# Utilising the Driver Behaviour Questionnaire in an Australian Organisational Fleet Setting: Can it Identify Risky Drivers?

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## Abstract

In this study the Manchester Driver Behaviour Questionnaire (DBQ) was employed in an Australian fleet setting to examine the self-reported driving behaviours of a group of professional drivers (N = 4792). Participants agreed to complete surveys advertised through the internal mail system. Analysis of the DBQ revealed a three factor solution with two of these factors consisting of a combination of both aggression and highway code violations from the original DBQ. The results indicate that further to the driving error construct common to both the original and present study's DBQ factor structures, the two additional factors are most accurately represented by aberrant driving behaviours involving low-level aggression and serious highway code violations. Logistic regression analysis revealed that, of the traditional DBQ factors, driving errors was the only significant predictor of self-reported crashes after controlling for driving exposure. However, similar analysis with the modified DBQ factors revealed that both driving errors made and low-level aggression were significant predictors of self-reported crashes. This paper further outlines the major findings of the study, highlights implications regarding professional drivers' involvement with aberrant driving behaviours in fleet-based settings and considers the utility of self-report measures to identify "at risk" drivers.

**Key words:** Driver Behaviour Questionnaire (DBQ), fleet drivers, road safety.

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## Introduction

### DBQ and the present driving context

The Manchester Driver Behaviour Questionnaire (DBQ) is currently one of the most prominent measurement scales to examine self-reported driving behaviours [1]. The DBQ has been extensively utilised in a range of driver safety research areas, such as: age differences in driving behaviour [2], the genetics of driving behaviour [3], cross cultural studies [4] as well as factors contributing to accident involvement [2,5,6] and demerit point loss [7]. In addition to the versatility of the DBQ, it's popularity is demonstrated via the utilisation of the instrument in a number of countries, including China [8], Australia [7,2,9], New Zealand [10], Finland [3], Spain [11] and the United Kingdom [12,5].

The popularity of the DBQ within road safety settings is also reflected in the considerable evolution of the scale since its inception. The original DBQ was developed by [13] and focused on two distinct driving behaviours that were identified as errors and violations. An additional factor referred to as "slips and lapses" was also developed that focused on attention and memory failures, which were traditionally not considered to affect overall road safety. Specifically, such behaviours were associated with attention and memory problems, while errors included more serious mistakes such as failures of observation and misjudgement [1]. Since this time, the original DBQ scale has undergone further modification by [14], incorporating additional items to assess other factors that have been proposed to contribute to driving violations. Currently the scale distinguishes between two forms of violations that are Highway code violations (e.g., speeding & running red lights) and Interpersonal aggressive violations (e.g., chasing another motorists when angry & sounding one's horn).

Given the popularity of the assessment tool, there has been a high level of variation within the literature regarding the number of factors identified from using the DBQ. Firstly, earlier research confirmed the original three factors of errors, violations and lapses [15,16,5]. For instance, Aberg and Rimmo [15] identified inattention and inexperience error factors from a large group of Swedish drivers, but overall found the same factor structure. In contrast, there has been evidence of four factors reported by Sullman and colleagues [10] that focused on errors, lapses, aggressive violations and ordinary violations. Similarly, Lajunen and colleagues [1] identified four factors with a group of UK drivers, and Ozkan and colleagues [17] reported from two to four factors (errors, lapses, speeding & interpersonal violations) when examining the driving behaviours of Finish motorists. In addition to the different number of factors identified, research has generally reported differences in factor structure, as specific items often load on different factors depending on the driving context [7], which ultimately influences the naming and interpretation of each factor. Despite such variability, previous applied research has demonstrated that the DBQ is robust to minor changes to some items that have been made to suit specific cultural and environmental contexts [16,7,18,12]. As highlighted above, the DBQ has been utilised in a number of motorised countries and has thus been translated and modified to tailor a vast array of driving situations.

## Professional drivers and fleet safety

Despite the tremendous amount of research and proven utility of the DBQ to investigate motorists' driving behaviours, there is currently only a small (but expanding) body of knowledge regarding the self-reported driving behaviours of those who drive on public roads for professional reasons [7,19,20,9,10,8]. At first this appears to be a surprising oversight, as early estimates suggest work related road incidents cost approximately AUD$1.5 billion (21), with the hidden costs somewhere between 3-36 times vehicle repair/replacement costs (22). Given evidence suggesting that drivers who drive company sponsored vehicles are at a greater level of risk to accident involvement [20,10], due to either increased exposure to the road or as a result of time pressures and other distractions [23], research is needed to determine the factors associated with negative driving behaviours within fleet settings e.g., crashes.

Nevertheless, in recent times there has been an increasing amount of research focus being directed towards assessing driving attitudes and behaviours within work-settings, as well as attempts to develop methods to identify "at risk" drivers. The DBQ has remained the prominent tool to assess behaviours within such work settings, and similar to general motorist research, findings that have utilised the DBQ have also found variations in the factor structure. For example, research that has focused on taxi, bus, and company drivers have identified three factors [8], truck driving research has demonstrated four factors [10], and earlier research that has focused exclusively on drivers of company vehicles have reported six factors [24]. One of the few Australian studies by Davey and colleagues [7] utilised the DBQ to examine the behaviours of a group of fleet drivers and reported a traditional three-factor solution of errors, aggressive and speeding violations, although it is noted that a greater number of traditional items considered to be speeding violations actually loaded on the aggressive violation factor. That is, the aggressive violations factor consisted of a mixture of emotion-oriented responses to driving situations and traditional highway code violations.

However, apart from research that has focused on the specific factor structure, less research has utilised the DBQ to identify individuals who are engaging in risky driving behaviours. Research by Chliaoutakis and colleagues [25] utilised the DBQ to investigate the relationship between socio-demographic characteristics of urban Crete drivers and aberrant driving behaviours. Although this study gave some indication of the lifestyle characteristics of motorists who are predisposed to risky driving behaviours, results were based on a cross-section of drivers that did not specifically address professional driving conditions. In Australian-based research, Newnam and colleagues [20] utilised aspects of the DBQ to investigate the driving behaviours of 204 individuals who drove for work purposes and identified that participants reported higher crash involvement in their work vehicle compared to private vehicle, and were less likely to engage in vehicle safety checking practices e.g., tyre pressure. Similarly, as noted above, Davey and colleagues [7] utilised the DBQ to examine a group of fleet workers' driving behaviours but found that kilometres driven per year was the only predictor of incurring demerit point losses in the past 12 months. Apart from this research, Australian research that has utilised the DBQ scale has focused on either the driving characteristics of women only [2] consisted of abbreviated DBQ measures [20,26] or contained small sample sizes e.g., <150 [16].

Considering the limited research available in this area, the aim of the present study was to utilise the DBQ to specifically investigate risky on road behaviours within a sample of Australian professional drivers. This study was designed to include a much larger sample of both men and women than previously accessed as well as determine the relationship that DBQ factors have with the likelihood of employees being involved in crashes. To operationalise this, the self-reported driving behaviours of a group of Australian drivers within a fleet setting were analysed. In particular, this study endeavoured to:

(a) examine the factor structure and applicability of the DBQ to a sample of professional Australian drivers; and

(b) investigate the relationship the DBQ has with self-reported crash involvement.

## Method

### Participants

A total of 4792 individuals volunteered to participate in the study who were all employees of an Australian organisation. The response rate was 45%. There were 4195 (88.9%) males and 597 (11.1%) females. The average age of the sample was 44 years (range 18-68yrs). Participants were located throughout Australia in both urban and rural areas. The largest proportion of vehicles driven by participants were reported to be for tool of trade (56%), although vehicles were also salary sacrificed (43%), and a small proportion were leased or participant's own vehicle (1%). Vehicles were reported to be sedans (85%), four wheel drives (12%) or other (3%). The majority of driving by participants was reported to be within the city (46%), or in the city and on country roads (40%). On average participants had held their licence for 26 years (range 5 – 48yrs), had been driving a work vehicle for approximately 5 years (range 1 – 33yrs), with the largest proportion driving between 11 and 20 hours per week (43%), and between 30,000 – 40,000kms per year.

## Materials

### Driver Behaviour Questionnaire (DBQ)

A modified version of the DBQ was used in the current study that consisted of 20 items. Questions relating to lapses were omitted due to previous research indicating that this factor is

not associated with crash involvement [14, Stradling, Personal Communication, 2003]. In addition, the authors of the current paper made minor re-wording or rephrasing modifications, in order to make the questionnaire more representative of Australian driving conditions. For example, references to turning "right" were removed on some items as there are instances where drivers may attempt to overtake someone who is turning left[1]. Respondents were required to indicate on a six point scale (0 = never to 5 = nearly all the time) how often they commit each of the errors (8 items), highway code violations (8 items) and aggressive violations (4 items).

**Demographic Measures**

A number of socio-demographic questions were included in the questionnaire to determine participants' age, gender, driving history (e.g., years experience, number of traffic offences and work-related crashes) and their weekly driving exposure (e.g., type of car driven, driving hours). The overall questionnaire contained 36 items.

## Procedure

A letter of introduction, the study questionnaire and a reply paid envelope were distributed through the company's internal mail system to the participants.

## Results

Factor structure and reliability of the Driver Behaviour Questionnaire for an Australian sample. The internal consistency estimates for the DBQ scale are presented in Table 1. These estimates were analysed via Cronbach's alpha reliability index. The alpha coefficients show that the items for each factor exhibited reasonable internal consistency with only the alpha coefficient for aggressive violations falling below acceptable conventions of reliability (>.70). However, it should be noted that aggressive violations consisted of only 4 items which may have resulted in the lower coefficient reported for this factor. Overall, these results are similar to the findings reported in previous Australian research [16,7,2], which also included investigations involving professional drivers [10].

**Table 1: Alpha Reliability Coefficients of the DBQ Scale**

| | Current sample | Sullman et al. (2002) |
|---|---|---|
| Errors (8 items) | .78 | .71 |
| Highway code violations (8 items) | .77 | .62 |
| Aggressive violations (4 items) | .56 | .57 |

Secondly, it is of interest to determine which of the behaviours measured by the DBQ were most often performed by participants. Table 2 shows the composite mean scores for the three DBQ factors and the highest ranked items. An examination revealed a significant overall difference between the three driving behaviours, □= .88, F(2, 4790) = 317.39, p < .001 with follow-up pairwise comparisons (Bonferroni adjustment) indicating that highway code violations occurred significantly more frequently than both driving errors (p < .001) and aggressive violations (p < .001). The means reported in Table 2 are higher than has been reported in previous research involving college students [3] elderly drivers [12], and professional drivers [10,8], indicating that the current sample engaged in, or at least reported, a higher level of aberrant driving behaviours[2]. Table 2 also reports the three highest ranked mean scores for items included in the factors which were: Exceed the speed limit on highway (M = 1.96, SD = 1.0); and Stay in lane till last minute (M = 1.65, SD = .82) and Race away from the traffic lights with the intention of beating the driver next to you (M = 1.63, SD = .86). The results indicate that speeding is the most common form of aberrant behaviour reported by the fleet drivers in the current sample, and similar to previous research on professional drivers [9,10], speeding remains one of the major road safety concerns.

**Table 2: Mean Scores for the DBQ Factors**

| | M | SD |
|---|---|---|
| Errors (8 items) | 1.36 | 0.38 |
| Highway code violations (8 items) | 1.50 | 0.47 |
| Aggressive violations (4 items) | 1.38 | 0.43 |
| **Highest Ranked Items** | | |
| 1. Exceed speed limit on a highway | 1.96 | 1.00 |
| 2. Stay in lane till last minute | 1.65 | 0.82 |
| 3. Race away from traffic light | 1.63 | 0.86 |

In order to determine the structure of the tool, the 20 item questionnaire was subjected to a factor analysis. Principle components analysis with oblique rotation was implemented to determine the factor structure of the DBQ, which revealed a three-factor solution. The solution for this PCA model explained 42.77% of the total variance in driver responses. Table 3 presents the factor loadings for all items and reveals that ten items loaded on the strongest factor in the solution which accounted for 29% of the total variance. Most of these items were consistent with the driving error factor identified in the traditional DBQ, with the exception of two items that were originally identified as an aggression violation (e.g., cross

[1] Previous research has demonstrated that the DBQ is robust to minor changes to some items in order to reflect specific cultural and environmental contexts (Blockey & Hartley, 1995; Ozkan & Lajunen, 2005; Parker et al., 2000).

[2] However, it is noted that the DBQ questionnaire utilised in the current study most likely varies slightly on the wording of some items compared to previous DBQ research, which should be borne in mind when making comparisons with previous research.

junction even though traffic lights have changed) and another item originally identified as a highway code violation e.g., pull out of junction and disrupt traffic flow. The second strongest factor identified in this analysis explained 8.29% of the total variance and consisted of six items. Four of these items were originally identified as highway code violations and the other two as aggression violations in the traditional DBQ, with the two aggression violation items loading the strongest on this factor. However, similar to previous research in an Australian context [7], the highway code violation items may also be considered to be aggressive acts in some circumstances. Thus, this factor was labelled as aggressive violations to reflect the context of these items in a professional driving setting. The remaining four items loaded on the third factor and explained 5.49% of the total variance. Three of these items were originally identified as highway code violations with speeding offences implicated and the other item related to drink driving. Internal consistency estimates were again computed for the new factors and the alpha coefficients were: (a) errors = .82, aggressive violations = .79 and highway code violations = .75.[3]

## Inter-correlations between the variables

Table 4 presents the inter-correlation Pearson coefficients for participants' driving exposure, crashes, offences and DBQ factors. Consistent with previous research [27,10], age and years driving experience appear to have a significant negative relationship with highway and aggressive violations. One possible explanation is that as drivers gain more experience, they are less likely to engage in aberrant driving behaviours on public roads. However, contrary to previous research [15,27,5,10] a positive relationship was not identified between the number of kilometres driven each year and highway code and aggressive violations. Although kilometres travelled and hours driven were significantly correlated with errors reported, they were not associated with highway code or aggressive violations. Finally, there were no significant correlations reported between years licensed and self-reported crashes or driving offences.

**Table 3: Factor Structure of the Modified DBQ**

| Description | F1 Errors | F2 Aggressive | F3 Highway |
|---|---|---|---|
| Attempt overtake of someone turning in front | .56 | | |
| Miss stop or give way signs | .61 | | |
| Pull out of junction and disrupt traffic flow | .53 | | |
| Fail to notice pedestrians crossing | .64 | | |
| Non-attention and nearly hitting vehicle in front | .57 | | |
| Cross junction even though traffic lights changed | .40 | | |
| Whilst turning nearly hit cyclist | .59 | | |
| Fail to check rear view mirror | .55 | | |
| Underestimate speed of oncoming vehicle while overtaking | .65 | | |
| Skid while braking or cornering on slippery road | .47 | | |
| Stay in lane till last minute | | .53 | |
| Drive close to car in front as signal to its driver | | .58 | |
| Sound horn to indicate annoyance | | .70 | |
| Become angered by other driver | | .65 | |
| Impatient with slow driver and overtake on inside | | .53 | |
| Race vehicle beside at traffic lights | | .52 | |
| Intentionally exceed speed limit on highway | | | .64 |
| Drive while over the blood alcohol limit | | | .60 |
| Intentionally disregard speed limit on residential road | | | .70 |
| Angered by another driver and give chase | | | .43 |

[3] The prior between-group analyses were recomputed with the new factor structures that revealed the same findings e.g., Highway code violations still occurred significantly more often than errors or aggressive violations.

**Table 4: Pearson Correlations Between the Major Driving Variables**

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|
| 1. Age | -- | .96** | .06** | .02 | -.02 | -.22** | -.14** | -.03* | -.02 |
| 2. Years licensed | | -- | .07** | .05** | -.01 | -.20** | -.13** | -.02 | -.01 |
| 3. Hours driving per week | | | -- | .52** | .13** | -.01 | .03 | .09** | .11** |
| 4. Kilometres per year | | | | -- | .10** | .01 | -.01 | .10** | .08** |
| 5. Errors | | | | | -- | .53** | .50** | .16** | .14** |
| 6. Highway violations | | | | | | -- | .59** | .12** | .10** |
| 7. Aggressive violations | | | | | | | -- | .14** | .13** |
| 8. Crashes past 12 months | | | | | | | | -- | .15** |
| 9. Offences last 12 months[1] | | | | | | | | | -- |

Note: [1] = fines or demerit points in the past 12 months
*p <.05, **p < .01.

## Prediction of crashes

Two logistic regressions were employed to evaluate the contributions of the traditional and present study's DBQ factors to participants' self-reported crashes after controlling for kilometres driven. Table 5 presents the model fit statistics, logit coefficients, standard errors of the parameter estimates, Wald statistics, odds ratios and 95% confidence intervals for the predictors in each model. Firstly, in regards to both models, the number of kilometres driven proved to be a significant predictor of crashes, as not surprisingly, individuals who drive greater distances per year are more likely to be involved in work-related crashes. However, after controlling for driving exposure, the model utilising the original DBQ factors indicated that errors was also identified as a significant predictor of work-related crash involvement, although at a weak level (wald = 10.31, p = .043). A similar analysis utilising the new factor loadings also revealed that kilometres travelled and errors were predictors of crash involvement (wald = 33.27, p = .013 & wald = 14.68, p = .013). Additionally, aggressive violations were also identified to be predictive within this latter model, indicating those who drive aggressive are also more likely to crash. However, it is noted that while the classification rate was high at 87.3% in both models (after controlling for kilometres driven), the overall model was more efficient at predicting drivers who are not involved in crashes, rather than those who reported engagement in traffic accidents (non-crash involvement = 87.3%, crash involvement = 0.0%).

## Discussion

The DBQ has been employed in a number of previous studies investigating driver behaviours [4,6], however little research has examined driving behaviours within the context of company driven vehicles [9,26]. The present research aimed to utilise the DBQ to examine the factor structure of the measurement tool along with determining its efficiency in predicting self-reported crashes.

Firstly, consistent with previous research [16,2,10], the traditional DBQ factors were relatively reliable. Although some items were altered to suite the driving conditions of Australian roads, this finding is encouraging for employing the DBQ with different driving populations such as found in fleeting settings. Furthermore, examination of the DBQ factor mean scores revealed that participants reported engaging in a higher frequency of highway code violations. This is consistent with previous research that indicated speeding is the most frequently reported aberrant driving behaviour on public roads [24,4]. Additionally, this result may be consistent with a general belief that minor speeding violations are acceptable in some circumstances and do not pose a serious road safety risk [7].

Secondly, similar to earlier research, an investigation into the inter-correlations between the driving behaviours also revealed moderately strong relationships between the traditional DBQ factors [7,2,18]. The findings suggest that individuals who engage in one form of aberrant driving behaviour (e.g., speeding) are also more likely to report other unsafe driving practices. To a lesser extent, while the three factors are usually considered discrete, at some level, they reflect related driving behaviours. And as discussed below, these differences between acts of speeding and aggression may prove to be more conceptual than practical, and thus may considerably overlap.

Thirdly, an exploratory factor analysis of the full scale DBQ was conducted to determine the consistency of the traditional DBQ factors for the current sample of Australian fleet drivers. Similar with a large body of previous research [15,16,4,5,13], a three factor solution was established from the DBQ in the present study. However, the structure is different to the majority of research that has focused on professional drivers [10,24]. Nevertheless, driving errors made was the most stable factor identified in the present study and item inclusion was reasonably consistent with the original driving error factor included in the DBQ. Item loadings suggested that this factor was predominantly represented by lack of attention and poor judgement issues on the part of drivers.

The other two DBQ factors identified in the present study were a combination of the aggression and highway code violation

**Table 5: Logistic Regression Analyses of Employees Self-Reported Crashes Over a One Year Period as a Function of the Traditional and Present Study's DBQ Factors after Controlling for Kilometres Travelled.**

| Predictors | *B* | *SE B* | Wald | Sig. | Odds Ratio | 95% CI | |
|---|---|---|---|---|---|---|---|
| | | | | | | Lower | Upper |
| Model 1: Original DBQ factors | | | | | | | |
| Step 1 | | | | | | | |
| Kilometres per year[a] | 0.15 | 0.03 | 37.51 | .014 | 1.16 | 1.11 | 1.22 |
| Adjusted $R^2$ = .02 | | | | | | | |
| Step 2 | | | | | | | |
| Kilometres per year[a] | 0.11 | 0.04 | 31.48 | .014 | 1.10 | 1.07 | 1.14 |
| Errors | 0.43 | 0.13 | 10.31 | .043 | 1.53 | 1.18 | 1.98 |
| Highway code violations | 0.06 | 0.12 | 0.27 | .150 | 1.07 | 0.84 | 1.35 |
| Aggressive violations | 0.14 | 0.13 | 1.19 | .240 | 1.15 | 0.90 | 1.47 |
| (Constant) | -3.43 | 0.20 | 309.95 | .310 | 0.03 | | |
| Adjusted $R^2$ = .03 | | | | | | | |
| Block = $\chi^2$ (3, *n* = 4638) = 30.23** | | | | | | | |
| Full model = $\chi^2$ (4, *n* = 4638) = 70.85** | | | | | | | |
| Model 2: Present study's DBQ factors | | | | | | | |
| Step 1 | | | | | | | |
| Kilometres per year[a] | 0.16 | 0.03 | 40.09 | .008 | 1.17 | 1.16 | 1.23 |
| Adjusted $R^2$ = .02 | | | | | | | |
| Step 2 | | | | | | | |
| Kilometres per year[a] | 0.13 | 0.05 | 33.27 | .013 | 1.11 | 1.08 | 1.16 |
| Errors | 0.52 | 0.14 | 14.68 | .013 | 1.69 | 1.29 | 2.20 |
| Highway code violations | -0.18 | 0.12 | 2.10 | .160 | 0.84 | 0.66 | 1.07 |
| Aggressive violations | 0.23 | 0.11 | 4.66 | .046 | 1.26 | 1.02 | 1.55 |
| (Constant) | -3.41 | 0.20 | 305.45 | .290 | 0.03 | | |
| Adjusted $R^2$ = .03 | | | | | | | |
| Block = $\chi^2$ (3, *n* = 4638) = 34.07** | | | | | | | |
| Full model = $\chi^2$ (4, *n* = 4638) = 74.69** | | | | | | | |

*Note.* [a] = controlled in these models.
**p < .01

items included in the original DBQ. In regards to the second factor, the two strongest item loadings were original DBQ aggressive violation items e.g., sounding a horn in annoyance and becoming angered with other motorists. However, it is also noted that four additional items loading on this second factor, were originally identified as highway code violations. Nevertheless, it is noted that the four highway code items, within an Australian context, may also be considered to be acts of driving aggression. For example in some circumstances, staying in a lane to the last minute and forcing one's way into traffic, driving especially close to another vehicle and overtaking on the inside, whilst they are acts of highway code violation can also be considered acts of aggression. Further research is required to determine the conceptual differences in the factors within a fleet environment.

Similarly, the third factor also contained a mixture of items reflecting three highway code violations items and one act of aggression. Given such item loading, this factor was labelled highway code violations. However, the overall factor loadings are consistent with previous research that has highlighted considerable factor structure variability, thus indicating the specific combination and interpretation of factors may differ with both sample characteristics and environment.

## Prediction of crashes

The final aim of the study was to investigate the relationship the DBQ has with self-reported crash involvement. Both the regression models (e.g., traditional and current modified DBQ factors) revealed that the number of kilometres driven by professional drivers in an Australian fleet setting was predictive of crash involvement. This finding is consistent with previous Australian research [7], and not surprisingly, indicates that exposure to the road is predictive of crashes. Additionally, errors were predictive of self-reported crashes after controlling for kilometres driven in the traditional model, and both errors and aggressive violations were predictive of crash involvement when utilising the modified DBQ factors. This finding suggest that errors made when driving may be a particularly important behaviour that contributes to crashes for professional drivers no matter how much exposure this population has to driving.

Furthermore, it is suggested that within a work related driving context drivers that errors and also aggression may contribute to crashes due to other underlying or organisational factors related to driving. For example, within a work context driver error and acts of aggression may be closely associated with other contributory factors such as fatigue, multi tasking and work or time pressure. This is consistent with other recent research indicating factors such as fatigue and multitasking affects driving performance [28]. Nevertheless within the current context, it is noteworthy that the DBQ was able to assist in identifying that unintentional behaviours (such as lapses) as well as low-level aggressive driving behaviours were linked to crashes among the sample of employees. Subsequently, the organisation was able to specifically tailor the corresponding interventions to address these underlying issues, that not only included a general awareness program about responsible (e.g., non-aggressive) driving practices, but also a further investigation to determine whether the driving errors resulted from fatigue and scheduling-related issues or more of a general lack of concern regarding road safety awareness.

## Limitations

A number of limitations should be borne in mind when considering the results of the study. The reliability of self-report crash data used in the present study may be more susceptible to under reporting of crashes, due to social response bias issues and perceived implications associated with admitting to, engaging in aberrant driving behaviours while driving for work.

It is also suggested that this limitation may have also contributed to the current sample being over represented by drivers who reported no crashes in comparison to drivers who reported one or more crashes in the last 12 months. Future research may need to overcome the possible limitations associated with self report crash data and develop a process for accessing and utilising official crash data from companies without potential ramifications being experienced by employees. This process would enable research to be linked to actual crashes and thus demonstrate applicability within a work related driving context. This procedure would most likely vary between different organisations, but the essential components of a proactive approach that coordinates and utilises multiple data outcomes (e.g., claims data, licence checks, observations, etc), is likely to prove most effective at identifying "at risk" drivers. Currently, policy makers and practitioners would benefit from future research focusing on determining the most valid and efficient data collection and analysis methods to achieve the above mentioned outcomes. The current sample was also overrepresented by males which, although possibly representative of the organisational setting, does suggest that further research should incorporate a more equivalent sample of males and females within a work driving setting. Finally, the response rate was relatively low but consistent with other research in the fleet area [7].

## Conclusion

In sum, the findings of this study suggest that the traditional DBQ can be applied to professional drivers in an Australian fleet setting. However, similar to previous research, factor analysis revealed that although the number of factors remained stable, the structure of these factors changed considerably for two of the original DBQ factors. While the driving errors factor remained mostly unchanged, the other two factors involved a mixture of both the original highway code and aggressive violation items. It is suggested that within an Australian fleet setting acts of aggression and highway code violations may hold core similarities, and as a result, a person who is likely to do one is also more likely to engage in the other. For instance, while racing a vehicle at traffic lights may be considered as a highway code violation, in some circumstances, it may in fact be considered an act of aggression. It is suggested that the wording of such items may needed to be reconsidered due to reduce ambiguity and more accurately reflect the work-related driving context within Australia. Furthermore it is suggested that future research needs to explore other factors that may contribute to the likelihood of driver crashes in an Australian fleet setting. This may include organisation culture, as well as situational factors such as fatigue, time pressure and multi-tasking which have currently received little research focus yet would appear to have some association with factors such as violations and errors associated with work related driving. Exploring the contribution of such factors to aberrant driving behaviours can only complement the development of countermeasures that effectively reduce unsafe driving practices.

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