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## Do driver anger and aggression contribute to the odds of a crash? A population-level analysis

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### ABSTRACT

**Background:** Driver anger and aggression are believed to be one of the primary contributing factors to motor vehicle collisions. While several methodologies have been used to assess the impact of driver anger and aggression on collision risk, few of these studies have adopted a population-level survey approach. Most, if not all, of the few population-level analyses published were conducted more than a decade ago and adjusted for only a few relevant variables. The current study analysed more recent population-level data, assessing the impact of driver aggression on collision risk, adjusting for several potential confounders.

**Method:** Based on data from a regionally stratified general-population telephone survey of adults in Ontario, Canada conducted from 2002 through 2009 ( $N = 12,830$ ), a binary logistic regression analysis examined self-reported collision involvement in the previous 12 months by measures of demographic characteristics, driving exposure, driving after alcohol or after cannabis use, probable anxiety and mood disorder, and driver aggression. The aggression measure subsumed an element of retaliation, and thus the concurrent experience of anger.

**Results:** Adjusting for demographic variables and potential confounders, driver aggression was associated with increased odds of collision involvement. Specifically, relative to those drivers reporting only minor driver aggression, drivers reporting no driver aggression had reduced odds of collision involvement ( $OR = 0.65, p < .001$ ), whereas drivers reporting both minor and serious driver aggression had increased odds of collision involvement ( $OR = 1.78, p = .03$ ).

**Conclusions:** Following a dose–response pattern, increasingly severe forms of driver aggression were associated with increasing odds of a crash. The magnitude of the effect on collision risk was comparable to that seen with other hazardous driving behaviours including driving after substance use. Implications of these findings are discussed.

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## 1. Introduction

It has been estimated that the cost of fatalities and injuries resulting from motor vehicle collisions (MVCs) in 2005 exceeded \$99 billion in the United States (U.S.) alone (Naumann, Dellinger, Zaloshnja, Lawrence, & Miller, 2010). Over the

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past decade, there has been a decline in the number of MVC-related injuries and fatalities in most of the developed world. Yet, in 2013, the most recent year for which data are currently available, there were still 32,719 people killed and 2.31 million people injured in MVCs in the U.S. (National Highway Traffic Safety Administration, 2014) and 1923 collision fatalities and 165,306 crash-related injuries in Canada (Statistics Canada, 2015). The costs associated with these crashes remain staggering.

### 1.1. Prevalence and impact of driver anger and aggression

Driver anger and aggression are believed to be major contributing factors to MVCs. There has been significant debate concerning the definition of aggressive driving, often focusing on whether or not the aggressive action was performed with the intention of harming another driver, or on which specific behaviours should be classified as aggressive (e.g., swearing in one's own vehicle without any other action against another driver). However, regardless of the definition used, the estimated prevalence of driver aggression is high. According to a report from the AAA Foundation for Traffic Safety (AAAFTS, 2008), 78% of respondents in a population-level survey rated aggressive drivers as a serious or extremely serious traffic safety problem. Yet, despite expressing strong concern about aggressive driving, 41% reported honking at another driver in the previous 30 days, 22% reported tailgating another driver, and 26% reported pressuring other drivers to speed up. Similar findings have been reported in surveys of other countries, including Canada (Smart, Mann, & Stoduto, 2003; Vanlaar, Simpson, Mayhew, & Robertson, 2007), the United Kingdom (Joint, 1995), and Australia (AAMI Insurance, 2011).

One of the leading determinants of driver aggression is driver anger. In the AAAFTS population survey, 60% of drivers reported becoming extremely angry at something another driver did in the previous 30 days (AAAFTS, 2008). Similarly, driving diary or log studies have also reported high prevalence of driver anger (Deffenbacher, Deffenbacher, Lynch, & Richards, 2003; Deffenbacher, Lynch, Filetti, Dahlen, & Oetting, 2003; Mesken, Hagenzieker, Rothengater, & De Waard, 2007; Neighbors, Vietor, & Knee, 2002; Underwood, Chapman, Wright, & Crundall, 1999; Wickens, Roseborough, Hall, & Wiesenthal, 2013). The roadway environment functions like any other social setting, guided by rules and norms for appropriate behaviour (Rothe, 1994). Violations of these formal and informal rules and norms can result in significant anger, which is likely to be amplified by the increasing seriousness of the violation's possible impact (e.g., high financial cost, injury, death) (Cota-McKinley, Woody, & Bell, 2001; Wickens, Wiesenthal, & Roseborough, 2015). While not all episodes of driver anger result in driver aggression, there is a very strong association between these constructs (Nesbit, Conger, & Conger, 2007; Wickens, Wiesenthal, Flora, & Flett, 2011).

### 1.2. Driver anger and aggression as determinants of motor vehicle collisions

Despite the substantial academic literature that has been amassed since the term "road rage" became part of the popular vernacular, there is surprisingly little research examining the negative outcomes of driver anger and aggression. Specifically, there has been relatively little assessment of the impact of roadway anger and aggression on MVCs. While it may seem justifiable to presume an increased risk of collision among highly aggressive drivers, it is important to empirically confirm this association and to measure the strength of effect adjusting for other relevant factors. Evidence-based policy-making requires this information when weighing alternative road safety initiatives.

The most common approach adopted in assessing the impact of driver anger and aggression on collisions has involved the selection of a small sample of participants, often a convenience sample of university students, who are asked to self-report both driver anger or aggression and previous collisions over a set period of time. Perhaps the most commonly used self-report measure among these studies is the Violations subscale of the Driver Behaviour Questionnaire (DBQ; Reason, 1990), which includes a number of aggressive driving items. Many studies have assessed the relationship between DBQ scores and self-reported or recorded collisions, and many have identified a relationship between the violations score and collision involvement (e.g., Özkan & Lajunen, 2005; Parker, Reason, Manstead, & Stradling, 1995). This demonstrated association has not always been straightforward. One study looking at the DBQ in professional truck drivers found that violations involving speeding, tailgating, and red-light running were associated with more crashes over the previous three years; however, aggressive violations such as horn honking and expressing hostility were not associated with previous collisions (Sullman, Meadows, & Pajo, 2002). A recent meta-analysis investigating the relationship between DBQ scores and crashes concluded that violations predicted self-reported collisions (de Winter & Dodou, 2010).

Other measures of driver anger and aggression have also been assessed relative to collisions, including the Larson Driver's Stress Profile (Larson, 1996), the Dula Dangerous Driving Index (Dula & Ballard, 2003), and the Propensity for Angry Driving Scale (DePasquale, Geller, Clarke, & Littleton, 2001). As with studies assessing the DBQ, the results have not been entirely consistent (Deffenbacher, Deffenbacher, et al., 2003; Deffenbacher, Lynch, et al., 2003), but many of these studies have found a positive association between risky driving and previous collisions (Blanchard, Barton, & Malta, 2000; Chliaoutakis et al., 2002; Nesbit & Conger, 2012).

Driver simulation studies are similar to the previously discussed small sample questionnaire studies, except that instead of asking participants to self-report their collisions or to provide access to formal driving records, participants are asked to demonstrate their driving skill on a driver simulator. Consistent with most of the small sample questionnaire research, simulator studies have found a positive correlation between scores on self-report measures of driver aggression and number

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