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# The impact of medical and non-medical prescription opioid use on motor vehicle collision risk

Christine M. Wickens [a,b,*], Robert E. Mann [a,b], Anca R. Ialomiteanu [a], Jürgen Rehm [a,b,c,d,e], Benedikt Fischer [a,f], Gina Stoduto [a], Russell C. Callaghan [g], Gillian Sayer [a,h], Bruna Brands [a,h,i]

[a] Institute for Mental Health Policy Research, Centre for Addiction and Mental Health, Toronto, Ontario, Canada
[b] Dalla Lana School of Public Health, University of Toronto, Toronto, Ontario, Canada
[c] Department of Psychiatry, Faculty of Medicine, University of Toronto, Toronto, Ontario, Canada
[d] Institute of Medical Science, University of Toronto, Toronto, Ontario, Canada
[e] Clinical Psychology and Psychotherapy, Technische Universität Dresden, Germany
[f] Centre for Applied Research in Mental Health and Addiction, Faculty of Health Sciences, Simon Fraser University, Vancouver, British Columbia, Canada
[g] Northern Medical Program, University of Northern British Columbia, Prince George, British Columbia, Canada
[h] Department of Pharmacology and Toxicology, University of Toronto, Toronto, Ontario, Canada
[i] Office of Research and Surveillance, Controlled Substances and Tobacco Directorate, Healthy Environment and Consumer Safety Branch, Health Canada, Ottawa, Ontario, Canada

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ABSTRACT

*Background:* Production and distribution of prescription opioid analgesic drugs (POs) has increased immensely across the globe. Both medical (MPO) and non-medical (NMPO) use of opioid medication are associated with increased rates of morbidity and mortality, including possibly motor vehicle collisions. The current study examined data from a population-level survey to determine the impact of any PO, MPO, and NMPO use on collision risk.

*Methods:* Data were based on the 2010–2011 Centre for Addiction and Mental Health Monitor, a regionally stratified general-population telephone survey of adults ($N = 3428$). Three binary logistic regressions of self-reported collision involvement in the previous 12 months were conducted, each consisting of: (1) measures of demographic characteristics, driving exposure, and binge drinking; and (2) one of three measures of PO use (any PO use, MPO use, or NMPO use).

*Results:* Any PO use and MPO use were associated with increased collision risk ($OR = 1.60$, $CI = 1.06, 2.40$ and $OR = 1.62$, $CI = 1.07, 2.45$, respectively). The odds ratio for NMPO use did not reach statistical significance ($OR = 1.86$, $CI = 0.91, 3.77$, $p = 0.09$).

*Conclusions:* These results suggested that doctor-prescribed PO use is associated with a 62% increase in collision risk. Although not a statistically significant finding, NMPO use may also be associated with increased collision risk. The magnitude of increased collision risk associated with PO use was comparable to that of driving after alcohol or cannabis use.



* Corresponding author at: Institute for Mental Health Policy Research, Centre for Addiction and Mental Health, 33 Russell Street - T417, Toronto, Ontario M5S 2S1, Canada. Fax: +1 416 595 6899.
*E-mail address:* christine.wickens@camh.ca (C.M. Wickens).

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## 1. Introduction

The global production and distribution of prescription opioid analgesic drugs (POs) has increased immensely over the past two decades. This rise in consumption has been centered primarily in North America. Based on data from the International Narcotics Control Board, the consumption of standardized defined daily doses of POs in the United States increased 112% from 2000–2002 to 2008–2010. Consumption of POs in Canada over the same period increased 203% (Fischer & Argento, 2012). While the rising prevalence in PO use is predominantly associated with prescribed medical use of these drugs (MPO), it is also associated with an increase in non-medical use (NMPO) such as taking the medication to 'get high' (Fischer, Gittins, & Rehm, 2008). Both medical and non-medical use of opioid medication are associated with increased rates of social, financial, and work-related problems (Brands, Flam Zalcman, Mann, Stoduto, & Thomas, 2009), morbidity (e.g., emergency room visits; Fischer & Argento, 2012; Fischer et al., 2008), and mortality (e.g., poisoning deaths; Callaghan et al., 2013; Fischer & Argento, 2012; Fischer et al., 2008). Motor vehicle collisions represent one of the possible morbidity and mortality outcomes of PO use.

Epidemiological research, including case-control and cohort studies, have examined the impact of opioid use on collision risk and have drawn contrasting conclusions. While some studies have found no effect of opioids on collision risk (Bachs, Engeland, Mørland, & Skurtveit, 2009; Dussault, Brault, Bouchard, & Lemire, 2002; Gibson et al., 2009; Movig et al., 2004; Ray, Fought, & Decker, 1992), others have reported significant increases in risk (Engeland, Skurtveit, & Mørland, 2007; Gjerde, Normann, Christophersen, Samuelsen, & Mørland, 2011; Gomes et al., 2013; Leveille et al., 1994; Mura et al., 2003). Of those studies reporting significant effects, the size of effect has varied greatly. Dassanayake, Michie, Carter, and Jones (2011) noted that studies that detect opioids in the blood of drivers involved in a motor vehicle collision reported less association between opioids and collision risk than studies that assess the prevalence of opioid prescriptions among this same type of sample. Responsibility analyses have also generated contrasting findings. While some studies have reported no difference in level of responsibility for a crash among opioid-positive versus opioid-absent drivers (Drummer et al., 2004; Laumon, Gadegbeku, Martin, Biecheler, & the SAM Group, 2005), other studies have found increased responsibility among opioid-positive drivers (Corsenac et al., 2012; Dussault et al., 2002).

The experimental cognitive/psychomotor literature has also produced a diverse set of findings. Although several experimental studies have identified a negative impact of PO use on various driving-related cognitive and psychomotor skills (e.g., information processing, concentration, psychomotor speed, working memory (Sjøgren, Thomsen, & Olsen, 2000; Walker, Zacny, Galva, & Lichtor, 2001)), a number of other such studies have failed to find an effect (Bradley & Nicholson, 1986; Hanks, O'Neill, Simpson, & Wesnes, 1995; Moskowitz & Robinson, 1985). In studies examining methadone, drug effects were more commonly found in studies where the control group consisted of drug-naïve participants versus former drug users (Lenné, Dietze, Rumbold, Redman, & Triggs, 2003), which may help to explain the inconsistency of findings concerning that particular opioid. Nonetheless, the ecological validity of these experimental findings is limited by their focus on isolated driving-related skills. When we operate a motor vehicle, numerous cognitive and psychomotor skills are used simultaneously. If one skill is impaired, it is possible that another may compensate, resulting in no net difference to overall driver performance. In order to avoid overestimation of the effects of PO use on driver performance, the greater validity offered by naturalistic and simulation studies is essential.

Relative to some potentially impairing substances, the impact of PO use on driver performance has received much less naturalistic and simulation-based research attention. Only a small number of studies have examined the relationship between PO use and on-the-road driver performance (Berghaus & Friede, 1998; Byas-Smith, Chapman, Reed, & Cotsonis, 2005; Chapman, 2001; Verster, Veldhuijzen, & Volkerts, 2006). While none of these studies has found an effect of the drug on driving, Verster et al. (2006) noted that reduced alertness and increased mental effort were associated with PO use in a dose-dependent manner. With few exceptions (Linnoila & Häkkinen, 1974; Macdonald, Gough, Nicoll, & Dow, 1989), studies using driver simulation have also found minimal to no effects of PO use on a number of driving-related outcome measures including reaction time, speed variability, standard deviation of lateral position, and collisions (Buvanendran, Moric, Kroin, Lubenow, & Tuman, 2007a; Buvanendran, Moric, Kroin, Venkatesan, & Tuman, 2007b; Galski, Williams, & Ehle, 2000; Lenné et al., 2003; Menefee et al., 2004; Nilsen et al., 2011; Strumpf et al., 1997). However, with so few such studies having been conducted, a number of potential explanatory variables remain unexplored, including dosage level, tolerance, nature of use (i.e., medical versus non-medical), and the specific PO being used.

The failure of existing epidemiological and experimental research to systematically assess the impact of these variables may help to explain why several systematic reviews and meta-analyses have drawn conflicting conclusions (Dassanayake et al., 2011; Elvik, 2013; European Monitoring Centre for Drugs & Drug Addiction, 2008; Fishbain, Cutler, Rosomoff, & Rosomoff, 2002; Fishbain, Cutler, Rosomoff, & Rosomoff, 2003; Lenné, Dietze, Rumbold, Redman, & Triggs, 2000; Leung, 2011). Differences in the focus and inclusion criteria of these reviews may have resulted in variation in which studies are included in the reviews, and thus differences in their conclusions concerning the overall impact of POs on collision risk.

### 1.1. Purpose of the current study

The purpose of the current study was to explore the relationship between PO use and collision risk, and also to provide a preliminary investigation of the impact that nature or type of PO use might have. Specifically, the current study examined