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Prevalence and characteristics of opioid-related deaths involving alcohol in Ontario, Canada

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ABSTRACT

Background: While it is well known that patients receiving opioids should refrain from alcohol consumption, little is known about the involvement of alcohol in opioid-related deaths.

Methods: We conducted a population-based analysis of opioid-related deaths in Ontario with and without alcohol involvement between 1993 and 2013, and reported rates overall and stratified by manner of death. We compared the characteristics of individuals who died of an opioid overdose based on the presence or absence of alcohol involvement.

Results: The rate of opioid-related deaths increased 288% from 11.9 per million (95% confidence interval (CI) 9.8–13.9 per million) in 1993–46.2 per million (95% CI 42.6–49.8 per million) in 2013. The rate of opioid-related deaths without alcohol involvement increased 388% from 7.4 per million to 36.1 per million, while deaths involving alcohol increased by 125% from 4.5 per million to 10.1 per million. Therefore, although the annual number of opioid-related deaths involving alcohol rose, the proportion of opioid-related deaths involving alcohol declined from 37.8% in 1993–21.9% by 2013. Generally, opioid-related deaths involving alcohol were less likely to involve other central nervous system depressants, and more likely to occur among men and those with a history of alcohol use disorder.

Conclusions: Although the relative contribution of alcohol in opioid-related deaths has declined, 1 in 5 fatal opioid overdoses still involved alcohol in 2013. Our findings highlight the ongoing need for targeted messaging around risks of opioids alone, and in combination with alcohol and other CNS depressants.

1. Introduction

Global statistics estimate that alcohol was involved in over 3 million deaths in 2012 (Public Health Agency of Canada, 2016) and per capita opioid consumption was approximately 60 milligrams of morphine equivalent (Pain and Policy Studies Group, 2015b). In North America, the prevalence of alcohol use disorders is high, reaching 3% of the adult population in Canada (Canadian Centre on Substance Abuse, 2014) and 6% of the adult population in the United States (National Institute on Alcohol Abuse and Alcoholism, 2016). Furthermore, North America has the highest opioid consumption in the world (Pain and Policy Studies Group, 2015a, c) with 12.5 million Americans misusing prescription opioids in 2015 (U.S. Department of Health and Human Services, 2016).

This high prevalence of substance misuse has considerable public health implications, with approximately 30 alcohol-related deaths occurring per 100,000 in Canada and the U.S. (Canadian Centre on Substance Abuse, 2014; National Institute on Alcohol Abuse and Alcoholism, 2016) and rates of opioid-related deaths ranging between 53 per million in Ontario (Canada's most populous province) and 103 per million in the U.S. (Gomes et al., 2017; Rudd et al., 2016b). Furthermore, these rates are similar to those reported in several countries in Europe, highlighting the international relevance of this issue (European Monitoring Centre for Drugs and Drug Addiction, 2015;

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Gomes et al., 2014; Leifman, 2016; Office for National Statistics, 2016). Given their high prevalence of use, their synergistic effects on central nervous system (CNS) depression, and the potential for pharmacokinetic interactions (i.e., 'dose-dumping') when long-acting opioids are combined with alcohol, prescribing guidelines recommend physicians review with patients the risk of respiratory depression when opioids are taken with alcohol or other CNS depressants (Dowell et al., 2016; Kahan et al., 2011; Koski et al., 2003; Ray, 2015).

Despite this recommendation, data among select populations suggests the concurrent use of alcohol and opioids remains high, particularly among chronic opioid recipients. Indeed, concurrent alcohol use exceeded 12% in a U.S. study of chronic opioid recipients (Saunders et al., 2012), and risky drinking behavior was reported by 24% of patients in a cohort of Australians with chronic non-cancer pain (Larance et al., 2016). Furthermore, alcohol use disorders are particularly high among individuals seeking treatment for opioid dependence, with recent reviews estimating that one-third of people in methadone treatment have an alcohol use disorder (Hartzler et al., 2010; Nolan et al., 2016; Soyka, 2015). Alcohol is also often involved in opioid-related deaths, with some studies in the U.S. suggesting a prevalence of up to 26% (Hall et al., 2008; Jones et al., 2014). However, these estimates derive from specific calendar years and do not quantify the extent to which this phenomenon has evolved over time. Data on the role of alcohol use in opioid-related deaths are important to better understand the contributors to opioid overdose in an ever-changing environment of prescription and illicit opioid use (Dart et al., 2015; Gomes and Juurlink, 2016; Gomes et al., 2011a; Rudd et al., 2016a).

The primary aim of this study was to examine coroners' death investigations to explore temporal trends in opioid-related deaths according to alcohol involvement and manner of death in Ontario, Canada between 1993 and 2013. Secondary aims were to describe the distribution of blood alcohol concentration in these deaths and to explore the extent to which patient demographics, health services utilization and medication use were associated with alcohol involvement in opioid-related deaths.

2. Methods

2.1. Setting

We conducted a population-based repeated cross-sectional study among residents of Ontario who died of an opioid-related cause as determined by the Chief Coroner of Ontario between January 1, 1993 and December 31, 2013. The study protocol was approved by the research ethics board of Sunnybrook Health Sciences Centre, Toronto, Ontario.

2.2. Data sources

We identified opioid-related deaths from the Drug and Drug/Alcohol Related Deaths (DDARD) database abstracted from the Office of the Chief Coroner of Ontario using methods described previously (Dhalla et al., 2009). This database contains details of all deaths in which a coroner deemed opioids to have contributed to death, either alone or in combination with another drug or alcohol. In Ontario, all coroners are required to be physicians, and therefore this system is considered to be of high quality and comparable to the medical examiner systems in other jurisdictions. Details captured in this database include recorded manner of death (i.e., accident, suicide, undetermined) and results from post-mortem toxicology analyses. The DDARD has been used regularly by our group to study opioid overdose deaths in Ontario (Dhalla et al., 2009; Gomes et al., 2014; Gomes et al., 2011b; Kaplovitch et al., 2015).

We used the Canadian Institute for Health Information's Discharge Abstract Database (DAD) and National Ambulatory Care Reporting System (NACRS) to identify all diagnoses and procedures provided during inpatient hospital admissions and emergency department visits in the 3 years preceding death, respectively.

We used the Ontario Health Insurance Plan (OHIP) Claims History Database, which records services rendered by physicians, to measure health services utilization in the year prior to death.

Finally, we ascertained demographic information of decedents, including age, sex, location of residence and neighbourhood income quintile, using the OHIP Registered Persons Database, which contains information on every Ontarian ever issued a health card.

All datasets were linked using unique, encoded identifiers, and were analyzed at the Institute for Clinical Evaluative Sciences (ICES, www.ices.on.ca).

2.3. Cohort definition

We included all individuals who died of an opioid-related cause during the study period, excluding those who could not be linked to ICES data sets (n = 217; see Supplementary appendix for characteristics of unlinked individuals) and those deemed to be homicides or natural deaths by the Office of the Chief Coroner (n = 26). We also excluded deaths occurring in 2005 (N = 425) and 2006 (N = 420) due to incomplete abstraction of post-mortem blood alcohol concentration (BAC) data during those years. Furthermore, deaths due to trauma and other injuries are not included, regardless of whether an opioid had been consumed.

BAC is routinely ordered on deaths suspected of being opioid related. We therefore determined post-mortem BAC through ethanol concentrations identified on postmortem testing reported as grams per deciliter (g/dL). Due to the potential for post-mortem alcohol formation, we only considered a death to involve alcohol if the BAC was greater than 0.0371 g/dL (Krabseth et al., 2014). All deaths involving lower BAC were classified as not involving alcohol.

2.4. Patient characteristics

We compared patient characteristics, including sociodemographic, comorbidities, and drug involvement, between individuals with and without alcohol involvement in the opioid-related deaths. Sociodemographic information included age, sex, urban vs. rural location of residence, and neighbourhood income quintile.

We characterized comorbidity using the Deyo-Charlson Comorbidity Index (Deyo et al., 1992) based on inpatient hospitalization data over the prior 3 years, and history of alcohol use disorder and number of physician visits in the in the year preceding death. Finally, we summarized the circumstances surrounding the deaths, including opioid involvement (e.g., codeine, oxycodone, morphine, fentanyl, hydromorphone), other drug and medication involvement (i.e., cocaine, stimulants, tricyclic antidepressants, benzodiazepines, antipsychotics, barbiturates, and antihistamines), and manner of death (accidental, suicide or undetermined). Manner of death is determined by the investigating coroner based on the results of the investigation. In cases where the manner of death is unclear, the death is classified as 'undetermined' manner. All patient characteristics studied were specified prior to analysis.

2.5. Statistical analysis

We calculated the rate of opioid-related deaths annually, stratified by alcohol involvement and type of death, and tested for the presence of a linear trend using the Cochran-Armitage test. All rates were calculated per million population using the Statistics Canada census population estimates as the denominator. In a sensitivity analysis, we age- and sex-standardized these rates to adjust for population changes over time. We used direct standardization using the 2003 Ontario population as the standard population. Further, we reported the distribution of BAC among all deaths involving both opioids and alcohol over the study