



## Pandemic-Related Changes in Alcohol and Cannabis Use: Comparing Retrospective Reports and Prospective Data

S. J. Bartel<sup>1</sup> · S. B. Sherry<sup>1</sup> · S. H. Stewart<sup>1,2</sup>

Accepted: 9 November 2021 / Published online: 29 November 2021

© The Author(s), under exclusive licence to Springer Science+Business Media, LLC, part of Springer Nature 2021

Research suggests that there is an increase in alcohol and cannabis use during the COVID-19 pandemic (Canada, 2020; Statistics Canada, 2020). In Canada, reports on the degree of this increase vary, ranging from 19 to 28% reporting an increase in alcohol use and 6–29% reporting an increase in cannabis use (Mental Health Research Canada, 2020; NANOS Research, 2020; Statistics Canada, 2020). While such statistics are concerning, several important gaps remain regarding the impact of the COVID-19 pandemic on substance use.

First, it is unclear whether the pandemic has a differential impact on frequency vs. quantity of use. As research suggests frequency and quantity are linked to health consequences and predict significant variance in substance-related problems, even after accounting for each other (Fischer et al., 2017; Griswold et al., 2018; Rehm et al., 2008; Zeisser et al., 2012), measuring both frequency and quantity of use is important. Second, it is unclear what impact the pandemic has had on certain populations which tend to have higher levels of risky substance use, such as emerging adults (Stone et al., 2012) or populations using both alcohol and cannabis (Metrik et al., 2018). This information gap is critical, as it may highlight whether particular attention needs to be paid to these already at-risk groups during the pandemic. Third, much of the current literature is cross-sectional and reliant on participants' retrospectively reported perceptions of substance use changes, rather than on an examination of actual change between pre-pandemic and during-pandemic levels of substance use. An analysis of whether subjective changes in pandemic-related substance use map onto objective changes in substance use is warranted to determine if cross-sectional research on COVID-19 impacts is accurate.

Given additional waves of COVID-19 continue to occur, and public health restrictions aimed at reducing the spread of COVID-19 continue to be active, it is crucial to have an accurate picture of the impact of COVID-19 on substance use. Our objectives were as follows: (1) provide data on the perceived impact of COVID-19 on substance use in a higher-risk sample of emerging adults who use both alcohol and cannabis and (2) provide data on the accuracy of perceived pandemic-related changes to alcohol and cannabis use.

We anticipated that at least 25% of participants would perceive their frequency and/or quantity of use to have increased during the pandemic, as this has been reported in prior

---

✉ S. J. Bartel  
sara.bartel@dal.ca

<sup>1</sup> Department of Psychology and Neuroscience, Dalhousie University, Life Sciences Center, PO BOX 15000, 1355 Oxford Street, NS B3H 4R2 Halifax, Canada

<sup>2</sup> Department of Psychiatry, Dalhousie University, Halifax, NS, Canada

general population studies, and our sample represents a theoretically higher-risk group (Mental Health Research Canada, 2020; NANOS Research, 2020; Statistics Canada, 2020). We also hypothesized that individuals would be relatively accurate in their retrospectively reported substance use change, with the actual increase of those who perceived an increase in their substance use due to the pandemic significantly greater than the actual increase of those who did not perceive an increase.

## Methods

### Participants

Seventy individuals between 19 and 25 ( $M=22.03$ ; male=24; female=45; other=1; 85% white), who were part of an ongoing Canadian longitudinal study on substance use, completed an online survey during the pandemic between March 23 and June 5, 2020, a time when all Canadian provinces had enacted States of Emergency and were encouraging/mandating individuals to stay at home due to COVID-19. Participants' pre-pandemic substance use was extracted from their previous time point, 4 months earlier. To be included, participants had to have used alcohol  $\geq$  four times, and cannabis recreationally  $\geq$  two times, in the past month at baseline (Cogle et al., 2015). Participants were recruited from the general community via posters, newspapers, and social media and through the psychology participant pool at an Eastern Canadian University.

### Measures

A *Substance Use Questionnaire* assessed cannabis and alcohol quantity and frequency using items from the Daily Sessions, Frequency, Age of Onset, and Quantity of Cannabis Use Inventory (Cuttler & Spradlin, 2017) and items recommended by the National Institute of Health for assessing alcohol use (National Institute of Health, 2003), respectively. An image depicting various cannabis quantities with a Canadian 5-dollar bill as a size reference was included to assist with estimating cannabis quantity (adapted from Cuttler and Spradlin (2017)), while an image depicting what is considered a standard drink was provided to assist in estimating alcohol quantity.

An author-compiled *COVID-19 Questionnaire* included assessment of perceived impact of COVID-19 on substance use patterns (quantity, frequency). For each substance, participants indicated if circumstances related to COVID-19 increased, decreased, or had no impact on their use in past 30 days.

### Procedure

Participants completed the measures online during the pandemic and 4 months earlier. At each time point, participants were compensated with a \$20 Amazon gift card or psychology credit points. This study received REB ethical approval at an Eastern Canadian University.

## Results

### Descriptive Statistics

To quantify objective change, substance use change scores were calculated for each variable by subtracting pre-pandemic scores from pandemic scores. Positive change scores indicate that substance use increased during the pandemic relative to pre-pandemic times, while scores of 0 indicate that substance use did not change, and negative change scores indicate that substance use decreased during the pandemic relative to pre-pandemic times. Objective change scores represent change over the past 4 months. See Table 1 for means, standard deviations, and percentages for participants' retrospective reports of whether substance use increased, decreased, or remained unchanged due to circumstances related to COVID-19. Four participants reported using highly improbable amounts of cannabis in a single sitting (10–100 g) for pandemic cannabis quantity, and this data was removed.

Substance use change scores were examined for each category of participants, and the percentage of participants who correctly perceived their substance use change was calculated (see Table 2). Due to low accuracy in the “decrease” and “no change” groups, these groups were collapsed to create a comparator category of “no increase,” which had improved accuracy. For those in the “increase” group, those who had a positive substance use change score were viewed to have accurately perceived their substance use change. For those in the “no increase” group, those who had a negative substance use change score or a score of zero were viewed to have accurately perceived their substance use change.

**Table 1** Means and standard deviations for pandemic and pre-pandemic alcohol use, cannabis use, and motives for use, as well as retrospective and actual increased, decreased, or unchanged substance use due to circumstances related to COVID-19

	Alcohol frequency	Alcohol quantity	Cannabis frequency	Cannabis quantity
<i>M</i> (pre-pandemic)	3.17	2.97	6.09	0.53
<i>Std Dev</i> (pre-pandemic)	1.42	1.15	0.76	3.05
<i>M</i> (pandemic)	3.29	2.39	6.03	0.48
<i>Std Dev</i> (pandemic)	1.53	1.23	3.43	0.75
% <i>perceiving increase</i>	51.4%	24.3%	54.3%	38.6%
% <i>actual increase</i>	35.7%	22.8%	50.0%	32.4%
% <i>perceiving no change</i>	30.0%	50.0%	17.1%	45.7%
% <i>actual no change</i>	30.0%	30.0%	21.4%	31.4%
% <i>perceiving decrease</i>	18.6%	25.7%	28.6%	15.7%
% <i>actual decrease</i>	34.3%	47.2%	28.6%	37.2%

Alcohol and cannabis frequency = number of times using per week. Alcohol quantity = number of drinks per typical drinking day. Cannabis quantity = number of grams of cannabis in a typical session of use. “Actual” change determined through comparison of pre- and during-pandemic use from the longitudinal study

**Table 2** Percentage of participants who correctly and incorrectly perceived changes in their substance use

Variable	Increase, no change, or decrease reported	Percentage correct	Percentage incorrect
Alcohol frequency	Increase	75.0%	25.0%
	No change	23.8%	76.2%
	Decrease	23.1%	76.9%
Alcohol quantity	No increase	82.4%	17.6%
	Increase	64.7%	35.3%
	No change	22.9%	77.1%
Cannabis frequency	Decrease	50.0%	50.0%
	No increase	83.0%	17.0%
	Increase	87.8%	13.2%
Cannabis quantity	No increase	68.8%	31.2%
	Decrease	54.5%	45.5%
	Increase	37.0%	63.0%
	No change	34.4%	35.6%
	Decrease	54.5%	45.5%
	No increase	72.0%	28.0%

The “no increase” category reflects a combined sample of “decrease” and “no change” categories

### Comparison of Residual Change with Perceived Change

In order to examine whether the actual increase of those who perceived an increase in their substance use due to the pandemic was significantly greater than the actual increase of those who did not perceive an increase (H2), pre-pandemic alcohol and cannabis frequency and quantity variables were separately regressed onto the same variables measured during COVID-19; residuals were saved. As those who have lower baseline scores have greater room to move upward than those with higher baseline scores (or vice versa), residual change scores were used so that starting values could be taken into account. Exploration of the pandemic alcohol and cannabis quantity variables indicated four extreme outliers and heterogeneity of variance. Thus, the top 5% of both variables was winsorized, resulting in all regression assumptions being met. A series of t-tests was used to compare residualized change between perceived change groups. Given data suggesting increased accuracy when using the category of “no increase” (“decrease” and “no change” combined) (see Table 2), categories of perceived “increase” vs. “no increase” were used. Given multiple testing, we corrected *p*-values using the Benjamini–Hochberg method for false discovery rate (Benjamini & Hochberg, 1995), with  $p < 0.05$  considered significant.

Those who perceived an “increase” had higher residual change scores than those who perceived no increase in the case of alcohol frequency ( $M [SD]=0.41 [1.04]$  vs.  $-0.40 [0.76]$ ,  $t(56.83)=3.52$ ,  $p=0.002$ ), cannabis frequency ( $M [SD]=0.45 [0.61]$  vs.  $-0.55 [1.10]$ ,  $t(41.79)=4.40$ ,  $p<0.001$ ), and alcohol quantity ( $M [SD]=0.52 [0.80]$  vs.  $-0.18 [1.00]$ ,  $t(61)=2.5$ ,  $p=0.018$ ). For cannabis quantity, however, those who perceived an “increase” did not have higher residual change scores than those who perceived “no increase” ( $M [SD]=0.03 [1.06]$  vs.  $-0.02 [0.96]$ ,  $t(56)=0.148$ ,  $p=0.88$ ).

## Discussion

Over 50% of our sample of emerging adults reported a perceived increase in the frequency of their alcohol and cannabis use, while 24% and 39% of our sample reported a perceived increase in the quantity of their alcohol and cannabis use, respectively. These perceived rates of increased quantity are comparable to the upper limits of previous Canadian reports on alcohol but are notably higher than previous Canadian reports on cannabis (Mental Health Research Canada, 2020; NANOS Research, 2020; Statistics Canada, 2020), which may reflect the higher-risk nature of our sample. An examination of actual change scores suggested a slight discrepancy between actual change and perceived change. We found 36% and 50% experienced an actual increase in the frequency of their alcohol and cannabis use, respectively, while 23% and 32% experienced an increase in the quantity of their alcohol and cannabis use, respectively. Importantly, our results suggest COVID-19 has had the strongest impact on frequency of use, highlighting the importance of assessing frequency and quantity separately in pandemic data.

Notably, an examination of participants' accuracy in perceived substance use change suggested that, with the exception of cannabis quantity, participants who perceived an increase in their substance use due to COVID-19 were notably more accurate in their perceptions than those who perceived no change or a decrease in their use. It may be that the distinction between unchanged and decreasing substance use habits is less salient in the memory of participants than an increase in use. In line with this, collapsing "no change" and "decrease" categories into "no increase" resulted in significant improvement in accuracy.

Supporting this idea and our hypothesis, we found that the residual change scores of those perceiving an increase in alcohol quantity and alcohol and cannabis frequency were significantly higher than those perceiving no increase. This suggests that cross-sectional surveys capturing the impact of COVID-19 on substance use may be a reasonably accurate reflection of actual pandemic-related substance use change. This finding is encouraging, given prospective data capturing changes in substance use due to COVID-19 is rare. Nonetheless, our results also indicate that a degree of caution is necessary in the case of data on perceived cannabis quantity; over 60% of participants who perceived an increase did so incorrectly, and those who perceived an "increase" or "no increase" in cannabis quantity did not have significantly different residual change scores. This may reflect our comparison of two variables with inherent measurement problems (subjective and objective cannabis quantity change; Prince et al., 2018). Future research should use and consider exploring other metrics of cannabis dose change (e.g., change in THC potency; Fischer et al., 2017).

Overall, our results indicate that the impact of the COVID-19 pandemic on substance use is not uniform; while a substantial proportion of our sample experienced an increase in alcohol and cannabis use, a notable proportion also experienced a decrease in alcohol and cannabis use. Although it is encouraging to think that the COVID-19 pandemic may have resulted in reduced substance use for some individuals, it is worrying that a significant proportion of our sample experienced an increase in substance use. These latter results suggest that COVID-19 could result in an "echo" pandemic—a surge in substance use problems resulting from circumstances related to COVID-19. Given the high rates of increasing substance use in our sample, the echo pandemic may be especially likely to impact groups who were already at increased risk of harmful substance use pre-pandemic (e.g., emerging adults and those who use both alcohol and cannabis). The substance-related impacts of the pandemic must be given specific attention and funding in the public health response

to COVID-19, and populations likely to increase their use of substances should be directly targeted in public health campaigns and resource allocation.

**Author Contribution** All authors contributed significantly and were involved in all phases of the project and subsequent manuscript.

**Funding** This work was made possible by a grant to Sara J. Bartel, Simon B. Sherry, and Sherry H. Stewart from the Department of Psychiatry Research Fund at the Dalhousie University. The funding organization had no role in the design and conduct of the study or collection, management, analysis, and interpretation of the data or preparation, review, or approval of the paper or decision to submit the paper for publication. Sherry H. Stewart is supported through a Tier 1 Canada Research Chair in Addiction and Mental Health, and Sara J. Bartel is supported through doctoral awards from the Killam Foundation of Canada, the Social Sciences and Humanities Research Council of Canada, and the Nova Scotia Graduate Scholarship program.

## Declarations

**Conflict of Interest** The authors declare no competing interests.

## References

- Benjamini, Y., & Hochberg, Y. (1995). Controlling the false discovery rate: A practical and powerful approach to multiple testing. *Journal of the Royal Statistical Society: Series B (methodological)*, 57(1), 289–300. <https://doi.org/10.1111/j.2517-6161.1995.tb02031.x>
- Cogle, J. R., Hakes, J. K., Macatee, R. J., Chavarría, J., & Zvolensky, M. J. (2015). Quality of life and risk of psychiatric disorders among regular users of alcohol, nicotine, and cannabis: An analysis of the National Epidemiological Survey on Alcohol and Related Conditions (NESARC). *Journal of Psychiatric Research*, 66, 135–141. <https://doi.org/10.1016/j.jpsychires.2015.05.004>
- Cuttler, C., & Spradlin, A. (2017). Measuring cannabis consumption: Psychometric properties of the daily sessions, frequency, age of onset, and quantity of cannabis use inventory (DFAQ-CU). *PLoS ONE*, 12(5), e0178194. <https://doi.org/10.1371/journal.pone.0178194>
- Fischer, B., Russell, C., Sabioni, P., Van Den Brink, W., Le Foll, B., Hall, W., ... & Room, R. (2017). Lower-risk cannabis use guidelines: A comprehensive update of evidence and recommendations. *American Journal of Public Health*, 107(8), e1–e12. <https://doi.org/10.2105/AJPH.2017.303818>
- Government of Canada. (2020, October 3). *Statement from the Chief Public Health Officer of Canada on October 3, 2020*. [Press Release]. Retrieved from <https://www.canada.ca/en/public-health/news/2020/10/statement-from-the-chief-public-health-officer-of-canada-on-october-3-2020.html>
- Griswold, M. G., Fullman, N., Hawley, C., Arian, N., Zimsen, S. R., Tymeson, H. D., ... & Abate, K. H. (2018). Alcohol use and burden for 195 countries and territories, 1990–2016: A systematic analysis for the Global Burden of Disease Study 2016. *The Lancet*, 392(10152), 1015–1035. [https://doi.org/10.1016/S0140-6736\(18\)31310-2](https://doi.org/10.1016/S0140-6736(18)31310-2)
- Leung, K., Wu, J. T., Liu, D., & Leung, G. M. (2020). First-wave COVID-19 transmissibility and severity in China outside Hubei after control measures, and second-wave scenario planning: A modelling impact assessment. *The Lancet*, 395(10233), 1382–1393. [https://doi.org/10.1016/S0140-6736\(20\)30746-7](https://doi.org/10.1016/S0140-6736(20)30746-7)
- Mental Health Research Canada (2020). *Mental health during COVID-19 outbreak wave 1*. Mental Health Research Canada. <https://www.mhrc.ca/wp-content/uploads/2020/05/Full-Report-of-Findings-of-Survey-FINAL.pdf>. Accessed 28 Aug 2020.
- Metrik, J., Gunn, R. L., Jackson, K. M., Sokolovsky, A. W., & Borsari, B. (2018). Daily patterns of marijuana and alcohol co-use among individuals with alcohol and cannabis use disorders. *Alcoholism: Clinical and Experimental Research*, 42(6), 1096–1104. <https://doi.org/10.1111/acer.13639>
- NANOS Research (2020). *COVID-19 and increased alcohol consumption: NANOS poll summary report*. NANOS Research. <https://www.ccsa.ca/sites/default/files/2020-04/CCSA-NANOS-Alcohol-Consumption-During-COVID-19-Report-2020-en.pdf>
- National Institute of Health (2003). *Recommended Alcohol Questions*. <https://www.niaaa.nih.gov/research/guidelines-and-resources/recommended-alcohol-questions>. Accessed 28 Aug 2020.

- Prince, M. A., Conner, B. T., & Pearson, M. R. (2018). Quantifying cannabis: A field study of marijuana quantity estimation. *Psychology of Addictive Behaviors*, 32(4), 426–433. <https://doi.org/10.1037/adb0000370>
- Rehm, J., Room, R., & Taylor, B. (2008). Method for moderation: Measuring lifetime risk of alcohol-attributable mortality as a basis for drinking guidelines. *International Journal of Methods in Psychiatric Research*, 17(3), 141–151. <https://doi.org/10.1002/mpr.259>
- Statistics Canada (2020). *Canadians who report lower self-perceived mental health during the COVID-19 pandemic more likely to report increased use of cannabis, alcohol and tobacco*. Statistics Canada. Statistics Canada. <https://www150.statcan.gc.ca/n1/pub/45-28-0001/2020001/article/00008-eng.htm>. Accessed 28 Aug 2020.
- Stone, A. L., Becker, L. G., Huber, A. M., & Catalano, R. F. (2012). Review of risk and protective factors of substance use and problem use in emerging adulthood. *Addictive Behaviors*, 37(7), 747–775. <https://doi.org/10.1016/j.addbeh.2012.02.014>
- Zeisser, C., Thompson, K., Stockwell, T., Duff, C., Chow, C., Vallance, K., ... & Lucas, P. (2012). A ‘standard joint’? The role of quantity in predicting cannabis-related problems. *Addiction Research & Theory*, 20(1), 82–92. <https://doi.org/10.3109/16066359.2011.569101>

**Publisher’s Note** Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.