Modernization of the Driver Behaviour Questionnaire

Sheila T.D. Cordazzo, Charles T. Scialfa*, Rachel Jones Ross

University of Calgary, Department of Psychology, 2500 University Drive, N.W., Calgary, Alberta, Canada T2N 1N4

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ABSTRACT

Introduction: The current study builds on previous versions of the Driver Behaviour Questionnaire (DBQ) by incorporating a larger sample of driving behaviors targeting inattention, distraction, aggressive driving, and health related to aging. The goals of this study were to determine if the resulting factor structure was consistent with a more contemporary view of unsafe driving behaviors, and to determine whether scores on the factors could predict self-reported collisions and police citations.
Methods: The instrument was given to a sample of 3295 drivers ranging in age from 19 to 80+ years old. It was divided in two sections, the first to provide demographic information and driving history data and the second containing 105 driver behavior questions.
Results: An exploratory factor analysis resulted in a 65-item scale organized in four factors. The factors were labeled tentatively as *Inattention Errors*, *Age-Related Problems*, *Distraction and Hurry*, and *Aggressive Violations*. Regression analyses showed that the factors were predictors of self-reported, at-fault collisions and police citations.
Practical implications: The factor scores found in this research are consistent with a useful theoretical framework for understanding unsafe driver actions, and demonstrate some potential to identify several individual difference variables that predict self-reported collisions and citations.

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1. Introduction

Drivers often engage in behaviors that pose a risk to both themselves and to other road users. While many of these unsafe actions are active, conscious rule violations, others are the result of errors due to inexperience, momentary mistakes, inattention or functional decline, the latter often related to age. Intentional or not, these behaviors can and do contribute to traffic collisions (Stanton and Salmon, 2009; Wierwille et al., 2002). Because of this, there is a need for tools that can measure these behaviors and the frequency with which they are exhibited, and that can determine which specific actions predict traffic collision involvement. There are a variety of tools used to such ends, including epidemiological analysis of collision data, naturalistic, quasi-naturalistic and simulated driving performance and self-report measures of those driving behaviors believed to be causal in crashes (for a brief review, see Castro, 2009).

For more than two decades, there has been a body of research published regarding the creation, modification and evaluation of one such tool, widely known as the Driver Behaviour Questionnaire (DBQ). In 1990, Reason et al. introduced the 50-item self-report

instrument, in which drivers rated the frequency of risky behaviors engaged in while driving. Winter and Dodou (2010) identified almost two hundred studies that have used the DBQ in part or in its entirety. af Wåhlberg et al. (2011) concur that the DBQ is one of the most widely used instruments for measuring driving behavior.

Since the time of its creation, there have been significant changes to both the driving population and the driving environment. In most developed countries, population aging has meant that while novice and younger drivers continue to use the roadways in large numbers, there are proportionally more older drivers whose driving difficulties are distinct from those of their younger counterparts (Boot and Scialfa, 2016). Additionally, there is increased recognition that distraction, inattention and aggressive behavior are critical causal factors in crashes and untoward driving events (see Regan et al., 2013; Stanislaw, 2012). As such, the behaviors sampled in the original DBQ may be inadequate to capture the actions that increase driver risk and may not be targeted to best remediate problematic behaviors.

The purpose of this study was three-fold. First, we supplemented currently available versions of the DBQ to sample more adequately the constructs of inattention, aggressive driving, and problems produced by functional decline most commonly related to aging. We then determined if the resulting factor structure was consistent with a contemporary view of risk-inducing driving behaviors. Secondly, we evaluated whether the resulting factor structure was

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* Corresponding author.
E-mail addresses: scheilacordazzo@hotmail.com (S.T.D. Cordazzo), scialfa@ucalgary.ca (C.T. Scialfa), rachel.jones.ross@icloud.com (R.J. Ross).

related to demographic variables such as gender and age. Finally, we examined the predictive value of these factors when the outcome variables were self-reported, at-fault collisions and police citations.

1.1. Emerging factors in driving risk

Traffic safety researchers have focused increasingly on the importance of inattention generally and distraction more specifically as causal to collisions (McKnight and McKnight, 2003; Redelmeier and Tibshirani, 1997). Though statistics vary, some studies indicate that 25–30% of police-reported traffic crashes in the United States are related to driver inattention (Klauer et al., 2010). There is currently no universal agreement on what constitutes inattention, but there is some consensus (Lee et al., 2009) that inattention involves the failure to allocate visual and cognitive processes adequately to the driving task. Inattention can result from a variety of sources inside the vehicle, in the external driving environment or within the individual. Some of the most frequently examined sources of inattention are technology-based activities such as cell phone use (Caird et al., 2008; Redelmeier and Tibshirani, 1997), text-messaging (Hosking et al., 2009) and navigational systems (Tijerina et al., 1998). Epidemiological and more naturalistic field studies indicate that compared to older drivers, younger adults are more likely to engage in these distracting activities (e.g., Rudin-Brown et al., 2013). This will likely change as the present young adult cohort ages while accustomed to and, perhaps, dependent on these technologies. And, it is likely that these sources of inattention will be even more problematic for older drivers (Boot and Scialfa, 2016).

Even in the absence of disease, aging brings with it considerable changes in perception and cognition that are relevant to driving performance and collision risk (Scialfa et al., 2004; Scialfa and Kline, 2007). These include declines in acuity and contrast sensitivity, increased sensitivity to glare, diminished peripheral vision, slower response times and greater costs of attentional task demands. Many of these changes increase the vulnerability of older drivers, particularly in complex driving tasks (e.g., intersections) and have been found to predict driving performance (Jones Ross et al., 2014; Wood et al., 2013). There have been several attempts to develop self-report instruments focusing on visual perception (e.g., problems with glare or making left turns) that capture and quantify driving problems experienced by older adults (Owsley et al., 1999; Kline et al., 1992), but these have not found widespread use in the traffic safety literature. Although the original DBQ has been used with older drivers (Parker et al., 2000), the instrument was not designed specifically to measure behaviors related to the difficulties they experience.

Among the risk-inducing behaviors that are less common in older adults, one is aggressive driving. While the definition and operationalization of aggressive driving is open to debate (Stanislaw, 2012), it is believed to be captured in actions such as honking at other drivers when irritated and driving at unsafe following distances to maintain high speeds. The media often report dramatic incidents of aggressive driving under the heading of "Road Rage", but less violent examples (e.g., "tailgating") are much more common and clearly increase the likelihood of adverse events on the roadway (Deffenbacher et al., 2003). Using a variety of scales to measure aggressive driving, the general finding is that these types of behaviors are more common in males and less frequent in older adults (Lajunen et al., 1998; Maxwell et al., 2005; Shinar, 1998). Clearly, any instrument intended to sample behaviors related driving risk must include items related to anger, aggression and hostility.

1.2. The evolving Driver Behaviour Questionnaire

The Driver Behaviour Questionnaire (DBQ) was developed by Reason et al. (1990) and refined by Parker et al. (1995). It is a self-report tool in which drivers rate the frequency of risk-elevating behaviors committed while driving. Its original purpose was to determine whether the distinction between errors and violations would surface, because of the belief that these two types of behaviors hold psychologically distinct origins, and thus would require separate techniques of remediation. Errors were defined as "the failure of planned actions to achieve their intended consequences" (p. 1315), while violations were defined as "deliberate deviations from those practices believed necessary to maintain the safe operation of a potentially hazardous system" (p. 1316). Errors were decomposed further to include slips and lapses, "the unwitting deviation of action from intention" (p. 1315), and mistakes, considered "the departure of planned actions from some satisfactory path toward a desired goal" (p. 1316).

Since its creation, the DBQ has been modified, updated and adapted for a variety of driving environments and populations (e.g., Aberg and Rimmö, 1998; Bener et al., 2008). A structure comprised of *Slips/Lapses*, *Mistakes*, *Ordinary Violations*, and *Aggressive Violations* has been broadly replicated, although the distinction between *Ordinary* and *Aggressive Violations* is not always obtained at the factor or component level (Lajunen et al., 2004; Lawton et al., 1997; Parker et al., 1995, 2000; Rimmö, 2002).

The inattention factor was explicitly incorporated into the DBQ by Aberg and Rimmö (1998), who added new items to the original scale. A four-factor solution identified *Violations*, *Mistakes*, *Inattention Errors* and *Errors by Inexperience*. *Inattention Errors* were significantly higher among the older drivers. The French version of the DBQ, developed by Guého et al. (2013) also revealed an *Inattention Error* factor that was of larger magnitude among females and drivers with less experience.

Similarly, Verschuur and Hurts (2008) developed a model that explains safety-related driver behavior. Based on DBQ studies, the authors argued that unsafe acts leading to collision involvement are of three types; violations, dangerous errors, and inattention errors. In a sample of 743 Dutch drivers, they measured the frequency of collision involvement in the last three years, active failures (from the DBQ), and items related to strategic decisions and psychological and physical precursors. Their findings suggest that collision involvement is predicted by four specific variables: driving under unsafe conditions, violations, Inattention Errors, and dangerous errors.

Rather than focusing on collisions, Rimmö and Hakamies-Blomqvist (2002) gathered data on self-imposed driving restrictions in a sample of 939 Swedish drivers who were given the Swedish version of the DBQ along with a questionnaire concerning 19 specific health issues (e.g., thyroid dysfunction or cataract). They reported that while age and gender were important predictors, problems with inattention, inexperience and impaired health were related to voluntary limitations to driving. Most of their older adults reported themselves to be in good health: It is reasonable to expect that medical fitness would be an even more important predictor of driving behavior in those who are less healthy. For example, compared with healthy older adults, those with a diagnosis of mild dementia are more likely to be rated as "unsafe" in a standardized on-road driving assessment (Duchek et al., 2003).

Recently, Cordazzo et al. (2014) carried out a replication of the original DBQ, developed by Reason et al. (1990) and Parker et al. (1995) in a North American life-span sample of adult drivers. The results revealed a three-component structure of *Lapses*, *Errors* and *Violations* as reported by Parker et al. (1995), but these components had limited ability to predict self-reported collisions. The authors pointed to the need to incorporate more items to address some