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7 **Descriptive Study: Substance-related injury Hospitalizations prior to and during**  
8 **the COVID-19 Pandemic**  
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29 conducted the analysis and drafted the manuscript. All authors have reviewed and approved the final  
30 manuscript.  
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## Abstract

**Background:** The COVID-19 pandemic posed many challenges to the lives of Canadians. Public health measures, uncertainty surrounding the pandemic and changes to healthcare access have indirectly affected other aspects of human behaviour and health, including changes in substance consumption and injuries. During the pandemic period, emergency department visits and hospitalizations overall decreased compared to before the pandemic, however hospitalizations related to substances increased.

**Methods:** Canadian hospitalization data was compared from pre-pandemic (March 2019-February 2020) to during the pandemic (March 2020-February 2021) using the Discharge Abstract Database. Substance-related injury hospitalizations were identified using ICD-10 codes. Percent change, age-standardized rates, age-specific rates and monthly percent changes were calculated. Results are stratified by sex and age group and substance type.

**Results:** Substance-related injury hospitalizations increased by 9% during the pandemic compared to pre-pandemic. Intentional substance-related injury hospitalizations decreased by 6% whereas, unintentional substance-related injuries increased by 19%, during the pandemic. Males accounted for 91% of the increase in substance-related injury hospitalizations seen during the pandemic. The distribution of substance-related injury hospitalizations across age-groups remained similar to pre-pandemic. During the pandemic, a percent increase was seen among alcohol, opioid, cannabinoid, hallucinogen, tobacco and polysubstance-related injury hospitalizations.

**Interpretation:** Overall, an increase in substance-related injury hospitalizations was observed during the COVID-19 pandemic compared to the same time period pre-pandemic. These results highlight changes in substance-related hospitalization during the pandemic compared to pre-pandemic by substance type, age and sex as well as monthly trends in substance-related injuries during the pandemic compared to

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3 pre-pandemic. This work can provide useful insight into the ongoing management of the COVID-19  
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5 pandemic.  
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Confidential

## Background

Early in 2020, when the SARS-CoV-2 virus began spreading in Canada, public health guidelines were implemented, encouraging Canadians to stay home as much as possible, wear masks in public and practice hand hygiene. These public health measures were crucial in mitigating the spread of the virus, but undeniably altered the lives of Canadians. These guidelines coupled with pandemic-related stress and changes to healthcare access may have affected other aspects of health.

Injuries have been a leading cause of death, morbidity and potential years of life lost, among Canadians.(1-3) Human behavioural changes during the pandemic have altered the injury landscape, with fewer sports-related injuries, motor vehicle collisions and accidental falls and a greater number of injuries now occurring in the home.(4-7) Unintentional poisonings, specifically overdose deaths and alcohol-induced mortality, have contributed to the excess mortality observed during the pandemic. As the pandemic continues to evolve and impose changes to human behaviour and access to support programs and services, the injury epidemiology in Canada may also change.(8)

Throughout the pandemic self-reported alcohol and cannabis use and hospitalizations due to substances have increased.(9-13) The pandemic has changed the way people consume and access substances.(14-16) With public health guidelines encouraging people to stay home and limit social gatherings, Canadians have changed their substance consumption habits, by increasing consumption, changing the substances they normally used and using alone more frequently.(14,16-20) Additionally, boarder closures, travel restrictions, supply chain disruptions and increased pricing, have altered the availability and toxicity of the illegal drug supply.(14,15,21-23) These changes in substance consumption and using practices along with the reduced availability of support services such as supervised consumption sites and addictions services, may have contributed to the increase in substance-related injury hospitalizations during the pandemic.(24)

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3 This work will examine monthly changes in substance-related injury hospitalizations during the  
4 pandemic compared to pre-pandemic, and identify subpopulations more greatly impacted by substance-  
5 related injury hospitalizations during the pandemic, by age group, sex and substance type. This work will  
6 contribute to the knowledge of the wider-health impacts of the COVID-19 pandemic, and help to inform  
7 decision makers on how to proceed with future public health interventions.  
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## 14 15 **Methods**

### 16 17 ***Data Source & Case Definitions***

18 The data used for this study is from the Discharge Abstract Database (DAD), a national  
19 database that collects administrative, clinical and demographic information on hospital  
20 discharges, from all provinces and territories, excluding Quebec. The DAD is managed by the  
21 Canadian Institute for Health Information (CIHI). The cases reported in this study are acute  
22 inpatient discharge records. Injuries resulting from the adverse effects of drugs and surgical or  
23 medical care or diagnoses that were uncertain have been excluded.  
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33 The *International Statistical Classification of Diseases and Related Health Problems, 10<sup>th</sup>*  
34 *Revision, Canada (ICD-10-CA)* is used to classify diagnoses and medical interventions.(25,26)  
35 Injury-related hospitalizations were identified by searching all 25 diagnostic fields for an ICD-10  
36 external cause of injury code (V01-Y98). External cause of injury ICD-10 codes have been grouped  
37 by injury intent (unintentional and intentional (self-harm, assault, self-inflicted injury)). To prevent  
38 misclassification of injury hospitalizations, only entries with a unique injury intent were included.  
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47 Identified cases of injury hospitalizations were further searched for a corresponding  
48 substance-related diagnostic code to identify substance-related cases. Substance codes are  
49 grouped according to substance type, as outlined in the ICD-10 manual, mental and behavioural  
50 disorders (F00-F99), as well as (T36-T65 and R70-R79). The substance groups included in this study  
51 are alcohol, opioids, cannabinoids, sedatives or hypnotics, cocaine, other stimulants (including  
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3 caffeine), hallucinogens, tobacco, volatile solvents, other psychoactive substance and cases where  
4 multiple categories of psychoactive substances were recorded (polysubstance).  
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### 7 8 **Statistical Analyses** 9

10 Substance-related injury hospitalizations have been compared from pre-pandemic (March  
11 2019 to February 2020) to during the COVID-19 pandemic (March 2020 to February 2021). The  
12 primary variables of interest were sex, age group, external cause of injury, and substance type.  
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15 Results have been presented as rates, proportions and percent changes. Age-specific rates  
16 per 100,000 population have been calculated using Statistics Canada population estimates  
17 (excluding Quebec), for 2019 and 2020. Age-standardized rates (ASR) per 100,000 were  
18 standardized to the 2011 Canadian population (excluding Quebec) using direct standardization.  
19 Monthly percent change (MPC) has been used to quantify monthly trends in age-standardized  
20 rates. Age-standardized rates that have significantly changed throughout the year were identified  
21 by a MPC that is significantly different from zero at the  $\alpha=0.05$  level. Percent change has been  
22 used to identify the relative difference of substance-related injury hospitalizations pre-pandemic  
23 (2019/20) compared to during-pandemic (2020/21).  
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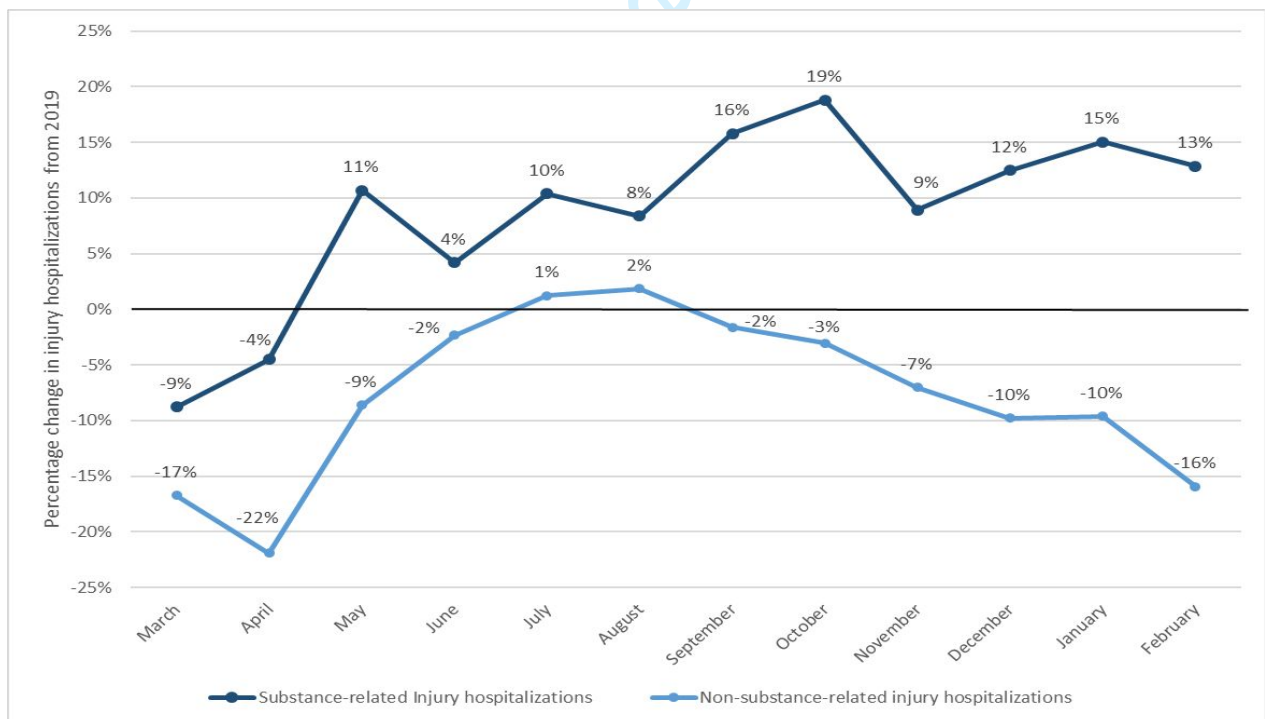
38 All analyses were conducted using SAS EG 7.1. Trend analyses, with 95% confidence  
39 intervals, were conducted using Joinpoint V4.9.0.1.(27) Rates and proportions calculated using  
40 small cells with counts between one and five have been suppressed.  
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### 45 **Results** 46

47 During the COVID-19 pandemic, March 2020-February 2021, the number of total  
48 hospitalizations decreased by 12.3%, compared to the same period in 2019/20. Injury hospitalizations,  
49 without an associated substance-related diagnoses also decreased during this time by 7.5% (2019/20:  
50 176,522 vs. 2020/21: 163,240), whereas injury hospitalizations, with substance-related diagnoses  
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increased by 8.6% (2019/20: 22,503 vs. 2020/21: 24,446). The odds of substance-related injury hospitalizations were 20% greater during the pandemic compared to pre-pandemic, OR 1.2 [1.1, 1.2] ( $p < 0.0001$ ).

Intentional substance-related injury hospitalizations decreased by 6.0% whereas, unintentional substance-related injuries increased by 18.7%, compared to pre-pandemic. **Figure 1** highlights the monthly percent change in injury hospitalizations, between 2019 and 2020. In the early months of the COVID-19 pandemic injury hospitalizations both with and without an associated substance diagnosis show a decrease compared to 2019. By the summer of 2020 injury hospitalizations without an associated substance diagnosis, returned to comparable numbers to 2019, whereas substance-related injury hospitalizations exceeded that of 2019. A peak in substance-related injury hospitalizations occurred in October with an increase of 19%, from October 2019 compared to October 2020, and remained higher than pre-pandemic throughout the winter months.



**Figure 1.** Percentage change in injury hospitalizations, with and without a substance-related diagnosis, March 2020 to February 2021 compared with March 2019 to February 2020, in Canada (excl. QC).

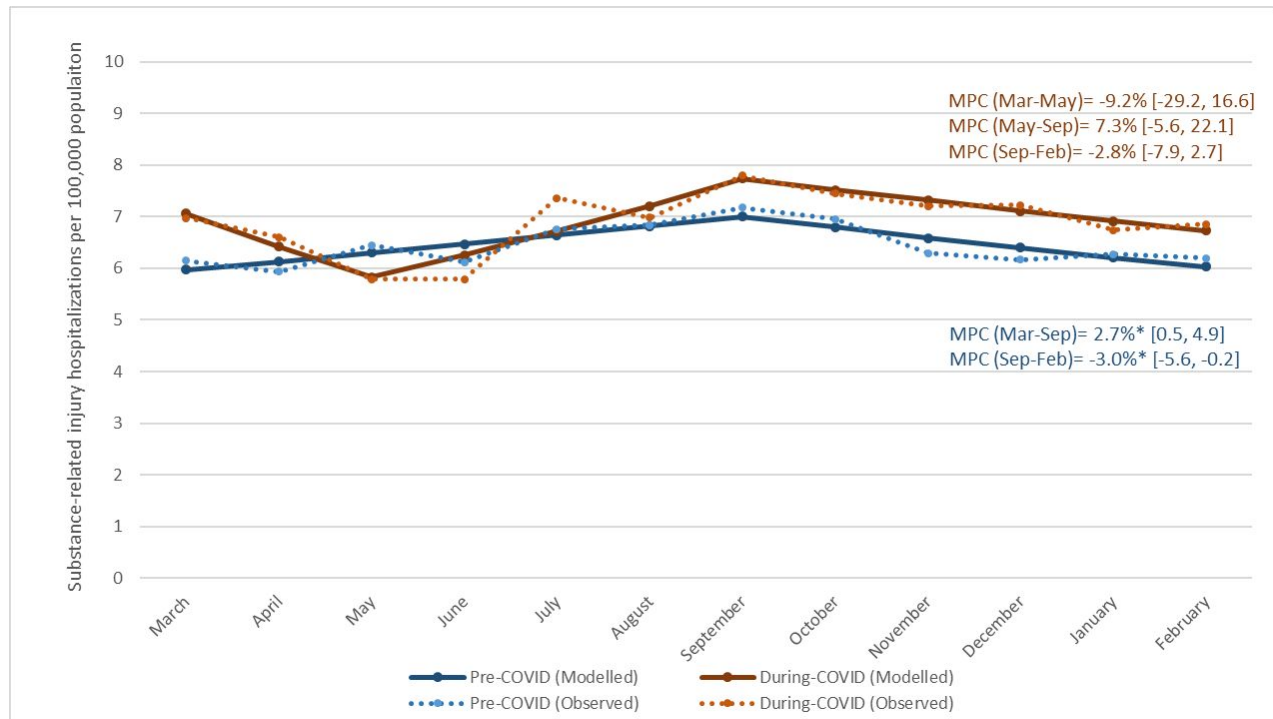
The first two months of the pandemic, March and April 2020, had lower counts and age-standardized rates of substance-related injury hospitalizations compared to 2019 (**Figure 2**). Beginning in May 2020, substance-related injury hospitalizations surpassed that of 2019.



**Figure 2.** Counts (bars, left y-axis) and age-standardized rates (lines, right y-axis) of substance-related injury hospitalizations in Canada (excl. QC) pre-pandemic (March 2019- February 2020) and during the pandemic (March 2020- February 2021). Notes: Age-standardized rates are standardized to the 2011 Canadian population (Excl. QC).

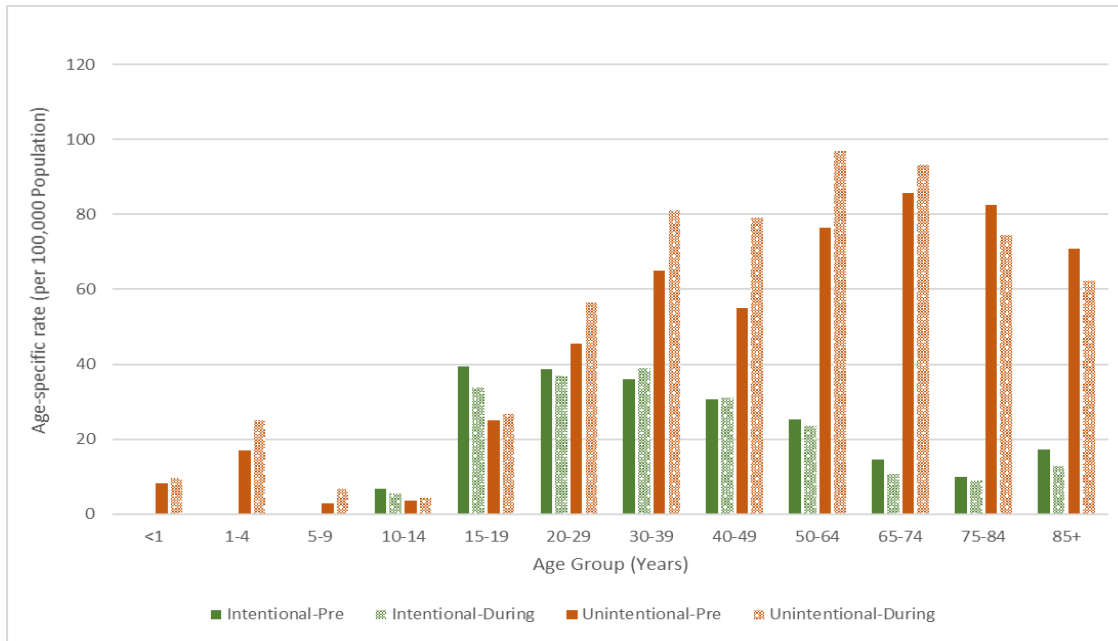
During the pandemic period no significant trends in substance-related injury hospitalizations were seen, however a decline in substance-related injury hospitalizations was observed from March to May 2020 by 9.2% [-29.2, 16.6], followed by an increase of 7.3% [-5.6, 22.1] from May to September. From September 2020 to February 2021 there was a slight decline of 2.8% [-7.9, 2.7], but ASRs remained higher than pre-pandemic levels, **Figure 3**.



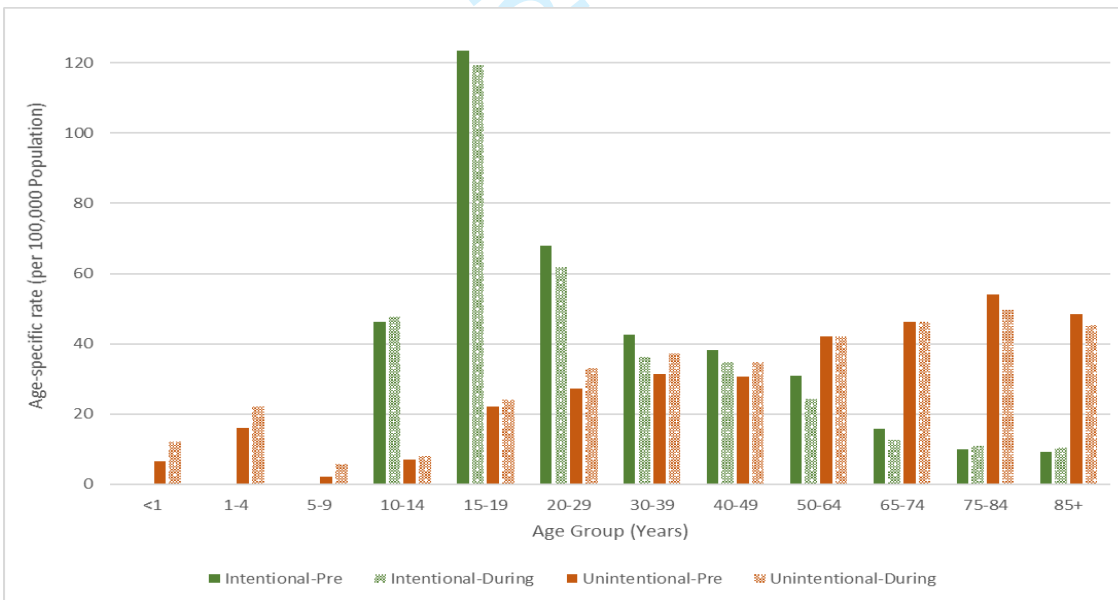


**Figure 3.** Age-standardized rates (ASR) per 100,000 population of Substance-related injury hospitalizations in Canada (excl. QC), pre-COVID-19 pandemic (March 2019-February 2020) and during the COVID-19 pandemic (March 2020-February 2021). *Notes: Rates are standardized to the 2011 Canadian population, excluding Quebec. MPC-Monthly percent change. \* Indicates that the MPC is significantly different from zero at the alpha=0.05 level.*

During the pandemic period, males comprised 91% of the increase in substance-related injury hospitalizations. Age-specific rates of unintentional substance-related injury hospitalizations among both males and females ages 0 to 74 years were consistently higher during the pandemic compared to pre-pandemic, whereas for males and females ages 75 or older, rates were lower during the pandemic (**Figure 4a & 4b**). Age-specific rates of intentional substance-related injuries among males were higher pre-pandemic, except for males aged 30-49 years. Age-specific rates of intentional substance-related injury hospitalizations among females aged 5-9 and 15-74 years were higher pre-pandemic, whereas females aged 10-14 and 75+ years exhibited higher age-specific rates during the pandemic.



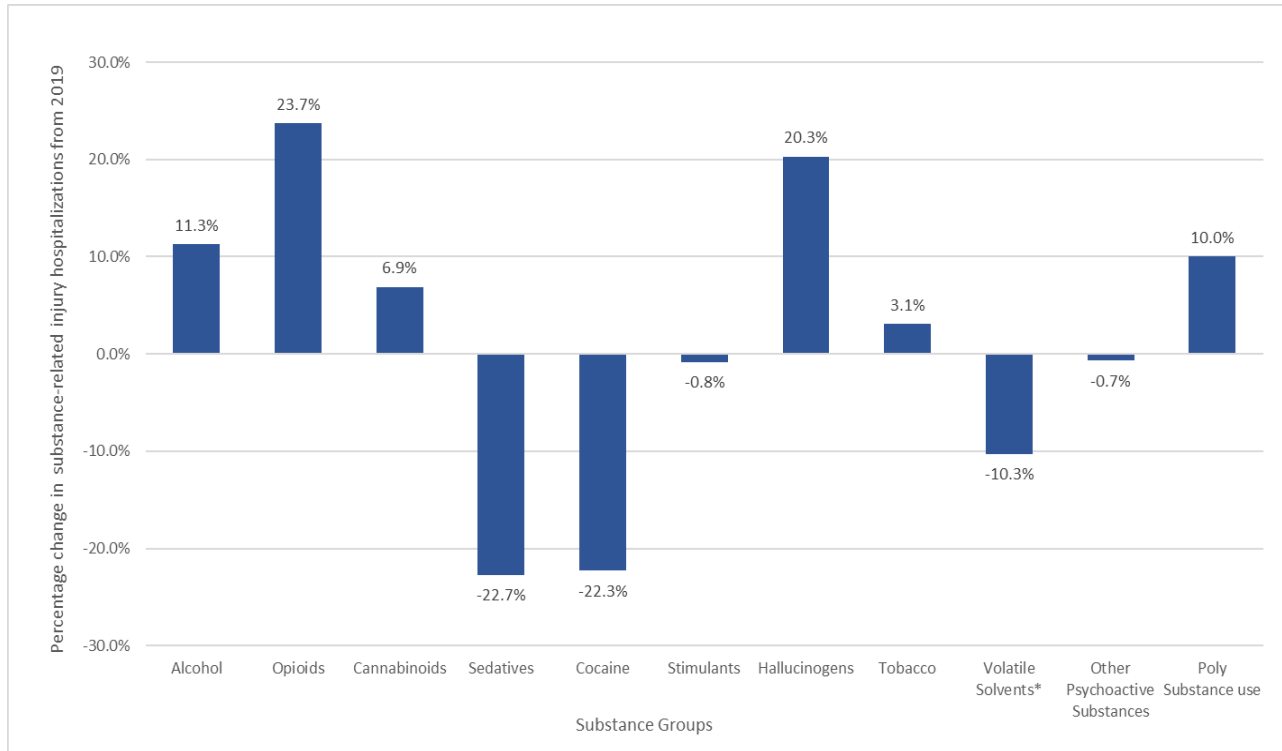
**Figure 4a.** Substance-related injury hospitalizations in Canada (excl. QC), 2010/11 to 2020/21, by age group and injury intent, males, age-specific rates/100,000 population. Age-specific rates per 100,000 population were calculated using Statistics Canada population estimates (excl. QC) for 2019/20 and 2020/21. Rates based on counts between one and five are not reported.



**Figure 4b.** Substance-related injury hospitalizations in Canada (excl. QC), 2010/11 to 2020/21, by age group and injury intent, females, age-specific rates/100,000 population. Age-specific rates per 100,000 population were calculated using Statistics Canada population estimates (excl. QC) for 2019/20 and 2020/21. Rates based on counts between one and five are not reported.

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3 The most frequent external causes of unintentional substance-related injuries among both males and  
4 females, pre-pandemic and during the pandemic, were unintentional poisonings, falls and transport  
5 collisions. During the pandemic, an increase was seen in unintentional poisonings (F: 9.7%, M: 31.3%), falls  
6 (F: 9.1%, M: 12.6%) and transport collisions (F: 20.1%, M: 24.8%), among both males and females. The most  
7 frequent external causes of intentional substance-related injuries among both males and females was self-  
8 harm, followed by assault. During the pandemic, substance-related self-harm injuries decreased (F: 9.7%, M:  
9 11.3%), compared to pre-pandemic, whereas substance-related assault injuries increased (F: 36.9%, M:  
10 34.3%).  
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21 Of the substance groups analyzed in this study, more than half of the substances had a percent  
22 increase compared to the same period in 2019 (**Figure 5**). Alcohol, opioids, cannabinoids, hallucinogens,  
23 tobacco and polysubstance groups exhibited an increase from pre-pandemic to during the pandemic period,  
24 ranging from a 3.1% to 23.7% increase. Conversely, sedatives, cocaine, stimulants and volatile substances,  
25 exhibited a percent decrease from pre-pandemic to during the pandemic ranging from a 0.7% to 22.7%  
26 decrease.  
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**Figure 5.** Percentage change in substance-related injury hospitalizations, by substance type, March 2020 to February 2021 compared to March 2019 to February 2020. \*Volatile solvents are typically found in fuels and paints and can be inhaled in high concentrations with the purpose of intoxication. Some examples include spray paint, lighter fluid, adhesives, air fresheners and compressed air dusters.

## Discussion

This study presents the most recent findings comparing substance-related injury hospitalizations prior to and during the COVID-19 pandemic in Canada (excluding Quebec). Between March 2020 and February 2021, substance-related injury hospitalizations increased by 8.6% compared to the same period in 2019/2020. Monthly trends show that substance-related injury hospitalizations initially declined at the onset of the pandemic (March-April 2020) but then remained consistently higher than pre-pandemic trends from May 2020 to February 2021. During the pandemic period, there was an increase in injury hospitalizations associated with alcohol, opioids, cannabinoids, hallucinogens, tobacco and polysubstance.

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3 The implementation of public health measures along with the uncertainty surrounding the  
4 pandemic, undoubtedly caused additional stress and exacerbation of pre-existing mental health  
5 conditions for some Canadians.(28-31) Lockdowns and transitions to virtual healthcare may have  
6 affected accessibility of mental health and addictions services for those in need.(32) Self-reported  
7 survey data during the first wave of the pandemic indicated that Canadians reporting worsening mental  
8 health were more likely to have increased substance consumption, which may be partly attributable to  
9 relying on substances as a coping mechanism when social support and health services were not as  
10 accessible.(32,33)

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12 Previous Canadian surveillance work has shown comparable trends to what was reported in the  
13 present study. Overall hospitalizations and hospitalizations related to substances at the onset of the  
14 pandemic rapidly declined. During the summer and fall of 2020, substance-related hospitalizations  
15 increased and surpassed pre-pandemic levels.(13,34) Additionally, the trends reported in this current  
16 study align with the epidemic curve of COVID-19 cases in Canada throughout the pandemic.(35) In our  
17 study the first major percent increase in substance-related injury hospitalizations was in May followed  
18 by slightly smaller percent increases over the summer months, and then larger percent increases in the  
19 fall and winter of 2020/21. The initial decline in substance-related hospitalizations may be attributable  
20 to public health messaging advising people to stay home and avoiding unnecessary hospital visits. For  
21 many Canadians, the hardships resulting from the pandemic may not have been immediately felt, but as  
22 the pandemic persisted and lockdowns, employment layoffs, and uncertainty prevailed, more Canadians  
23 may have experienced deteriorating mental health and turned to different coping mechanisms during  
24 this difficult time.(36,37)

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26 Unintentional substance-related injury hospitalizations overall increased during the pandemic  
27 among both males and females, whereas intentional substance-related injury hospitalizations declined.  
28 The overall distribution of substance-related injury hospitalizations for both intentional and

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3 unintentional injuries across age-groups has remained relatively consistent with recent work presenting  
4 age-specific rates over the last 10-years, pre-pandemic.(*article in publication*) During the pandemic,  
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6 males aged 20-74 had a more observable increase in rates of substance-related unintentional injury  
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8 hospitalizations compared to females in the same age groups. About 90% of the additional substance-  
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10 related injury hospitalizations occurring in 2020/21 were among males, which is consistent with other  
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12 surveillance work indicating that males had a greater increase in hospitalizations for substance harms  
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14 compared to females during the pandemic.(34)  
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19 Injury research during the pandemic has highlighted that some of the most frequent external  
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21 causes of unintentional injury, including motor vehicle collisions, falls and sports injuries, had declined  
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23 during the pandemic, whereas unintentional poisonings have increased. (7,8) Conversely, our work has  
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25 shown an increase in substance-related injury hospitalizations related to these external causes of injury.  
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27 Recent work has shown that hospitalizations for self-harm behaviour in Canada during the pandemic  
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29 decreased by 6% compared to pre-pandemic, with the exception in females ages 10-24 and males ages  
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31 80 years and older, who showed an increase in self-harm hospitalizations throughout the  
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33 pandemic.(13,38,39) Other Canadian studies indicate that death by suicide and suicidal ideation has  
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35 decreased during the pandemic compared to pre-pandemic,(40,41) however global studies have shown  
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37 increases in suicidal behaviours.(42,43) Assault-related emergency department visits and  
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39 hospitalizations had also declined compared to pre-pandemic in Canada from March to December  
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41 2020.(44) The minor changes in substance-related intentional injury hospitalizations, across age groups,  
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43 seen in our work, may be attributable to individuals not seeking medical attention for these injuries,  
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45 during the pandemic. Reasons that may deter someone from seeking help for a self-harm or assault  
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47 injury during the pandemic include; concern about burdening the healthcare system, social stigma, or  
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49 fear of aggravating a domestic violence situation especially when more time is being spent at home.(45-  
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3 Substance-related injury hospitalizations involving alcohol, opioids, cannabis, hallucinogens,  
4 tobacco and polysubstance, increased during the pandemic compared to pre-pandemic, in our study.  
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6 Other Canadian surveillance work, has reported an increase in alcohol harm hospitalizations by 10%,  
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8 opioids by 30% and cannabis by 14%.<sup>(13)</sup> Increases in alcohol and cannabis injury hospitalizations during  
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10 the pandemic may be related to the increase in self-reported substance use during the pandemic,  
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12 indicating that 14% of Canadians increased alcohol consumption and 6.5% increased cannabis  
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14 consumption early on in the pandemic.<sup>(33,48)</sup> The increase in alcohol and cannabis-related injury  
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16 hospitalizations may be due to the ease of access to these substances in Canada during the pandemic, as  
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18 stores where these substances can be purchased were considered essential services in most  
19  
20 jurisdictions.<sup>(18-20)</sup> Opioid related harms and deaths have increased considerably during the  
21  
22 pandemic.<sup>(14,23,49,50)</sup> This may be attributable to lack of support services such as supervised  
23  
24 consumption sites, changes in access to the illegal drug supply, and changes to the levels of fentanyl in  
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26 the illegal opioid supply, resulting in more cases of opioid poisonings and overdoses.<sup>(36,49)</sup> A decrease  
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28 in volatile solvent, sedative and cocaine-related injury hospitalizations was observed during the  
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30 pandemic. Due to limited social opportunities during the pandemic, there may have been fewer  
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32 occasions to use these substances. Additionally, travel restrictions, supply chain disruptions and  
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34 increased pricing has made access to the illegal drug market more challenging during the  
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36 pandemic.<sup>(14,15,22)</sup>  
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#### 44 **Limitations**

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46 One of the primary limitations of this work include the data source used, the DAD does not  
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48 include hospital discharge data from Quebec, and substance use diagnostic codes are only reported in  
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50 cases where the substance was a significant contributor in the overall diagnosis or episode of  
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52 care.<sup>(article in publication)</sup> As a result, the substance-related injury hospitalizations presented here are  
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54 an underrepresentation of substance-related injury hospitalizations in Canada. Further, this work only  
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3 presents results at the national level, and although all of Canada was impacted by the COVID-19  
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5 pandemic in some regard, across provinces and territories there were differences in how the pandemic  
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7 evolved. (35) This work was also unable to provide sub-group analyses beyond sex and age. Individuals  
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9 experiencing pre-existing inequalities prior to the pandemic may have had these inequalities further  
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11 exacerbated by the pandemic,(32) which may have caused varying changes in substance-related injury  
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13 hospitalizations across sociodemographic groups. Although this work provides overall trends in  
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15 substance-related injury hospitalizations, additional work including geographic and sociodemographic  
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17 breakdowns, as well as pre-existing health conditions, would aid in providing a more complete  
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19 understanding of the populations most affected.  
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## 24 **Conclusion**

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26 During the COVID-19 pandemic substance-related injury hospitalizations increased by 8.6%.  
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28 Injury hospitalizations associated with alcohol, opioids, cannabis, hallucinogens, tobacco and  
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30 polysubstance use increased during the pandemic compared to pre-pandemic. Understanding patterns  
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32 in substance-related injury hospitalizations may help inform the ongoing management of the COVID-19  
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34 pandemic and aid in priority setting for health services during public health emergencies.  
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