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Version Post-Print/Accepted Manuscript

Citation (published version) Wickens, C. M., Mann, R. E., Stoduto, G., Ialomiteanu, A., & Smart, R. G. (2011). Age group differences in self-reported aggressive driving perpetration and victimization. *Transportation Research Part F*, 14(5), 400-412.

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Publisher's Statement The final publication is available at Elsevier via <http://dx.doi.org/10.1016/j.trf.2011.04.007>.

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Running head: AGE GROUP DIFFERENCES

**Age Group Differences in
Self-Reported Aggressive Driving Perpetration and Victimization**

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ABSTRACT

Aim: This study examined whether the predictors of self-reported aggressive driving perpetration and victimization vary across age groups.

Method: Based on data from a general-population telephone survey conducted from July 2002 through June 2005, three groups of drivers were examined: 18-34 year olds ($N = 1522$), 35-54 year olds ($N = 2726$), and 55 years of age or older ($N = 1883$). For each age group sample, logistic regression analyses examined self-reported aggressive driving perpetration and victimization in the last 12 months by measures of driving exposure, heavy drinking, cannabis use, and drinking-driving, while controlling for demographic factors.

Results: The prevalence of aggressive driving perpetration within the past year was highest for the youngest age group (51%), followed by the middle-aged group (37%), and then the oldest age group (18%). The same pattern of results was found for prevalence of aggressive driving victimization (54%, 47%, and 31%, respectively). Controlling for demographic factors, the predictors of perpetration were generally consistent across the age groups. The logistic regression model for the youngest drivers revealed that those who reported stressful driving, heavy drinking, and cannabis use had significantly increased odds of reporting perpetration of aggressive driving. For middle-aged and older drivers, stressful driving, driving on busy roads, cannabis use, and driving after drinking were associated with perpetration. In addition, increased mileage contributed to perpetration in the oldest group. The findings for victimization by aggressive driving were similar. The logistic regression model for the youngest age group identified stressful driving, cannabis use, and higher annual mileage as being associated with victimization. For the oldest age group, these same variables were significant predictors of victimization, in addition to driving on busy roads. The logistic regression for the middle-aged group identified the same predictors as that of the oldest age group; however, interestingly driving after drinking was found to predict lower victimization among middle-aged drivers.

Conclusions: Although the prevalence of aggressive driving perpetration and victimization declined with age, the factors that contributed to aggressive driving remained generally stable across the lifespan. The results suggest that efforts to reduce aggressive driving among young drivers may prove to be effective for drivers from all age groups.

Keywords: driver aggression, road rage, drink-driving, alcohol, cannabis, population survey

1. INTRODUCTION

Younger drivers are disproportionately over-represented among drivers involved in motor vehicle collisions (MVCs), as well as among the resulting injuries and fatalities. For instance, in 2007, individuals aged 15-20 represented 6.4% of licensed drivers in the United States, but 13% of all driver deaths resulting from MVCs (National Highway Traffic Safety Administration [NHTSA], 2008). This over-representation of younger drivers among those involved in MVCs is a consistent finding across many nations including Canada, Australia, and many Western European countries (Organisation for Economic Co-operation and Development [OECD], 2006; Statistics Canada, 2003). Younger motorists are also over-represented among drivers considered to be aggressive. Compared to more mature motorists, younger drivers report experiencing greater anger and reacting with more intense aggression in response to frustrating roadway events (Lajunen & Parker, 2001; Smart, Mann, & Stoduto, 2003, Smart, Stoduto, Mann, & Adlaf, 2004). They are also less patient in response to such events, resorting to shouting, gesturing, or horn-honking sooner or more frequently than other drivers (Hauber, 1980; Shinar, 1998, Smart et al., 2003).

Extreme forms of road rage, such as chasing another vehicle or physical violence by one driver against another, are not the most common form of retaliation; however, driver anger is virtually always associated with at least a minor aggressive response such as muttering comments, shouting, and gesturing (Neighbors, Vietor, & Knee, 2002). Analyses derived from an annual general population survey of adults in Ontario, Canada (cumulative *N* from 1996 to 2009 > 30,000; Mann, Smart, Stoduto, Adlaf, & Ialomiteanu, 2004; Smart et al., 2003) revealed that nearly half of respondents reported being shouted at, cursed at, or having rude gestures directed at them in the past year. Less than 8% of respondents reported having another driver

threaten to hurt them or to damage their vehicle. Only a third of respondents admitted that they themselves had shouted at, cursed at, or made rude gestures at another driver, and only about 2% of drivers confessed to having threatened to hurt another driver or damage another driver's vehicle. Similar results were found in a nationwide survey of members of the Canadian Automobile Association (CAA) in 2000, which revealed that 47% of motorists had been victims of aggressive driving. Obscene gestures, being cut off in traffic, and being tailgated were the most commonly reported aggressive driving behaviours (as cited in Herzog, 2005). Slightly higher estimates of self-reported driver aggression came from a survey of American customers of Progressive Insurance conducted in 2000. Results indicated that 46% of drivers admitted expressing their anger toward other motorists while behind the wheel (Progressive, 2000).

In studying aggressive behaviour on roads and highways, several related concepts typically emerge: driver anger, aggressive driving, and road rage. For the current study, driver anger is conceptualized as an emotional precursor to aggressive behaviour, which is often elicited by the seemingly offensive actions of other motorists. In terms of the behavioural response to driver anger, researchers have generally made a dichotomous distinction between more minor acts of aggression (e.g., gesturing, cursing) and incidents of extreme violence (e.g., physical fights, shooting a firearm). According to Ellison-Potter, Bell, and Deffenbacher (2001), aggressive driving refers to “any driving behaviour that intentionally ... endangers others psychologically, physically, or both” (p. 432). Road rage, on the contrary, is defined as a more extreme form of aggressive driving that involves “assaultive behaviour with the intent of bodily harm and possible homicide” (p. 432).

Roadway aggression is strongly related to the occurrence of MVCs. Mann et al. (2007) found that drivers who reported perpetration of or victimization by even a minor form of

aggression, such as shouting or rude gesturing, had a significantly higher risk of collision involvement than those drivers without aggressive driving experience. At a Congressional hearing of the Committee on Transportation and Infrastructure in 1997, aggressive driving was estimated to be involved in 50% of all motor vehicle collisions (Snyder, 1997). The head of the NHTSA testified that aggressive driving contributed to one third of all personal injuries and two thirds of all fatalities resulting from motor vehicle crashes (Martinez, 1997).

In light of this strong relationship between aggressive driving and MVCs, a large body of research has attempted to identify factors associated with driver aggression. Given their over-representation among aggressive drivers, younger motorists have often been the primary group of interest. Several possible contributors to an aggressive driving style among younger motorists have been identified, including personality variables typically associated with youth such as sensation seeking, as well as age-related risk-taking behaviours including the use of alcohol and cannabis (Hatfield & Fernandes, 2009; Jonah, 1990, 1997; Jonah, Thiessen, & Au-Yeung, 2001). Also included have been young drivers' lack of driving experience and their over-confidence behind the wheel, which may contribute to an increased tendency to perceive the errors and lapses of other drivers as more upsetting and frustrating, and perhaps as more controllable or intentional (Lajunen & Parker, 2001). These perceptions, in turn, may contribute to greater anger and retaliatory aggression (Vallières, Bergeron, & Vallerand, 2005; Wickens, 2009; Wickens, Wiesenthal, Flora, & Flett, submitted for publication).

Mann et al. (2010) recently reported that factors associated with collision involvement varied across the lifespan. For younger drivers (18-34 years old), those who reported driving as stressful at least some of the time, who drank five or more drinks on an occasion, and who drove after drinking had an increased risk of collision involvement. For middle-aged drivers (35-54

years old), those who reported using cannabis in the last year had an increased risk of collision involvement. For older drivers (55+ years old), none of these factors increased their risk of collision. The current study sought to extend the findings of Mann et al. (2010) by examining differences in factors associated with self-reported aggressive driving perpetration and victimization across the same three age groups. Given that driver aggression declines with age, do the factors associated with aggressive driving differ across the lifespan, as do the factors associated with collision involvement? Or, do the factors associated with aggressive driving remain the same, suggesting that we either experience those risk factors less frequently or learn to cope with them better as we age?

2. METHOD

2.1 Sample

The sample is derived from data collected in the CAMH Monitor, a repeated cross-sectional telephone survey of Ontario adults aged 18 years and older. The survey is conducted by the Centre for Addiction and Mental Health (CAMH) and administered by the Institute for Social Research at York University. The CAMH Monitor uses regional stratification and consists of independent monthly samples with approximately 200 completions each (response rate 56-61%; see Ialomiteanu & Adlaf, 2006 for sampling design details). Between July 2002 and June 2005, the CAMH Monitor included a series of items to measure both aggressive driving victimization and perpetration. Data from this time period was merged into a single dataset, and then separated into three individual samples: 18-34 year-olds ($N = 1522$), 35-54 year-olds ($N = 2726$), and 55 years of age and older ($N = 1883$).

2.2 Outcome variables

Two key outcome measures were used: aggressive driving victimization or perpetration. Four items from the CAMH Monitor were used to determine the experience of aggressive driving victimization: During the past 12 months, how many times has someone in another vehicle (1) shouted, cursed, or made rude gestures at you or others with you?, (2) threatened to hurt you or others with you, or threatened to damage the vehicle you were in?, (3) intentionally damaged or attempted to damage the vehicle you were in?, (4) intentionally hurt or attempted to hurt you or others with you? The first item reflected aggressive driving behaviour, whereas the latter three items reflected more of a road rage response. Respondents who replied never to all questions were coded as 0. Respondents who reported at least one experience of aggressive driving victimization in the past year were coded as 1.

Four similar items from the CAMH Monitor were used to determine perpetration of driver aggression: During the past 12 months, how many times have you (1) shouted, cursed, or made rude gestures at a driver or passenger in another vehicle?, (2) threatened to hurt a driver or passenger in another vehicle, or threatened to damage their vehicle?, (3) intentionally damaged or attempted to damage another driver's vehicle?, (4) intentionally hurt or attempted to hurt a driver or passenger in another vehicle? Again, the first item reflected aggressive driving behaviour, whereas the final three items reflected a more violent road rage response. Respondents who replied never to all questions were coded as 0. Respondents who reported at least one episode of perpetrated driver aggression in the past year were coded as 1.

2.3 Predictor variables

Demographic variables included gender (coded 0 = female, 1 = male), region (comprised of six regions in Ontario: Toronto, Central East, Central West, West, East, North), income

(coded 1 = <\$30,000, 2 = \$30,000-49,999, 3 = \$50,000-79,999, 4 = \$80,000+, 5 = not stated), marital status (1 = not married, 2 = married or common law), and education (coded 1 = less than high school, 2 = completed high school, 3 = some post-secondary, 4 = university degree).

Measures of driving exposure included driving distance, stressful driving, and busy roads. Driving distance was treated as a continuous variable, asking respondents to indicate how many kilometres they drive in a typical week. For stressful driving, respondents were asked how much of their driving in the past 12 months was stressful. Response options included ‘none’, ‘some of the time’, ‘about half’, ‘much’, and ‘all’. Early analyses revealed few differences in the odds ratios generated for each category of stressful driving. Thus, for the purposes of parsimony, these responses were recoded to 0=none of the time and 1 = at least some of the time. For busy roads, respondents were asked how much of their driving in the past 12 months was on busy roads and were given the same five response options as the stressful driving item. Again, early analyses revealed few differences in the odds ratios generated for each category of driving experience on busy roads. Thus, responses for the busy roads item were also recoded to 0 = none of the time and 1=at least some of the time.

Other risk factors included heavy drinking, cannabis use, and driving after drinking. Heavy drinking was measured by a single item: About how often during the past 12 months would you say you had five or more drinks at the same sitting or occasion? (coded 0 = less than once per month/non-drinker, 1 = at least monthly). A drink was defined as one 12-oz bottle of beer or glass of draft, one 5-oz glass of wine, or one straight or mixed drink with one ounce and a half of hard liquor. Cannabis use was assessed by two items: Have you ever in your lifetime used marijuana or hash? (coded 0 = no, 1 = yes) and How many times, if any, have you used marijuana during the past 12 months? (coded 0 = never, 1 = at least once). Driving after drinking

was measured by a single item: During the past 12 months, have you driven a motor vehicle after having two or more drinks in the previous hour? (coded 0 = no, 1 = yes). An attempt was also made to include driving after cannabis use among the independent variables; however, the low incidence of this behaviour among the oldest group of drivers ($n = 5$) prohibited inclusion of this variable.

2.4 Analyses

The data were screened such that ‘don’t know’ responses and refusals were excluded from analyses. Only respondents who had held a valid driver’s licence at some point in the previous 12 months and who had driven in the previous 12 months were included in the analyses. The weighted sample size was used when reporting percentages, and these are considered representative of the population surveyed. All analyses were conducted using SPSS 15.0 software. In order to replicate the analysis conducted by Mann et al. (2010), logistic regression analyses of both aggressive driving victimization and perpetration were conducted for each age group. Each logistic regression analysis assessed the predictive value of driving exposure (including average weekly kilometres, exposure to busy roads, and stressful driving), heavy drinking, cannabis use, and driving after drinking, controlling for demographic characteristics.

3. RESULTS

3.1 Self-reported aggressive driving victimization

Table 1 presents self-reported aggressive driving victimization for each age group, as a function of demographic characteristics, driving exposure measures, and other risk factor variables. Overall, the prevalence of victimization was greatest for the youngest (18-34 years) age group (53.5%), followed by the middle-aged (35-54 years) group (46.6%). The oldest age group (55+ years) reported much less victimization (30.9%). Table 2 presents the prevalence of

each form of aggressive driving victimization for each age group. Having someone in another vehicle shout, curse, or make rude gestures at you was the most common form of driver aggression for all age groups. Virtually all respondents who reported being victimized described experiencing this form of aggression. The other categories of victimization were far less commonly reported, with the highest rate of victimization being reported by the youngest group for having someone threaten to do harm to yourself or your vehicle (7.5%) and the lowest rate of victimization being reported by the oldest group for someone intentionally hurting or attempting to hurt you or someone with you (0.6%).

Based on a series of chi-square tests, the demographic variables found to be significantly related to aggressive driving victimization were fairly consistent across age groups. Victimization varied significantly by region of residence, with the highest victimization occurring in Toronto and the lowest victimization occurring in the North region of the province. Victimization varied by income. For the youngest age group, victimization was greatest for those earning between \$30,000 and \$49,999. For the middle-aged and oldest groups, victimization was greatest for those earning more than \$80,000. Across all age groups, those not providing their annual income reported the lowest rates of aggressive driving victimization. For only two of the demographic variables were there age differences in self-reported victimization. Level of education varied significantly for the middle-aged and oldest age groups, with the highest rates of victimization impacting most those drivers holding a university degree. The lowest rate of victimization for the middle-aged group was reported by those drivers who had completed high school, whereas the lowest rate of victimization for the oldest age group was reported by those drivers who had not completed high school. Finally, a significant gender difference was found among the oldest group, such that males reported more victimization.

The driving exposure measures significantly associated with aggressive driving victimization were also consistent across age groups. Regardless of age, victims of aggressive driving reported higher mileage than non-victims. Victimization was also more common for motorists who reported that driving is stressful and who reported that they drive on busy roads.

Other risk factors significantly associated with victimization were also relatively consistent across age groups. Both lifetime cannabis use and cannabis use within the past year were significantly associated with higher rates of self-reported aggressive driving victimization. For the youngest group, there was a marginally significant association between driving after drinking and victimization ($p = .053$).

Table 3 presents the logistic regression models of self-reported aggressive driving victimization for each age group. Missing cases were deleted listwise, resulting in a slightly lower sample size for each model. Before the logistic regression models were conducted, markers for multicollinearity were assessed (see Field, 2005). The results of this analysis were generally indicative of an absence of multicollinearity. The greatest intercorrelation among independent variables was found for lifetime cannabis use and cannabis use within the past 12 months ($r = .47, p < .001$).

For each logistic regression model of victimization, the Hosmer and Lemeshow test was not significant, indicating good fit of the model. Controlling for demographic variables, it was found that drivers from all age groups who reported driving as stressful had an increased risk of road rage victimization. Lifetime cannabis use was also associated with increased risk of victimization for all age groups, as was number of kilometres driven.¹ Reporting driving on busy roads was associated with greater risk of victimization for the middle-aged and the oldest groups

¹ Values for kilometres driven varied from 0 to 7000, thus the number of decimal places needed to demonstrate an odds ratio greater than 1 should be very high. Given the positive odds ratio for kilometres driven (i.e., not below 1), it can be safely interpreted that the risk of road rage victimization increased with the number of kilometres driven.

only. Interestingly, driving after drinking was associated with a decreased risk of victimization among the middle-aged drivers.

3.2 Self-reported aggressive driving perpetration

Table 4 presents self-reported aggressive driving perpetration for each age group, as a function of demographic characteristics, driving exposure measures, and other risk factor variables. As with self-reported victimization, the overall prevalence of perpetrated driver aggression was greatest for the youngest (18-34 years) age group (51.0%), followed by the middle-aged (35-54 years) group (37.2%). The oldest age group (55+ years) reported much less perpetration (18.0%). The difference in self-reported victimization versus perpetration was greatest for the oldest group (victimization 30.9% versus perpetration 18.0%), followed by the middle-aged group (victimization 46.6% versus perpetration 37.2%). This difference was much smaller for the youngest group (victimization 53.5% versus perpetration 51.0%).

As with victimization, shouting, cursing, or making rude gestures at another driver was the most common form of driver aggression for all age groups (see Table 2). Virtually all respondents who reported perpetration confessed to engaging in this form of aggression. The other categories of perpetration were far less commonly reported, with the highest rate of driver aggression being admitted by the youngest group for having someone threaten to do harm to yourself or your vehicle (2.8%).

Demographic variables found to be significantly related to the perpetration of driver aggression were relatively consistent across age groups. A significant gender difference was found for all age groups, such that male drivers self-reported more perpetrated driver aggression than female drivers. Across all age groups, perpetration also varied by income. For all age groups, the highest rates of perpetration were reported by those earning \$80,000+ annually. The

lowest rates of perpetration were found among those not stating their income, or among those earning less than \$30,000 for the middle-aged group and among those earning between \$30,000 and \$49,999 for the oldest group. Perpetration varied significantly by region of residence for the middle-aged and oldest groups. For all three age groups, the lowest rates of self-reported perpetration came from the North region. For the middle-aged and oldest groups, the highest rates of perpetration came from Toronto. For the oldest group only, perpetration rates varied significantly by education, with the highest rates of perpetration being reported by those with a university degree.

As with self-reported aggressive driving victimization, the driving exposure measures significantly associated with perpetration were consistent across age groups. For all three samples, perpetrators of driver aggression reported higher mileage than non-perpetrators. As well, self-reported perpetration was more common for drivers who reported that driving is stressful at least some of the time and who reported that they drive on busy roads at least some of the time.

Other risk factors significantly associated with perpetration were equally consistent across age groups. For all three samples, self-reported perpetration was more common for drivers who also reported lifetime cannabis use, cannabis use within the past year, and driving after drinking. Consuming 5+ drinks at least monthly in the past year was also associated with self-reported perpetration, although within the oldest group of drivers, this relationship was only marginally significant ($p = .053$).

Table 5 provides the logistic regression models of self-reported road rage perpetration for each age group. Within each model, the Hosmer and Lemeshow test was not significant, indicating good fit of the model. For many of the risk factors, the results for the perpetration

models were very similar to those of the victimization models. For instance, with demographic variables controlled, the odds ratios indicated that drivers from all age groups were at increased risk of perpetration if they reported experiencing driving as stressful. As with the victimization models, lifetime cannabis use was also associated with increased risk of perpetrated driver aggression for all age groups, and driving on busy roads was associated with increased risk of perpetration for the middle-aged and the oldest groups. Contrary to the findings of the victimization model, number of kilometres driven was only associated with increased risk of perpetration among the oldest drivers.² As well, driving after drinking was associated with an increased risk of perpetration among the middle-aged and oldest age groups, although this relationship also approached significance ($OR = 1.36, p = .086$) among the youngest age group. Finally, cannabis use within the past year also approached significance among the oldest drivers ($OR = 2.44, p = .051$).

4. DISCUSSION

4.1 Demographic characteristics and driver aggression

Overall, results of this general population survey revealed that the incidence of both self-reported aggressive driving victimization and perpetration declined with age. This was particularly the case for the prevalence of perpetration, which was greatest for the youngest group of drivers (51.0%) and lowest for the oldest group of drivers (18.0%). This is consistent with previous research which has demonstrated that younger drivers are more likely to be involved in collisions, to drive recklessly or aggressively, and to be involved with cases of road rage (Hauber, 1980; Lajunen & Parker, 2001; NHTSA, 2008; OECD, 2006; Smart & Mann, 2002; Statistics Canada, 2003; Wells-Parker et al., 2002). Likewise, univariate analyses revealed

² Values for kilometres driven varied from 0 to 7000, thus the number of decimal places needed to demonstrate an odds ratio greater than 1 should be very high. Given the positive odds ratio for kilometres driven (i.e., not below 1), it can be safely interpreted that the risk of road rage perpetration increased with the number of kilometres driven.

that the incidence of self-reported perpetration was more prevalent among male than female drivers, which is a highly reliable finding in the literature. Males are more likely to be involved in collisions, to commit driving violations, to adopt a risky driving style, and to engage in more extreme driving-related aggression (Hennessy, Wiesenthal, Wickens, & Lustman, 2004; Jonah, 1990, 1997; OECD, 2006; Smart & Mann, 2002; Wickens, Toplak, & Wiesenthal, 2008). It should be noted, however, that gender differences are more likely to emerge when examining more violent or extreme forms of driver aggression (Hennessy et al., 2004).

According to univariate analyses, both aggressive driving victimization and perpetration were generally more common in Toronto, the most densely populated area in the province. The North region experienced the least prevalent reporting of victimization and perpetration. This is consistent with other analyses of this general population survey (e.g., Mann et al., 2004; Smart et al., 2003, 2004) and with other observational and survey research (Rathbone & Huckabee, 1999; Shinar, 1998; Smart, Stoduto, Adlaf, Mann, & Sharpley, 2007). Driver anger and aggression are known to rise in the presence of traffic congestion, longer traffic light delays, and the resulting time urgency (Hennessy & Wiesenthal, 1999; Neighbors et al., 2002; Shinar, 1998; Wickens & Wiesenthal, 2005), all of which are more characteristic of urban driving. In addition, the increased number of interactions with other motorists means an increased risk of a miscommunication or a misunderstanding with another motorist, which could result in driver anger or aggression. A recent quasi-experimental study examined differences in driver anger, aggression, and risky behaviour on the roadways among urban versus rural motorists; however, no significant differences were found (Deffenbacher, 2008).

Univariate analyses also revealed a general tendency for increased aggressive driving victimization and perpetration to be reported by high income earners (\$80,000+ annually). In

some of the analyses, educational status was also associated with the prevalence of aggressive driving victimization and perpetration, indicating that drivers with a university degree reported the most prevalent involvement with incidents of driver aggression. These findings are consistent with previous analyses of this dataset (Mann et al., 2004, Smart et al., 2003) and with other survey research conducted in the United States and the United Kingdom (Shinar, Schechtman, & Compton, 2001; Stradling & Meadows, 2000). It is possible that high income earners may have more business or social engagements and may be more rushed for time (Smart et al., 2003), or they may be less deterred by the risk of fines should they be pulled over by the police. As well, the relationship between high income and aggressive driving perpetration may reflect a status differential between the type of vehicle driven by high income earners versus other road users. Previous research has found that drivers are more aggressive toward vehicles of lower status (Diekmann, Jungbauer-Gans, Krassnig, & Lorenz, 1996; McGarva & Steiner, 2000), and that drivers of high performance vehicles (e.g., muscle cars, sports cars) self-report more involvement with both aggressive driving victimization and perpetration (Smart, Stoduto, Mann, & Adlaf, 2008).

Although the univariate analyses suggested a significant association between demographic characteristics and both aggressive driving victimization and perpetration, multivariate analyses presented a different perspective. The primary predictor of aggressive driving victimization and perpetration was region of residence, indicating that the odds of victimization were less outside of the Toronto area for all age groups of drivers and that the odds of perpetration were less outside of the Toronto area for the middle-aged and older drivers. The only other significant demographic finding was found among the youngest drivers: those earning more than \$80,000 annually were at greater risk of perpetrated driver aggression.

4.2 Driving exposure variables and driver aggression

In order to control for differences in exposure to the driving environment, number of kilometres driven in a typical week was included in the analysis. Greater risk of aggressive driving victimization was associated with higher mileage for all age groups, as was greater risk of perpetrated driver aggression among the oldest group of drivers.

The nature of this exposure was also controlled by including measures of busy roads and stressful driving. Univariate analyses revealed that driving on busy roads at least some of the time was associated with increased self-reports of both aggressive driving victimization and perpetration across all age groups. Multivariate analyses revealed that driving busy roads was associated with increased risk of both aggressive driving victimization and perpetration for the middle-aged and oldest groups of drivers. This is consistent with a sizeable research literature which has demonstrated a strong relationship between traffic congestion and driver stress, anger, aggression, and risk-taking (e.g., Hennessy & Wiesenthal, 1999; Neighbors et al., 2002; Shinar, 1998; Wickens & Wiesenthal, 2005).

Likewise, driving under stressful conditions at least some of the time was associated with an increased risk of both aggressive driving victimization and perpetration for all age groups. Again, this is consistent with the existing literature, which has demonstrated that driver stress (which can be a consequence of traffic congestion) is strongly related to incidents of driver anger and aggression (Hennessy & Wiesenthal, 1999). Driver stress likely reduces the minimum threshold needed for an emotional and/or behavioural response to another driver's offensive behaviour. It is also possible that victims of driver aggression report more driver stress due to their victimization.

4.3 Other risk variables and driver aggression

The other risk variables included in the models reflect other forms of risky behaviour. Heavy drinking, defined as consuming five or more alcoholic beverages on a single occasion, was associated with more prevalent aggressive driving perpetration among all age groups in the univariate analyses; although, it produced a significant odds ratio for only the youngest group of drivers. Heavy drinking was not related to aggressive driving victimization. Driving after drinking was also associated with more prevalent aggressive driving perpetration across all age groups within the univariate analyses. The multivariate analyses revealed a similar picture, indicating that driving after drinking was associated with an increased risk of perpetration for the middle-aged and older drivers. The odds ratio for the youngest group followed a similar trend, although the finding only approached significance. Interestingly, driving after drinking was associated with a reduced risk of aggressive driving victimization among the middle-aged drivers. This may represent a chance or spurious finding. Together, these alcohol-related findings are consistent with previous research, which has found that aggressive drivers are more likely to have been convicted of impaired driving (Galovski & Blanchard, 2002) and to have evidenced alcohol-related disorders (Galovski, Blanchard, & Veazey, 2002; Malta, Blanchard, & Freidenberg, 2005). Likewise, research has shown that alcohol problems and impaired driving are predictive of aggressive driving and more severe road rage (Butters, Smart, Mann, & Asbridge, 2005; Mann et al., 2004; Yu, Evans, & Perfetti, 2004).

Cannabis use, within the past year and within one's lifetime, was associated with more prevalent aggressive driving victimization and perpetration across all age groups in the univariate analyses; however, only lifetime cannabis use was associated with an increased risk of victimization and perpetration across all age groups in the multivariate analyses. It is likely that

the two measures of cannabis use were accounting for common variance, making the measure of cannabis use in the past year a redundant variable in the multivariate analyses. A model that included only the measure of past-year cannabis use was considered. In that analysis, cannabis use in the past 12 months was generally associated with increased risk of victimization and perpetration across the age groups; however, the Hosmer and Lemeshow test approached significance for one of the age groups, suggesting that the model was unstable. Overall, the predictive value of cannabis use with both aggressive driving victimization and perpetration is in line with other research findings that have found cannabis use and driving under the influence of cannabis to be associated with increased driver anger, if not driver aggression (Butters, Mann, & Smart, 2006; Butters et al., 2005; Richer & Bergeron, 2009). Perhaps most interesting among the cannabis use findings is that lifetime prevalence is predictive of behaviour later in life. The correlation between lifetime cannabis use and past-year cannabis use was strong ($r = .47$), but not perfect. Furthermore, a review of Tables 1 and 3 reveals that only a portion of those who reported lifetime cannabis use also reported past-year cannabis use. This confirms that past risky behaviour (possibly decades-old behaviour in the case of the oldest group of drivers) is acting as a significant predictor of more recent aggressive driving involvement.

The finding that cannabis use and driving after drinking are both associated with increased risk of perpetrated driver aggression across the lifespan may be indicative of a general risk-taking tendency among a segment of the population. The contribution of heavy drinking to perpetration among the youngest drivers also adds support to this possibility. According to Jessor's (1987) Problem Behaviour Theory (PBT), drinking and driving is associated with engaging in problem behaviour more generally, and is therefore correlated with risky driving, alcohol use, and drug use. The current findings are consistent with PBT, suggesting that those

individuals who engage in risky behaviours such as cannabis use and drink-driving may also engage in risky driving behaviour such as road rage.

4.4 Age group differences in the predictors of road rage

Although the incidence of aggressive driving tends to decline across the lifespan, the results of the current study suggest that the risk factors associated with both victimization and perpetration remain fairly consistent across the lifespan. With few exceptions, factors that are predictive of aggressive driving involvement were the same for all three groups of drivers. Increased risk of victimization for all age groups was associated with residing in the Toronto area, driving more kilometres per week, reporting driving as stressful, and having used cannabis during one's lifetime. As well, driving on busy roads was associated with increased risk of victimization for the middle-aged and older groups and, although it was not significant, the odds ratio for the youngest group also followed this trend.

Increased risk of perpetration for all age groups was associated with reporting driving as stressful and lifetime cannabis use. As was the case for victimization, driving on busy roads was associated with an increased risk of perpetration for the middle-aged and older drivers and, although not significant, the odds ratio for the youngest group was in the same direction. Region of residence results for perpetration were very similar to those found for victimization; residing in Toronto was associated with an increased risk of perpetration, although this finding did not extend to the younger drivers. In addition, driving after drinking was associated with an increased risk of perpetration for all age groups, although the odds ratio for the youngest group only approached significance.

4.5 Limitations

It is important to note some of the limitations of this research. First, the data are based on self-report measures and thus may be subject to bias; however, previous studies have found self-report measures of alcohol and drug use to be valid in general population samples (Harrison, 1997). Second, it cannot be determined whether non-respondents would have responded the same way as did respondents in this study. However, given that previous research has established that non-respondents in studies of substance use and driving behaviour are likely to be heavier substance users (Mann et al., 2003), it seems likely that any bias introduced by non-response would be minimal. Finally, certain groups within the population were unavoidably excluded from potential participation. The survey is based on a target population of households with landline telephones; therefore, it excludes those in prisons, hospitals, and military establishments, the homeless, and those who rely exclusively on cellular telephones. Although the potential for bias exists, the size of the excluded group should be small relative to the total population. For instance, the number of households without a landline telephone accounted for only 4.1% of Ontario households at the end of 2005 (Statistics Canada, 2006).

4.6 Conclusion

Together, these findings suggest that the risk factors for aggressive driving involvement do not change from the time of our youth to our golden years. However, it may be that our threshold for perceived victimization or our “boiling point” for retaliation may increase as we become more experienced and mature drivers. We may develop better coping strategies, make less dispositional attributions for seemingly offensive behaviour of other drivers, or be more conscious of the potential consequences of expressing our anger on the roadways. Future research will need to address each of these possibilities more closely. Nonetheless, these findings

suggest that initiatives taken to reduce retaliatory driver aggression have the potential to be effective across all age groups. Although educators and enforcement agencies may wish to focus more intently on the youngest drivers where the prevalence of driver aggression appears highest, their efforts may prove to be successful for all drivers.

ACKNOWLEDGEMENTS

This research was supported by a grant from AUTO21, a member of the Networks of Centres of Excellence (NCE) program that is administered and funded by the Natural Sciences and Engineering Research Council (NSERC), the Canadian Institutes of Health Research (CIHR), and the Social Sciences and Humanities Research Council (SSHRC), in partnership with Industry Canada. Dr. Wickens was supported by a Postdoctoral Fellowship from the SSHRC. The authors also acknowledge ongoing funding support from the Ontario Ministry of Health and Long-Term Care.

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TABLE 1

Aggressive Driving Victimization for three age groups (18-34, 35-54, 55+) by demographic, driving exposure, heavy drinking, cannabis use, and impaired driving measures: Ontario CAMH Monitor, July 2002–June 2005.

	Age 18-34		Age 35-54		Age 55+	
	Any Vict ^a		Any Vict ^a		Any Vict ^a	
	<i>n</i>	Yes (%) ^b	<i>n</i>	Yes (%) ^b	<i>n</i>	Yes (%) ^b
TOTAL^c	1522	53.5	2726	46.6	1883	30.9
Gender						*
Female	807	51.9	1410	46.7	1034	28.2
Male	715	55.0	1316	46.6	849	33.6
Region		***		***		***
Toronto	236	59.7	365	55.5	211	41.6
Central East	265	59.3	454	48.7	319	30.2
Central West	262	51.0	510	49.6	256	30.4
West	281	47.7	438	38.7	321	29.2
East	239	48.9	449	44.8	334	28.4
North	239	44.4	510	29.0	442	20.8
Income^d		*		***		***
<\$30,000	212	51.7	241	44.7	406	26.5
\$30,000-49,999	283	59.2	428	42.9	367	27.5
\$50,000-79,999	391	54.3	696	45.3	364	31.0
\$80,000+	448	53.6	1031	51.9	329	42.5
Not stated	188	46.1	330	37.0	416	26.1
Marital Status						
Not married	846	54.6	751	48.8	674	28.9
Married/partner	671	52.1	1966	46.1	1193	31.4
Education				**		***
< High school	74	59.3	239	44.0	509	25.0
Completed high school	343	53.6	621	41.3	487	29.6
Some post-secondary	654	52.7	1043	47.4	465	29.4
University degree	446	53.1	808	50.1	393	40.8
Km driven-typical week		**		***		***
mean (SD) Any Vict ^a Yes	707	352.6 (489.3)	1124	394.1 (626.8)	494	312.5 (499.4)
Any Vict ^a No	680	279.6 (485.8)	1422	300.7 (420.8)	1180	199.2 (367.3)
Driving is Stressful		***		***		***
None of the time	566	42.8	1098	33.9	982	22.3
At least some of the time	845	60.6	1489	55.2	774	41.5
Driving on Busy Roads		*		***		***
None of the time	73	41.3	208	22.4	219	14.7
At least some of the time	1343	54.6	2384	48.4	1532	33.1
Five+ drinks monthly-last 12 mths.						

Less than monthly/Non-drinker	840	52.6	1980	47.0	1589	31.0
At least monthly	677	54.3	733	45.6	282	30.9
Cannabis Use-Lifetime		***		***		***
No	674	47.0	1325	40.2	1568	26.8
Yes	841	59.2	1372	53.2	307	52.1
Cannabis Use-last 12 mths.		**		*		***
Never	1118	51.5	2425	45.9	1847	30.4
At least once	396	58.6	290	53.1	33	59.4
Driving after drinking						
No	1332	53.2	2502	47.3	1786	30.5
Yes	178	60.2	211	41.8	82	34.2

^a In the last 12 months.

^b Percentages reported are based on weighted sample size.

^c Drivers who (1) currently hold a valid driver's licence or have held a valid driver's licence in the last 12 months and (2) have driven a motor vehicle in the last 12 months.

^d Canadian dollars.

* Chi-square statistical significance $p < .05$.

** Chi-square statistical significance $p < .01$.

*** Chi-square statistical significance $p < .001$.

TABLE 2

Aggressive Driving Victimization and Perpetration by category for three age groups (18-34, 35-54, 55+): Ontario CAMH Monitor, July 2002–June 2005.

	Age 18-34		Age 35-54		Age 55+	
	<i>n</i>	Any Vict ^a Yes (%) ^b	<i>n</i>	Any Vict ^a Yes (%) ^b	<i>n</i>	Any Vict ^a Yes (%) ^b
VICTIMIZATION :						
Shouted, cursed, made rude gestures	1492	53.1	2654	46.2	1830	30.3
Threatened to hurt you/passenger or damage your vehicle	1520	7.5	2714	5.2	1874	1.9
Intentionally damaged or attempted to damage your vehicle	1520	3.9	2721	2.5	1875	2.0
Intentionally hurt or attempted to hurt you/passenger	1521	3.2	2717	2.3	1876	0.6
Total^c	1522	53.5	2726	46.6	1883	30.9
	<i>n</i>	Any Perp ^a Yes (%) ^b	<i>n</i>	Any Perp ^a Yes (%) ^b	<i>n</i>	Any Perp ^a Yes (%) ^b
PERPETRATION:						
Shouted, cursed, made rude gestures	1505	51.4	2699	37.2	1857	18.0
Threatened to hurt a driver/passenger or damage another vehicle	1520	2.8	2719	1.0	1881	0.5
Intentionally damaged or attempted to damage another vehicle	1522	0.6	2723	<0.1	1881	0.1
Intentionally hurt or attempted to hurt a driver/passenger	1522	0.8	2723	0.2	1880	<0.1
Total^c	1522	51.0	2725	37.2	1881	18.0

^a In the last 12 months.

^b Percentages reported are based on weighted sample size.

^c Drivers who (1) currently hold a valid driver's licence or have held a valid driver's licence in the last 12 months and (2) have driven a motor vehicle in the last 12 months.

TABLE 3

Logistic regression models of aggressive driving victimization for three age groups (18-34, 35-54, 55+): Ontario CAMH Monitor, July 2002–June 2005.

	Aggressive Driving Victimization ^a		
	Age 18-34	Age 35-54	Age 55+
	(N=1304) OR ^{b,c}	(N=2394) OR ^{b,c}	(N=1532) OR ^{b,c}
<i>Control Variables:</i>			
Gender (ref. = female)	1.01	.84	.94
Region (ref. = Toronto)	***	***	**
Central East	.87	.68**	.68
Central West	.61**	.76*	.61*
West	.54***	.47***	.60*
East	.62**	.61***	.56**
North	.52**	.34***	.40***
Income ^d (ref. = <\$30,000)			
\$30,000-49,999	1.20	.84	1.00
\$50,000-79,999	1.06	.81	1.05
\$80,000+	.95	.90	1.17
Not stated	.81	.67	.84
Marital Status (ref. = not married)	.94	.95	1.08
Education (ref. = < high school)			
Completed high school	.76	.79	.97
Some post-secondary	.69	1.03	.89
University degree	.71	1.07	1.19
<i>Risk Factor Variables:</i>			
Kilometres driven-typical week	1.00*	1.00**	1.00**
Driving is Stressful (ref. = none of the time)	1.94***	1.89***	1.91***
Driving on Busy Roads (ref. = none of the time)	1.41	2.28***	1.85*
Five+ drinks monthly (ref. = less than monthly/no)	.99	1.01	.85
Cannabis use-lifetime (ref. = no)	1.48**	1.59***	2.43***
Cannabis use-last 12 months (ref. = never)	1.07	1.10	1.41
Driving after Drinking (ref. = no)	1.09	.66*	.85
Constant	.80	.44**	.22***
Hosmer & Lemeshow test	9.38 _(8df)	5.34 _(8df)	5.37 _(8df)
	<i>p</i> = .31	<i>p</i> = .72	<i>p</i> = .72

Ref. = reference category.

^a In the last 12 months.

^b Odds ratio.

^c Based on weighted sample size.

^d Canadian dollars.

* Wald statistical significance $p < .05$.

** Wald statistical significance $p < .01$.

*** Wald statistical significance $p < .001$.

TABLE 4

Aggressive Driving Perpetration for three age groups (18-34, 35-54, 55+) by demographic, driving exposure, heavy drinking, cannabis use, and impaired driving measures: Ontario CAMH Monitor, July 2002–June 2005.

	Age 18-34		Age 35-54		Age 55+	
	<i>n</i>	Any Perp ^a Yes (%) ^b	<i>n</i>	Any Perp ^a Yes (%) ^b	<i>n</i>	Any Perp ^a Yes (%) ^b
TOTAL^c	1522	51.0	2725	37.2	1881	18.0
Gender		**		**		***
Female	807	47.3	1409	35.4	1032	15.1
Male	715	54.5	1316	38.8	849	20.9
Region				***		***
Toronto	236	50.4	366	41.2	211	26.8
Central East	265	54.0	454	39.7	319	19.0
Central West	262	53.4	509	39.2	256	16.8
West	281	49.6	438	35.1	321	14.1
East	239	48.9	448	31.2	333	15.8
North	239	43.6	510	29.4	441	11.9
Income^d		***		***		**
<\$30,000	212	45.8	241	27.1	404	17.2
\$30,000-49,999	283	45.6	429	34.4	367	14.2
\$50,000-79,999	391	52.7	696	40.1	364	19.8
\$80,000+	448	56.9	1030	40.6	329	23.5
Not stated	188	43.6	329	28.4	416	15.3
Marital Status						
Not ever/not currently married	846	52.5	752	36.9	673	19.9
Married/partner	671	49.0	1964	37.3	1192	17.6
Education						**
< High school	74	45.3	238	38.1	509	18.1
Completed high school	343	55.2	621	36.3	485	16.3
Some post-secondary	654	51.4	1044	38.6	465	16.0
University degree	446	48.3	807	36.1	393	23.6
Km driven-typical week		***		***		***
mean (SD) Any Perp ^a Yes	691	359.3 (489.3)	928	399.9 (580.5)	291	348.2 (638.4)
Any Perp ^a No	696	275.5 (485.0)	1618	311.5 (493.9)	1381	209.5 (343.3)
Driving is Stressful		***		***		***
None of the time	566	39.1	1097	27.0	981	12.0
At least some of the time	845	58.5	1489	44.9	773	26.1
Driving on Busy Roads		**		***		***
None of the time	73	37.0	208	19.7	218	6.8
At least some of the time	1343	51.9	2382	38.9	1531	19.9
Five+ drinks monthly -last 12 mths.		***		***		

Less than monthly/non-drinker	840	44.9	1978	35.1	1587	17.2
At least monthly	677	58.4	734	42.9	282	22.4
Cannabis Use-Lifetime		***		***		***
No	674	40.7	1325	27.8	1566	15.7
Yes	841	60.2	1371	47.5	307	30.2
Cannabis Use-last 12 mths.		***		**		***
Never	1118	46.5	2424	36.2	1845	17.4
At least once	396	63.0	290	47.3	33	50.0
Driving after drinking		***		***		***
No	1332	49.3	2501	36.2	1784	17.2
Yes	178	65.6	211	50.2	82	38.4

^a In the last 12 months.

^b Percentages reported are based on weighted sample size.

^c Drivers who (1) currently hold a valid driver's licence or have held a valid driver's licence in the last 12 months and (2) have driven a motor vehicle in the last 12 months.

^d Canadian dollars.

* Chi-square statistical significance $p < .05$.

** Chi-square statistical significance $p < .01$.

*** Chi-square statistical significance $p < .001$.

TABLE 5

Logistic regression models of aggressive driving perpetration for three age groups (18-34, 35-54, 55+): Ontario CAMH Monitor, July 2002–June 2005.

	Aggressive Driving Perpetration ^a		
	Age 18-34	Age 35-54	Age 55+
	(N=1304)	(N=2393)	(N=1530)
	OR ^{b,c}	OR ^{b,c}	OR ^{b,c}
<i>Control Variables:</i>			
Gender (ref. = female)	1.11	.92	1.29
Region (ref. = Toronto)		*	*
Central East	1.19	.92	.63*
Central West	1.28	.88	.61*
West	1.06	.73	.47**
East	1.10	.69*	.55*
North	.95	.61*	.40**
Income ^d (ref. = <\$30,000)			
\$30,000-49,999	.95	1.27	.87
\$50,000-79,999	1.28	1.52	.96
\$80,000+	1.45*	1.30	.94
Not stated	1.12	1.11	.94
Marital Status (ref. = not married)	.92	1.27	.87
Education (ref. = < high school)			
Completed high school	1.37	.88	.73
Some post-secondary	1.05	.95	.77
University degree	1.00	.83	.83
<i>Risk Factor Variables:</i>			
Kilometres driven-typical week	1.00	1.00	1.00*
Driving is Stressful (ref. = none of the time)	2.20***	1.89***	2.20***
Driving on Busy Roads (ref. = none of the time)	1.56	2.08***	2.15*
Five+ drinks monthly (ref. = less than monthly/no)	1.32*	1.12	.89
Cannabis use-lifetime (ref. = no)	1.62***	2.13***	1.62*
Cannabis use-last 12 months (ref. = never)	1.24	.92	2.44
Driving after Drinking (ref. = no)	1.36	1.51*	2.32**
Constant	.17***	.11***	.12***
Hosmer & Lemeshow test	10.99 _(8df)	1.85 _(8df)	5.43 _(8df)
	<i>p</i> = .20	<i>p</i> = .99	<i>p</i> = .71

Ref. = reference category.

^a In the last 12 months.

^b Odds ratio.

^c Based on weighted sample size.

^d Canadian dollars.

* Wald statistical significance $p < .05$.

** Wald statistical significance $p < .01$.

*** Wald statistical significance $p < .001$.