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Running head: ANXIETY AND MOOD DISORDER AND COLLISIONS

**The Impact of Probable Anxiety and Mood Disorder on Self-Reported Collisions:
A Population Study**

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Abstract

Background. Individuals diagnosed with psychiatric disorder are at significantly increased risk of death and serious injury, to which motor vehicle collisions may be important contributors.

This study examined the association between probable anxiety or mood disorder (AMD) and self-reported collision risk in a large representative sample of the adult population in Ontario.

Methods. Based on data from a regionally stratified general-population telephone survey of adults conducted from 2002 through 2009 ($N = 12,830$), a logistic regression analysis examined self-reported collision involvement in the previous 12 months by measures of demographic characteristics, driving exposure, impaired driving behaviour, and probable AMD.

Results. Controlling for demographic variables and potential confounders, probable AMD was associated with an increased risk of collision involvement ($OR = 1.78$, 95% $CI = 1.37, 2.31$).

Limitations. The use of self-report measures and the potential for bias created by groups excluded because they do not have access to landline telephones represent limitations to the current findings. Nevertheless, the benefits of a large sample derived from general population survey data far outweigh these limitations.

Conclusions. The results suggest that the increased risk of injury and mortality associated with some psychiatric disorders is at least partially related to increased risk of collision involvement. The magnitude of the increase in risk associated with probable AMD is similar to that seen among individuals who drive after drinking or using cannabis. In view of these findings, more work to understand this risk among individuals experiencing probable AMD and how it can be avoided is necessary.

Keywords: Anxiety disorder, mood disorder, collisions

The Impact of Probable Anxiety and Mood Disorder on Collision Risk

1. Introduction

Mortality rates among those diagnosed with a psychiatric disorder may be increased four times or more and life expectancy is substantially reduced (Grigoletti et al., 2009; Thornicroft, 2011). A leading contributor to premature mortality is involvement in motor vehicle collisions (MVCs), which may be affected by some psychiatric conditions (Grigoletti et al., 2009; Dumais et al., 2005). Anxiety and mood disorders (AMD) are among the most common psychiatric disorders (Kessler & Wang, 2008) and, along with some of the drugs used to treat them, may affect driving-related skills adversely (Hindmarch et al., 1992; Vingilis and Wilk, 2012). However, the available evidence on the association of AMD with collision risk is mixed (Dumais et al., 2005; Sagberg, 2006; Selzer et al., 1968; Vingilis and Wilk, 2012). Several explanations for these inconsistent results are possible. Many studies are older and involve restricted sample sizes (e.g., Selzer et al., 1968). As well, available studies do not control for the effects of confounders or covariates that could account for an observed association between AMD and collision risk. One very important class of potential confounding measures is substance use. AMD is frequently comorbid with substance abuse or dependence (Kessler & Wang, 2008), and the increased collision risk associated with AMD seen in some studies may instead be due to higher rates of driving after drinking or after using cannabis among individuals experiencing these disorders. In this study we assess the association of past year collision involvement with probable AMD while controlling for the effects of demographic measures, driving exposure, and driving after using alcohol and cannabis in a large representative sample of the adult population.

2. Method

2.1. Sample

Data are based on telephone interviews with 12,830 respondents who reported having driven a vehicle in the past year, derived from the 2002-2009 cycles of the Centre for Addiction and Mental Health (CAMH) Monitor, an ongoing cross-sectional survey of adults in Ontario, Canada aged 18 years and older that employs random-digit-dialling methods via Computer Assisted Telephone Interviewing. Each annual cycle consists of 12 independent monthly samples with approximately 200 completions each. The annual response rates range from 53% to 61% (see Ialomiteanu and Adlaf, 2010 for sampling design details). Institutional research ethics committees at CAMH have approved the survey annually.

2.2. Variables

The key outcome measure was involvement in a MVC in the past 12 months (coded no=0, yes=1). Demographic variables included age, gender, region of residence, income and marital status. Weekly driving distance, included as a control for differences in exposure, was treated as a continuous variable. Impaired driving measures included past-year driving after drinking (driving one or more times after having two or more drinks in the previous hour: coded 0=no, 1=yes) and driving after cannabis use (driving one or more times within an hour of using cannabis, marijuana or hash: coded 0=no, 1=yes).

The General Health Questionnaire was originally developed as a screening instrument for detecting non-psychotic mental illness, and a 12-item version (GHQ12) that focuses on indicators of depression and anxiety has been widely validated in general population samples. In survey samples of adults (Bijl et al., 1998; Mann et al., 2011a) and adolescents (Mann et al., 2011b) the GHQ12 performed well in identifying probable AMD. Among Ontario adults (Mann

et al., 2011a), the AUC value was .89 and a cutoff value of 4 appeared optimal for detecting probable AMD. At this level the estimated prevalence of probable AMD in the population overall, and in males and females separately, were nearly identical to those obtained using the Composite International Diagnostic Interview (Rush et al., 2008). We use the term ‘probable AMD’ to distinguish between this measure and AMD cases that would be identified by a more formal diagnostic process. For this research we used the binary scoring system for the GHQ12. The Likert responses for each item were recoded to “0-0-1-1”, where 1 represents a response indicating somewhat or a lot more than usual experience of a depression or anxiety symptom, and a score of 4 or more indicated probable AMD (Mann et al., 2011a).

2.3. Analyses

We employed design-based analyses using Taylor Series Linearization found in STATA11 software. Thus, all estimates and statistical tests were corrected for the sampling design. The weighted sample size was used when reporting percentages, and these are considered representative of the population surveyed. Item missing data (i.e. “don’t know” responses and refusals) were excluded listwise from all analyses.

3. Results

Table 1 presents self-reported MVC involvement by demographic characteristics, driving exposure, impaired driving, and evidence of AMD. The overall prevalence of MVC involvement was 7.6%. Based on chi-square (svy: tab) and linear regression (svy: reg) analyses, with *p*-values evaluated from the design-based *F* statistic, MVC involvement was higher for males, drivers aged 18-34 years, drivers who at least completed high school and who earned higher incomes, and drivers who had never been married. Motorists who reported involvement in a MVC also reported a greater number of kilometres driven weekly than motorists not involved in a MVC.

Likewise, motorists who reported driving after drinking or driving after cannabis use were also more likely to report MVC involvement. Finally, reporting a MVC was significantly more likely among drivers identified with probable AMD.

We then conducted a binary logistic regression analysis (svy: logit) (Lee & Forthofer, 2006) of the relationship between AMD and collision risk while controlling for the potentially confounding influences of gender, age, region, income, marital status, driving exposure, driving after drinking, and driving after cannabis use. Before the logistic regression model was conducted, markers for multicollinearity were assessed (Field, 2005) and were indicative of an absence of multicollinearity. The *F*-adjusted mean residual goodness-of-fit test for the final model was not significant, indicating good fit. The odds of self-reported collision involvement for those classified with probable AMD was nearly doubled (OR=1.78, 95% CI=1.37, 2.31, $p<.001$) after controlling for potential confounders.

4. Discussion

Both univariate and multivariate analyses showed that probable AMD in a large representative adult population sample was associated with significantly higher odds of past-year collision involvement. This increase is observed even after controlling for demographic factors, driving exposure, and driving after alcohol and cannabis use. Probable AMD was found to nearly double the risk of a past-year MVC. This finding supports other recent studies suggesting that AMD is associated with increased collision risk (Sagberg, 2006; Selzer et al., 1968) and suggests that the results of other studies are not simply due to the confounding effects of demographic factors, differential driving exposure or increased driving after alcohol or cannabis use. The increased risk of collision involvement associated with probable AMD is comparable to that seen with driving after drinking or cannabis use.

There are several possible reasons for this relationship between AMD and collision risk. Anxious and depressed drivers exhibit driving skills deficits that result in the commission of more driving errors (Ramaekers et al., 1997; Stephens & Groeger, 2009). Both anxiety and depression have been found to intensify aggressive responses to frustrating roadway events (Yu et al., 2004). These conditions, and some of the drugs used to treat them, have been associated with cognitive and psychomotor disturbances that can affect driving skills (Hindmarch et al., 1992; Taylor et al., 2008). More research is needed to understand why these effects occur, and how they may be alleviated.

The limitations of this study include use of self-report measures and the potential for bias created by groups excluded because they do not have access to landline telephones. Nevertheless, based on a large sample derived from general population survey data, the current study suggests that for patients with AMD, increased mortality rates and reduced life expectancy may result in part from increased likelihood of MVC involvement. The magnitude of the increase in collision risk seen was comparable to that seen for driving after substance use.

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TABLE 1

Self-reported past year MVC involvement by demographics, driving exposure, impaired driving, and probable AMD: Ontario CAMH Monitor, 2002 – 2009.

	<i>n</i>	MVC ^a % Yes ^b (95% CI ^c)
TOTAL^d	12830	7.6 (7.0, 8.2)
DEMOGRAPHIC VARIABLES:		
Gender		*
Female	6950	6.8 (6.1, 7.6)
Male	5880	8.3 (7.5, 9.2)
Age		***
18-34 years	2630	11.1 (9.7, 12.7)
35-54 years	5531	6.7 (6.0, 7.5)
55+ years	4394	5.5 (4.7, 6.4)
Region		
Toronto	1796	8.4 (7.1, 10.0)
Central East	2168	7.9 (6.6, 9.4)
Central West	2135	8.2 (7.0, 9.6)
West	2263	6.4 (5.3, 7.6)
East	2147	7.1 (5.9, 8.4)
North	2321	5.6 (4.6, 6.7)
Income^e		***
<\$30,000	1545	6.8 (5.3, 8.6)
\$30,000-49,999	2014	7.6 (6.2, 9.2)
\$50,000-79,999	2807	8.2 (7.0, 9.5)
\$80,000+	4058	8.7 (7.7, 9.8)
Not stated	2406	5.1 (4.1, 6.3)
Marital Status		***
Married/partner	8257	6.3 (5.8, 7.0)
Previously married	2317	7.7 (6.3, 9.2)
Never married	2149	11.7 (10.1, 13.6)
DRIVING EXPOSURE:		
Km driven-typical week (100s)^f		***
mean (SD; 95% CI ^c) MVC ^a No	11004	3.05 (5.15; 2.92, 3.17)
MVC ^a Yes	802	3.86 (5.55; 3.41, 4.31)
IMPAIRED DRIVING VARIABLES:		
Driving after drinking^a		***
No	11830	7.2 (6.6, 7.8)
Yes	897	11.8 (9.3, 14.9)
Driving after cannabis use^a		***

No	12467	7.2 (6.6, 7.8)
Yes	269	20.9 (15.2, 28.0)

PROBABLE AMD:

No	11686	7.1 (6.5, 7.7)
Yes	1135	12.5 (10.2, 15.2)

^a In the last 12 months.^b Percentages reported are based on weighted sample size.^c Confidence intervals.^d Respondents who report having driven a motor vehicle in the last 12 months.^e Canadian dollars.^f Driving distance was divided by 100 so that the resulting odds ratio reflected the change in risk for each additional 100 kilometres of weekly driving.Design-based *F* statistical significance * $p < .05$; ** $p < .01$; *** $p < .001$