage ( $\beta = .21, p = .001$ ) emerging as a significant predictor. Step two revealed that the organisational factors accounted for an additional, and significant 11% of the variance in the ODBQ. Furthermore, observation of the individual effects found that role overload ( $\beta = .29, p < .001$ ) and safety climate ( $\beta = -.14, p < .05$ ) were significant predictors of the ODBQ. Examination of the individual effects sizes revealed a large effect size for role overload ( $\eta = .09$ ) and a small effect for safety climate ( $\eta = .02$ ).

Overall, the model predicting the DBQ revealed that the organisational factors and control variables together accounted for 8% ( $R^2_{adj} = .07, R = .28$ ) of the variance in the DBQ,  $F(4, 230) = 5.03, p < .001, \eta = .11$ . In the first step, the control variables accounted for only .01% of the variance. In step 2, the organisational factors accounted for 7% of the variance within the model. Observation of the individual effects revealed that safety climate ( $\beta = -.21, p < .05$ ) and role overload ( $\beta = .15, p < .05$ ) emerged as significant predictors of the DBQ. Examination of the individual effects sizes revealed small effect sizes for role overload ( $\eta = .03$ ) and safety climate ( $\eta = .03$ ).

In summary, the hypothesis was supported as organisational factors explained a higher proportion of the variance in the ODBQ ( $R^2 = .18, p < .001$ ) than the DBQ ( $R^2 = .08, p < .05$ ), after controlling for age and driving exposure. To provide further support for this hypothesis a statistic developed by Steiger (1980) was adopted to examine whether the organisational factors explained a significantly higher proportion of the variance in the ODBQ than the DBQ. This statistic provides a Z value that is compared to the critical value of  $\pm 1.96$  (see Appendix). The results indicate that the multiple correlation coefficients differed significantly ( $z = 2.07, p < .05$ ) providing support for the hypothesis and demonstrating that the ODBQ accounts for a significantly higher proportion of the variance in organisational factors than the DBQ.

#### 4. Discussion

This study aimed to identify an appropriate tool for assessing occupational driving behaviour by comparing whether the effects of organisational factors explained a higher proportion of the variance in the ODBQ or the DBQ. The argument presented in this paper was that the ODBQ would be a more suitable behavioural measurement tool for the occupational driving context as it was conceptualised on a theoretical framework that accounted for workplace factors in its consideration of performance. In contrast to the DBQ that was developed on a model of human error, we argued that organisational factors would explain a higher proportion of the variance in the ODBQ, and support was found for this hypothesis.

Specifically, this study found that the organisational factors of safety climate and role overload accounted for significantly greater variance in the ODBQ than the DBQ. This suggests that the ODBQ is a more sensitive measure of the workplace environment than the DBQ. This finding is not surprising considering the different goal perspectives (i.e., general driving, occupational driving) adopted in the development of these scales. The results of this study, thus, support the argument that theoretical models or frameworks are important additions in the development of driver behaviour scales for specific driving contexts or groups of drivers.

This study also found that role overload and safety climate were significant predictors of both the ODBQ and the DBQ. This finding is consistent with previous research, which found that role overload adversely affects safe driving behaviour (Newnam, in press, Wills et al., 2006; 2009). Past research has also supported the significant relationship between safety climate and driving behaviour (Wills et al., 2006; 2009). It is important to note that the effect sizes were similar for safety climate and the ODBQ ( $\eta = .02$ ) and the DBQ ( $\eta = .03$ ), while a larger effect size was identified with role overload and the ODBQ ( $\eta = .09$ ), than the DBQ ( $\eta = .03$ ). A possible explanation for these findings is that role overload reflects an individual's cognitive and emotional reaction to their actual resource capacity to satisfy role demands, while



safety climate is an objective evaluation of their supervisors' role in prioritising safety in the workplace. As such, these results suggest that the ODBQ is a more sensitive measure of individual reactions to role demands, rather than features of the work environment that individuals' attribute meaning and value to.

#### *4.1 Practical Applications*

This paper contributes to research in the occupational driving field by identifying an appropriate self-report scale for assessing driving behaviour. Overall, this study identified the ODBQ as a more sensitive measure of the occupational driving context as opposed to the DBQ. As such, these findings offer practical and theoretical applications.

In regards to the practical applications, this study supports the use of the ODBQ as a self-report tool for assessing unsafe driving behaviour in the occupational driving context. At the organisational level, this scale could be utilised as one component of a larger risk management program. Specifically, the ODBQ could be utilised to monitor driving practices or as a diagnostic tool when recruiting drivers, in order to determine those individuals who are more likely to engage in high-risk driving behaviour. However, it should be noted that future research is needed to establish the validity of this scale against objective measurement tools. Specifically, future research could attempt to validate the ODBQ with objective measures of occupational driver behavior, through utilising possibilities such as in-vehicle telemetry devices like intelligent speed adaptation, eye-tracking devices (i.e. attentional behaviors), or utilising distal measures such as driving infractions (e.g. being stopped for speeding, running lights, illegal left-turns, etc.).

A second practical application relates to safety initiatives focused on improving the safety culture. Given the results of this study demonstrated significant relationships between role overload, safety climate, and unsafe driving behaviour, organisations implementing driver-safety initiatives should consider the deleterious influence of excessive role demands and the value given to safety practices by workgroup supervisors. Thus, by effectively

monitoring individual workloads and safety practices, organisations could potentially improve driver behaviour. As such, the findings of this research have strong practical utility.

In regards to the theoretical applications of this study, the results support the argument that a behavioural assessment scale should be context specific, and based on a relevant theoretical framework that accurately identifies those behaviours prevalent and unique within a particular context. These findings have important theoretical applications for the development of future driver behaviour scales in particular driving contexts. For example, crash statistics indicate that young male drivers are particularly at risk; however, no theoretically-derived scale has been developed that specifically identifies those behaviours prevalent within this driving group. As utilising theoretical frameworks enables a comprehensive assessment of antecedents and outcomes of behaviour, future driver behaviour research should strongly consider the implications of the results identified in this study.

#### *4.2 Limitations*

Although this study presented a number of practical and theoretical applications, a number of limitations need to be addressed. First, this study used self-report measures to assess driving behaviour and predictor variables. Although self-report measures are often used in traffic research, these measures are subject to memory biases and participant response biases. Due to social desirability, participants may respond inaccurately to questions assessing undesirable behaviours including aberrant driving. However, this may not be a major issue since Lajunen and Summala (2003) found that driver-behaviour questionnaires incur only minimal social desirability bias. Regardless of this issue, to reduce possible bias in this study, drivers were assured anonymity in their responses by returning the surveys in a replied paid envelope directly to the researcher. Future research should, however, attempt to utilise more objective measures of driver behaviour, such as in vehicle GPS speed monitoring devices.

A second limitation relates to the representativeness of the sample. This study assessed predominantly female drivers from a community nursing organisation. Thus, the results may not generalise to all occupational drivers, especially drivers in other industries and work-

cultures where larger proportions of younger, male drivers are present (Murray et al., 2003). Further, as only 29% of potential occupational drivers responded in this study, the sample may represent those drivers most conscious about driver safety. Past studies have, however, found support for the utility of the ODBQ within diverse samples of occupational drivers (see Newnam & Watson, 2011a; Newnam, Newton & McGregor, 2009).

Finally, as this research utilised a cross sectional design, it was not possible to assess the causal relationships proposed in this study. The relationship between the variables could, therefore, also be explained by reverse causation. For instance, drivers who drive unsafely may do so under a high workload as they have not experienced any unfavourable outcomes in their past driving, such as crashes resulting in delayed or uncompleted work tasks. As such, longitudinal research is needed to provide further validation of the hypothesized causal relationships.

#### *4.3 Conclusion*

In conclusion, the results suggest that the ODBQ is a more sensitive measure of the occupational driving context than the DBQ. Thus, the findings support the original assumption that a driving behaviour questionnaire based on a theoretical framework that takes workplace conditions into its consideration of performance is a more appropriate tool for assessing occupational driving than a tool designed for the general motoring population. As such, these findings have important practical and theoretical implications, including the need for future research to theoretically revise and define those behaviours prevalent within other groups of drivers and driving contexts. This study, thus, contributes to the limited and much needed research assessing driver behaviour in the occupational setting, by uniquely determining a driver behaviour scale sensitive to the workplace context.

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Table 1. Factor Matrix for the ODBQ

Sub-scales	M	SD	ODBQ
Speeding	1.26	.50	.54
Rule violation	1.20	.35	.58
Inattention	2.26	.95	.67
Tiredness	1.50	.58	.55
Total variance explained			51%

Table 2. Factor Matrix for the DBQ

Sub-scales	M	SD	DBQ
Errors	1.12	.16	.49
Ordinary violations	1.15	.21	.56
Aggressive violations	1.19	.30	.49
Total variance explained			51%

Table 3

*Means, standard deviations, variable correlations and Cronbach's alpha (N = 246)*

Variables	M	SD	1	2	3	4	5	6
1. Age	50.53	9.38	—					
2. Mileage	269.22	230.47	-.02	—				
3. Climate	4.34	.79	.21*	-.00	$\alpha = .97$			
4. Role overload	2.89	1.05	-.21*	.07	-.19*	$\alpha = .88$		
5. ODBQ	1.63	.44	-.14*	.23**	-.20*	.35**	$\alpha = .83$	
6. DBQ	1.14	.15	-.08	.04	-.24**	.19*	.60**	$\alpha = .74$

Note. \*  $p < .05$ , \*\*  $p < .001$ .

Table 4

*Hierarchical Regression Analysis of Organisational Variables and the ODBQ (N = 235)*

Predictors	<i>B</i>	$\beta$	<i>SE</i>	$sr^2$	95% CI	$R^2$	$AdjR^2$	$\Delta R^2$
<i>Step 1 – control variables</i>								
Age	-.00	-.04	.00	.00	[-.007, .004]			
Mileage	.00*	.19	.00	.03	[.00, .001]			
						.07	.06	.07**
<i>Step 2 – organisational factors</i>								
Climate	-.06*	-.14	.03	.01	[-.14, -.002]			
Role overload	.**	.30	.03	.08	[.07, .17]			
						.18	.16	.11**

Note. \*  $p < .05$ , \*\*  $p < .001$ .

Table 5

*Hierarchical Regression Analysis of Organisational Variables and the DBQ (N = 235)*

Predictors	<i>B</i>	$\beta$	<i>SE</i>	$sr^2$	95% CI	$R^2$	$AdjR^2$	$\Delta R^2$
<i>Step 1 – control variables</i>								
Age	-.00	-.00	.00	.00	[-.002, .002]			
Mileage	-.00	.00	.00	.00	[.00, .00]			
						.01	.00	.01
<i>Step 2 – organisational factors</i>								
Climate	-.04*	-.21	.01	.02	[-.06, -.01]			
Role overload	.02*	.15	.01	.03	[.004, .04]			
						.08	.07	.07**

Note. \*  $p < .05$ , \*\*  $p < .001$ .

## Appendix: Steiger's (1980) Formulae

$$Z^* = (Z_{ya} - Z_{yb}) \sqrt{\frac{N-3}{2-2s_{ya,yb}}}$$

$$Z_{ya} = (1/2) \ln \left( \frac{1 + r_{ya}}{1 - r_{ya}} \right) \quad \text{and} \quad Z_{yb} = (1/2) \ln \left( \frac{1 + r_{yb}}{1 - r_{yb}} \right)$$

and

$$s_{ya,yb} = \frac{[(r_{ab})(1-2\bar{r}^2)] - [(1/2)(\bar{r}^2)(1-2\bar{r}^2 - r_{ab}^2)]}{(1 - \bar{r}^2)^2}$$

Where  $\bar{r} = (1/2)(r_{ya} + r_{yb})$

$r_{ya}$  and  $r_{yb}$  are the two correlations being compared

$r_{ab}$  is the correlation between the predicted scores for each of the correlations

$N$  is sample size

$$\bar{r} = (1/2)(.43 + .33) = .38$$

$$z_{ya} = (1/2) \ln \left( \frac{1 + .43}{1 - .43} \right) = .47$$

$$z_{yb} = (1/2) \ln \left( \frac{1 + .33}{1 - .33} \right) = .34$$

$$s_{ya,yb} = \frac{[(.60)(1-2*.38^2)] - [(1/2)(.38^2)(1-2*.38^2 - .60^2)]}{(1 - .38^2)^2} = .54$$

$$Z^* = (.47 - .34) \sqrt{\frac{235}{2-2*.54}} = 2.07$$

Appendix: The ODBQ scale items

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ODBQ scale items

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*Speeding*

Deliberately exceed the speed limit on a residential road

Deliberately exceed the speed limit on a highway or freeway

Deliberately exceed the speed limit when travelling to clients or the office

*Rule Violations*

Fail to use your indicators to change lanes when no other traffic is around

Perform a U-turn in a non-designated zone

Fail to come to a complete standstill at a stop sign

*Inattention*

Drive while thinking about how to get to your destination

Drive while thinking about your next patient or work task

Drive while thinking about work-related problems/issues

*Driving while tired*

Drive while tired

Have difficulty driving because of tiredness or fatigue

Find yourself nodding off while driving

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