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Alcohol and substance use in pregnancy during the COVID-19 pandemic

Preeti Kar\textsuperscript{a,b}, Lianne Tomfohr-Madsen\textsuperscript{a,c,d}, Gerald Giesbrecht\textsuperscript{a,c,d}, Mercedes Bagshaw\textsuperscript{a,b,e}, Catherine Lebel\textsuperscript{a,b,e,*}

\textsuperscript{a} Alberta Children’s Hospital Research Institute, University of Calgary, Calgary, AB, Canada
\textsuperscript{b} Hotchkiss Brain Institute, University of Calgary, Canada
\textsuperscript{c} Department of Psychology, University of Calgary, Canada
\textsuperscript{d} Department of Pediatrics, University of Calgary, Canada
\textsuperscript{e} Department of Radiology, University of Calgary, Canada

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\textbf{ABSTRACT}

\textbf{Background:} The impact of the COVID-19 pandemic on alcohol and substance use has been a topic of concern. Pregnant women are currently experiencing elevated anxiety and depression symptoms, which may increase risk of substance use, and potentially result in poor perinatal and neurodevelopmental outcomes for children.

\textbf{Methods:} Survey results were analyzed from an ongoing study of 7470 pregnant individuals in Canada: Pregnancy during the COVID-19 Pandemic. Participants were asked about current use of alcohol and substances, symptoms of depression and anxiety, and COVID-19 concerns: how much they worry about COVID-19 threatening their baby’s life, threatening their own life, care for themselves or the baby, feelings of social isolation, and financial difficulties.

\textbf{Results:} The percentage of participants who reported use during pregnancy was 6.7\% for alcohol, 4.3\% for cannabis, 4.9\% for tobacco, and 0.3\% for illicit drugs; 2.6\% were using multiple substances. Higher depression symptoms and financial difficulties were associated with more cannabis and/or tobacco use as well as the co-use of substances. There were no associations between alcohol use and mental health or COVID-19 concerns.

\textbf{Conclusions:} Self-reported rates of use and co-use were lower or comparable to previous research, perhaps reflecting pandemic-related circumstances or the demographics of this sample. Depression symptoms and pandemic-related financial difficulties were associated with more tobacco use, cannabis use, and substance co-use. It remains important to maintain access to perinatal, mental health, and financial supports during the pandemic to mitigate prenatal alcohol and substance use and prevent poor perinatal and long-term neurodevelopmental outcomes for children.

1. Introduction

Alcohol and substance use during pregnancy are major public health concerns with significant implications for both the pregnant individual and the child (World Health Organization, 2014). Despite no known safe amount of use, and recommendations against consumption, it is estimated that 10\% of pregnant individuals in North America use alcohol (Popova et al., 2016; Public Health Agency of Canada, 2013; Substance Abuse and Mental Health Services Administration, 2013), 13–16\% use tobacco (Public Health Agency of Canada, 2013; Substance Abuse and Mental Health Services Administration, 2013), 2–5\% use cannabis (Badowski and Smith, 2020; Cook et al., 2017; Corsi et al., 2019; Luke et al., 2019), and 5–6\% use illicit drugs (Public Health Agency of Canada, 2013; Substance Abuse and Mental Health Services Administration, 2013). Moreover, recent work estimates that 5.1\% of pregnant individuals are co-using two or more substances (Qato et al., 2020). Alcohol and substance use in pregnancy can result in poor perinatal outcomes such as miscarriage, preterm birth, and low birthweight (Cook et al., 2017) along with long-term consequences for children such as neurological changes (Behnke and Smith, 2013; Derauf et al., 2019; Minnes et al., 2011; Ross et al., 2015). Alcohol use during pregnancy can lead to a diagnosis of fetal alcohol spectrum disorder (FASD), which is a lifelong disability characterized by cognitive and behavioral impairments stemming from widespread alterations to brain structure (Cook et al., 2016; Donald et al., 2015).

There are growing concerns about the impact of the novel...
coronavirus (COVID-19) pandemic, and the policies put in place to contain it, on global mental health and alcohol/substance use (Clay and Parker, 2020; Galea et al., 2020; Pfefferbaum and North, 2020). While findings vary somewhat, there is emerging evidence internationally that some individuals are increasing their alcohol and substance use to cope with symptoms of depression, social isolation, as well as worries about their health and finances (Bartel et al., 2020; Cesisler et al., 2020; Rogers et al., 2020; Tran et al., 2020; Wardell et al., 2020).

Historically, factors associated with alcohol and substance use during pregnancy include concurrent mental health problems (Zhao et al., 2017) and financial difficulties (Finnegan, 2013; Latuski et al., 2019), both of which have been dramatically elevated by the COVID-19 pandemic (Durankus and Aksu, 2020; Lebel et al., 2020; Mappa et al., 2021; Moyer et al., 2020). Previous studies have indicated that pregnant individuals are facing changes in perinatal care (Afsihar et al., 2020; Bradley et al., 2020; Burgess et al., 2021; Groulx et al., 2021; Peshl et al., 2021), are worried about mom and baby’s health, and notably, are experiencing higher symptoms of anxiety and depression (Durankus and Aksu, 2020; Lebel et al., 2020; Mappa et al., 2020; Moyer et al., 2020).

Additionally, physical distancing and related restrictions have contributed to feelings of loneliness, loss of employment, and consequent financial instability (Brooks et al., 2020; Pfefferbaum and North, 2020). It is possible that alcohol and substances may be used as ways of coping with the feelings of stress and uncertainty impacting pregnant individuals in particular.

The purpose of the current study was to investigate self-reported alcohol, cannabis, tobacco, and illicit drug use in pregnant Canadians during the COVID-19 pandemic in order to understand: 1) patterns of use, 2) mental health predictors of use and, 3) COVID-19 predictors of use. These findings may help inform public health education and perinatal support services during the pandemic to mitigate long-term consequences of alcohol/substance use for pregnant individuals and their children.

2. Methods

2.1. Participants

Here we report data collected between April 5th and September 8th, 2020 from an ongoing study: Pregnancy during the COVID-19 Pandemic (Giesbrecht et al., 2021). Pregnant individuals were recruited via social media to complete an online survey. Inclusion criteria were: living in Canada, >17 years of age, able to read and write English or French, and having a pregnancy <35 weeks gestation. In total, we recruited 7629 pregnant individuals; 159 were removed from the study not providing consent or providing a gestational age >35 weeks, leaving a total of 7470 participants.

2.2. Demographics

Participants provided demographic information about their age, ethnicity, marital status, their baby’s due date, number of prior pregnancies, number of children, education, and household income. Maternal education was reported from 1 to 7 (less than high school diploma; completed high school; completed trade, technical, vocational school or business/community college; bachelor’s degree; master’s degree; doctorate (PhD); professional (MD, JD, DDS etc.)). Household income was reported on a scale of 1–8 (less than $20,000; $40,000–$69,999; $70,000–$99,999; $100,000–$124,999; $125,000–$149,999; $150,000–$174,999; $175,000–$199,999; $200,000+).

2.3. Mental Health

Participants were asked whether or not they had a diagnosis of anxiety or depression prior to their current pregnancy. The Edinburgh Depression Scale (EPDS) (Cox et al., 1987; Kozinszky and Dudas, 2015) was used to assess depression symptoms during pregnancy. The EPDS is not a diagnostic tool, but scores ≥13 are typically consistent with a diagnosis of major depressive disorder (Cox et al., 1987). The PROMIS Anxiety Adult 7-item short form was used to assess general anxiety during pregnancy; scores ≥60 indicate clinically-elevated anxiety (Cella et al., 2010). For both measures, higher scores indicate worse symptoms.

2.4. Substance use

Participants were asked about their use of alcohol, cannabis, tobacco, and illicit drugs in the year before the current pregnancy and during the current pregnancy by reporting the number of days per week they used, and number of drinks/products used per day. 186 participants were missing information about alcohol use (n = 7284), 103 for cannabis use (n = 7367), 65 for tobacco use (n = 7405), and 64 for illicit drug use (n = 7406) during pregnancy.

2.5. COVID-19 concerns

Participants completed a questionnaire about how COVID-19 pandemic has affected their life, such as infections, social isolation, and employment status. Participants were asked specifically about concerns due to COVID-19 with the following statements/questions: “How much do (did) you think your unborn baby’s life is in danger at any time during the COVID-19 pandemic?” “During the COVID-19 pandemic, I have felt more alone than usual.” “Are you concerned that you or your baby are not receiving the care that you need?” and “Have changes in your personal financial situation during the COVID-19 pandemic made it if hard for you to pay for the basics like food, housing, medicine, and/or heating?”. Participants answered each question on a scale from 0 (“not at all”) to 100 (“very much so”).

2.6. Statistical analysis

All data was manually checked for accuracy and consistency prior to analysis. Illicit drug use was not included in regression analyses because the number of users was too small (n = 19 during pregnancy), but it was included in co-use analyses.

Linear regression was used to identify whether symptoms of depression and anxiety were associated with 1) self-reported amount of alcohol, cannabis, tobacco use (number of drinks or products per week) and 2) co-use of substances (number of substances included 1, 2, 3, and 4+). Follow-up analyses added demographic factors (age, income, education) as covariates to the main regression model. Additionally, prior history of anxiety or depression, and the use of the substances in the year prior to pregnancy were added as categorical covariates.

Similarly, linear regression was used to separately investigate whether individual COVID-19 related factors (worry about threat to baby’s life, worry about threat to own life, worry about care for themselves or their baby, social isolation, financial difficulties) were associated with 1) self-reported amount of alcohol, cannabis, and tobacco use and 2) co-use of substances. Demographic factors (age, income, education) were added as covariates in the main regression model. Additionally, current symptoms of anxiety and depression (scores on the EPDS and the PROMIS anxiety scale) along other COVID-19 related factors were added as covariates. Lastly, prior history of anxiety or depression, and the use of the substances in the year prior to pregnancy were added as categorical covariates.

False discovery rate was used to correct for 40 multiple comparisons (2 mental health measures x 5 COVID-19 concerns for 3 substances and 1 measure of co-use) in regression analyses at q < 0.05.
3. Results

3.1. Demographics

Participants had a mean age of 31.9 ± 4.5 years and were at 21 ± 9 weeks gestation. The majority of participants were multigravida, nulliparous, Caucasian, and married or cohabiting. Full sample demographics are summarized in Table 1. There were some missing data for demographic information, and the number of respondents per question is reported.

3.2. Rates of alcohol/substance use during pregnancy

In the whole sample (n = 7470), after recognition of pregnancy, 12.8% of pregnant individuals self-reported using at least one substance (87.2 % reported using no alcohol or substances). 9.8% were only using one substance while 2.6% were co-using substances (0.4% of participants were missing information about one or more substances therefore co-use could not be calculated). Rates were 6.7% for alcohol use, 4.3% for cannabis use, 4.9% for tobacco use, and 0.3% for illicit drug use (Fig. 1). When calculated among those using at least one substance (n = 958), 79.3% were using only one substance, 18.6% were using two substances, 1.8% were using three substances, and 0.3% were using four or more substances.

In the year prior to the current pregnancy, 66.6% of pregnant individuals self-reported using at least one substance (33.4% reported using no alcohol or substances). Rates were 67.1% for alcohol use, 17.9% for cannabis use, 11.3% for tobacco use, and 1.3% for illicit drug use; 20.1% reported using multiple substances.

3.3. Patterns of alcohol/substance use during pregnancy

Among individuals using each substance, average use after recognition of pregnancy was: 3.1 ± 3.7 drinks per week (n = 485 individuals using; range = 0.25–24 drinks/week); 6.8 ± 9.5 cannabis products per week.

For the Edinburgh Depression Scale (EPDS), scores ≥13 are considered clinically-elevated while for the PROMIS Anxiety Adult 7-item short form, scores ≥60 indicate clinically elevated anxiety.

Table 1

Summary of demographic, mental health and COVID-19 factors. Note that due to missing data, the number of respondents for each question varies slightly. Specific numbers are reported for each measure.

| N | Mean ± Standard Deviation | Range |
|---|--------------------------|-------|
| Demographics | | |
| Age (years) | 7373 | 31.9 ± 4.5 | 18.0-50.5 |
| Education (mode) | 7376 | Bachelor’s degree | – |
| Income (median/year) | 7232 | $100,000–124,999 CAD [– $76,000–96,000 USD] | – |
| Gestational weeks | 7470 | 21 ± 9 | 4.0–35.0 |
| Primigravida (%) | 6262 | 45.9% | – |
| Multigravida (%) | 6262 | 54.1% | – |
| Nulliparous (%) | 6262 | 56.8% | – |
| Primiparous (%) | 6262 | 30.4% | – |
| Multiparous (%) | 6262 | 12.8% | – |
| Caucasian (%) | 7228 | 81.6% | – |
| Married or Cohabiting (%) | 7377 | 95.7% | – |
| Mental Health | | |
| Depression diagnosis prior to pregnancy | 6262 | 18.7% | – |
| Anxiety diagnosis prior to pregnancy | 6262 | 38.7% | – |
| EPDS Score | 6636 | 10 ± 5 | 0-30 |
| Clinically-elevated (%) | 6636 | 32.9% | – |
| PROMIS Anxiety Scale Score | 6612 | 58.3 ± 8.3 | 36.3–82.7 |
| Clinically-elevated (%) | 6612 | 47.4% | – |
| COVID-19 factors | | |
| Financial Difficulties | 6859 | 21 ± 2 | 1–100 |
| Threat to Own Life | 6824 | 44 ± 25 | 1–100 |
| Threat to Baby Life | 6823 | 52 ± 26 | 1–100 |
| Not Receiving Care | 6069 | 36 ± 28 | 1–100 |
| Social Isolation | 6796 | 64 ± 27 | 1–100 |

For the Edinburgh Depression Scale (EPDS), scores ≥13 are considered clinically-elevated while for the PROMIS Anxiety Adult 7-item short form, scores ≥60 indicate clinically elevated anxiety.

Fig. 1. Co-occurrence of alcohol, cannabis, tobacco and illicit drug use during pregnancy. Total percentage of participants using each substance, or a combination of substances is indicated on the diagram. 12.8% of pregnant individuals were using at least one substance (87.2% reported using nothing).
week (n = 316; range = 1–70 products/week); 35.9 ± 36.0 tobacco products per week (n = 360; range = 1–175 products/week); and 4.1 ± 3.0 illicit drug products per week (n = 19; range = 1–10 products/week).

3.4. Mental health and alcohol/substance use

Symptoms of anxiety and depression are summarized in Table 1. There were no significant associations between mental health and alcohol use. More cannabis use (p = 0.008; q = 0.027) and tobacco use (p < 0.001; q < 0.001) were significantly associated with higher depression symptoms among pregnant individuals. Both findings survived correction for multiple comparisons, but only the association with tobacco use remained significant after controlling for demographic variables as well as pre-pregnancy mental health and substance use (Table 2).

3.5. COVID-19 factors and alcohol/substance use

COVID-19 factors are summarized in Table 1. There were no significant associations between COVID-19 concerns and alcohol use. More financial difficulties were significantly associated with more cannabis (p = 0.003; q = 0.014) and tobacco use (p = 0.024; q = 0.073). Feeling more worried about receiving care for mom and baby was associated with more cannabis (p = 0.010; q = 0.033) and tobacco use (p = 0.005; q = 0.022). Feeling more worried about not receiving care for themselves and their baby was associated with more cannabis (p = 0.003; q = 0.014) and tobacco use (p = 0.024; q = 0.073). Lastly, feeling more socially isolated was associated with more cannabis use (p = 0.001; q = 0.001) and cannabis use (p = 0.032; q = 0.091). All findings survived correction for multiple comparisons, except the association between not receiving care and cannabis use. Only the associations between financial difficulties with cannabis and tobacco use remained significant after controlling for demographic variables, mental health during pregnancy, other COVID-19 concerns, and pre-pregnancy mental health and substance use (Table 3).

3.6. Mental health and alcohol/substance co-use

More symptoms of depression were significantly associated with a higher number of substances being used (p < 0.001; q < 0.001). This finding survived correction for multiple comparisons and remained significant after controlling for demographic variables as well as mental health and substance co-use before pregnancy (Table 4).

3.7. COVID-19 factors and alcohol/substance co-use

More financial difficulties were significantly associated with more substances being used (p < 0.001; q < 0.001). More worry about not receiving care for mom and baby (p < 0.001; q < 0.001) and more feelings of social isolation (p = 0.001; q = 0.006) were associated with more substances being used. All findings survived correction for multiple comparisons but only the association with financial difficulties remained significant after controlling for demographic variables, mental health during pregnancy, COVID-19 concerns, as well as pre-pregnancy mental health and substance co-use (Table 5).

4. Discussion

This study describes self-reported alcohol, cannabis, tobacco, and illicit drug use in a large sample of pregnant Canadians during the COVID-19 pandemic. Reported rates of substance use were lower or comparable to studies prior to the COVID-19 pandemic (Cook et al., 2017; Finnegan, 2013; Popova et al., 2017a, b), suggesting that increased substance use in pregnancy is not widespread. However, several mental health and COVID-19 related concerns predicted use in this sample, suggesting that a subset of individuals may be using substances to cope with COVID-19 related circumstances, which has implications for targeted public health strategies.

Alcohol was the most widely reported substance used during pregnancy (6.7 %) followed by tobacco (4.9 %), cannabis (4.3 %), and then illicit drugs (0.3 %). Self-reported rates of alcohol, tobacco, and illicit drug use in this sample are lower than estimates in other studies in North America, which report approximately 10 % for alcohol, 13–16 % for tobacco, and 5–6 % for illicit drugs (Cook et al., 2017; Finnegan, 2013; Popova et al., 2017a, b). Prevalence of cannabis use was comparable to previous research, which estimates use at 2–5 % (Baldowski and Smith, 2020; Corsi et al., 2019). 2.6 % of pregnant individuals in our study reported co-using two or more substances, which is lower than previous population estimates of 5.1 %, though aligns with our overall pattern of reduced use compared to population estimates. The most common combinations of substances (cannabis and tobacco, alcohol and cannabis, alcohol and tobacco) were similar to previous work (Qato et al., 2020). Sociodemographic variables can help to contextualize these results. For example, cannabis and tobacco use are commonly associated with lower income and lower education (el Marroun et al., 2008; Finnegan, 2013; Lange et al., 2015; van Gelder et al., 2010). Thus, lower use in our sample may stem from an overall higher median household income and higher education among our participants ($100, 000–124,000; 39.7 % have at least a bachelor’s degree) relative to the general Canadian population ($59,000; 15.5 % have a bachelor’s

Table 2

| Mental health symptoms associated with alcohol/substance use. | N | Standardized B | SE | 95 % CI for B | t | p | 95 % CI for B | Lower | Upper |
|----------------------------------|---|----------------|----|--------------|---|---|--------------|-------|-------|
| Alcohol                          | 6443 | 1.41E-4 | 0.005 | 0.001 | 0.030 | 0.976 | −0.009 | 0.009 |
| Symptoms of Depression           | 1.41E-4 | 0.005 | 0.001 | 0.030 | 0.976 | −0.009 | 0.009 |
| Symptoms of Anxiety              | 0.003 | 0.003 | 0.019 | 0.931 | 0.352 | −0.003 | 0.009 |
| Constant                         | 0.036 | 0.147 | 0.243 | 0.808 | −0.252 | 0.323 |
| Cannabis                         | 6565 | 0.023 | 0.009 | 0.055 | 2.674 | 0.008 | 0.006 | 0.040 |
| Symptoms of Depression           | 0.023 | 0.009 | 0.055 | 2.674 | 0.008 | 0.006 | 0.040 |
| Symptoms of Anxiety              | 0.002 | 0.006 | 0.007 | 0.352 | 0.725 | −0.009 | 0.013 |
| Constant                         | −0.077 | 0.264 | −0.290 | 0.772 | −0.595 | 0.442 |
| Tobacco                          | 6577 | 0.218 | 0.038 | 0.117 | 5.757 | <0.001 | −0.143 | 0.292 |
| Symptoms of Depression           | 0.218 | 0.038 | 0.117 | 5.757 | <0.001 | −0.143 | 0.292 |
| Symptoms of Anxiety              | −0.038 | 0.025 | −0.031 | −1.522 | 0.128 | −0.086 | 0.011 |
| Constant                         | 1.516 | 1.163 | 1.303 | 0.193 | −0.765 | 3.797 |

Bolded finding survived correction for multiple comparisons.

* Findings that remained significant after controlling for demographic variables and mental health before pregnancy.
In fact, relative larger proportions (>70 %) of participants across studies report no change or a decrease in their consumption of alcohol and substances during the COVID-19 pandemic (Czeisler et al., 2020; Imtiaz et al., 2020; Tran et al., 2020). The Canadian Perspectives Survey Series (CPSS; collected from March 29 to April 3, 2020) indicated that most women (≥15 years of age) reported no changes or a decrease in their consumption of alcohol (87 %), cannabis (95 %), or tobacco (97 %). Among non-pregnant individuals during the pandemic align with the lower rates of alcohol and substance use during the pandemic. These lower rates of alcohol and substance use among non-pregnant individuals during the pandemic align with the lower rates in our sample of pregnant individuals, suggesting that it is only a subset of individuals who have increased alcohol and substance use during the pandemic. 

Prenatal alcohol and substance exposure are associated with poorer perinatal outcomes such as low birth weight, preterm birth, and miscarriage (Cook et al., 2017) as well as longer term neuro-developmental problems for children (Behnke and Smith, 2013; Derauf developmental problems for children (Behnke and Smith, 2013; Derauf degree) (Statistics Canada, 2017, 2019). On the other hand, alcohol use has been variably associated with income and education (Brown et al., 2019; Dejong et al., 2019; O’Keeffe et al., 2015; Shmulewitz and Hasin, 2019; Washio et al., 2017). Overall, these results reiterate the need for universal screenings and resources across sociodemographic backgrounds.

Table 3
COVID-19 factors associated with alcohol/substance use.

|                          | N  | Unstandardized B | SE | Standardized B | t   | p     | 95 % CI for B       |
|--------------------------|----|------------------|----|----------------|-----|-------|---------------------|
| Alcohol                  |    |                  |    |                |     |       |                     |
| Financial Difficulties   | 6688| 0.001            | 0.001 | 0.017       | 1.427 | 0.153 | 3.46E-4       | 0.002 |
| Constant                 | 0.189 | 0.020            | 9.336 | <0.001 | 0.149 | 0.229 |
| Threat to Baby Life      | 6652| 3.11E-4          | 0.001 | −0.007     | −0.540 | 0.589 | −0.001       | 0.001 |
| Constant                 | 0.222 | 0.034            | 6.635 | <0.001 | 0.157 | 0.288 |
| Threat to Own Life       | 6655| −0.001           | 0.001 | −0.010     | −0.851 | 0.395 | −0.002       | 0.001 |
| Constant                 | 0.227 | 0.030            | 7.495 | <0.001 | 0.168 | 0.286 |
| Not Receiving Care       | 5923| 0.001            | 0.001 | 0.023      | 1.778 | 0.076 | 1.02E-4       | 0.002 |
| Constant                 | 0.166 | 0.026            | 6.429 | <0.001 | 0.115 | 0.216 |
| Social Isolation         | 6627| −0.001           | 0.001 | −0.015     | −1.181 | 0.238 | −0.002       | 4.36E-4 |
| Constant                 | 0.247 | 0.029            | 6.392 | <0.001 | 0.171 | 0.223 |
| Cannabis                 |    |                  |    |              |     |       |                     |
| Financial Difficulties   | 6812| 0.011            | 0.001 | 0.112      | 9.330 | <0.001 | 0.008       | 0.013 |
| Constant                 | 0.048 | 0.036            | 1.335 | 0.182 | −0.022 | 0.118 |
| Threat to Baby Life      | 6776| 0.003            | 0.001 | 0.031      | 2.580 | 0.010 | 0.001       | 0.005 |
| Constant                 | 0.131 | 0.060            | 2.178 | 0.029 | 0.013 | 0.249 |
| Threat to Own Life       | 6777| 0.002            | 0.001 | 0.018      | 1.463 | 0.144 | −0.001       | 0.004 |
| Constant                 | 0.200 | 0.055            | 3.672 | <0.001 | 0.093 | 0.308 |
| Not Receiving Care       | 6029| 0.003            | 0.001 | 0.038      | 2.959 | 0.003 | 0.001       | 0.005 |
| Social Isolation         | 6749| −0.002           | 0.001 | 0.026      | 2.145 | 0.032 | 1.85E-4       | 0.004 |
| Constant                 | 0.132 | 0.069            | 1.902 | 0.057 | −0.004 | 0.268 |
| Tobacco                  |    |                  |    |              |     |       |                     |
| Financial Difficulties   | 6824| 0.056            | 0.005 | 0.129      | 10.763 | <0.001 | 0.046       | 0.066 |
| Constant                 | 0.407 | 0.162            | 2.515 | 0.012 | 0.090 | 0.724 |
| Threat to Baby Life      | 6788| 0.013            | 0.005 | 0.034      | 2.781 | 0.005 | 0.004       | 0.022 |
| Constant                 | 0.892 | 0.272            | 3.284 | 0.001 | 0.359 | 1.424 |
| Threat to Own Life       | 6789| 0.007            | 0.005 | 0.018      | 1.517 | 0.129 | −0.002       | 0.017 |
| Constant                 | 1.219 | 0.243            | 5.022 | <0.001 | 0.743 | 1.695 |
| Not Receiving Care       | 6037| 0.011            | 0.005 | 0.029      | 2.264 | 0.024 | 0.001       | 0.020 |
| Constant                 | 1.197 | 0.214            | 5.598 | <0.001 | 0.778 | 1.616 |
| Social Isolation         | 6761| 0.020            | 0.005 | 0.054      | 4.440 | <0.001 | 0.011       | 0.029 |
| Constant                 | 0.286 | 0.313            | 0.914 | 0.361 | −0.327 | 0.900 |

Bolded findings survived correction for multiple comparisons.

* Findings that remained significant after controlling for demographic, mental health before and during pregnancy, as well as other COVID-19 concerns.

Table 4
Mental health symptoms associated with alcohol/substance co-use.

|                          | N  | Unstandardized B | SE | Standardized B | t   | p     | 95 % CI for B       |
|--------------------------|----|------------------|----|----------------|-----|-------|---------------------|
| Alcohol/substance co-use |    |                  |    |                |     |       |                     |
| Symptoms of Depression   | 6381| 0.010            | 0.002 | 0.125       | 6.060 | <0.001 | 0.007       | 0.013 |
| Symptoms of Anxiety      |    |                  |    |                |     |       |                     |
| Constant                 | −0.001 | 0.001           | −0.021 | −1.035 | 0.301 | −0.003 | 0.001 |
| Constant                 | 0.110 | 0.051            | 2.161 | 0.001 | 0.010 | 0.210 |

Bolded finding survived correction for multiple comparisons.

* Findings that remained significant after controlling for demographic variables and mental health before pregnancy.
substances were experiencing more symptoms of depression, which also and during pregnancy. As well, pregnant individuals co-using more tobacco remained significant after controlling for confounders before using more cannabis and tobacco, but only the association with pregnancy (McCormack et al., 2017; Rodriguez and Smith, 2019). Since pregnant individuals (Chamberlain et al., 2017; Chou et al., 2018; Durankus & Aksu, 2020; Lebel et al., 2020; Mappa et al., 2020). Since prenatal care, education, and screenings to reduce substance use during pregnancy and optimize child outcomes (Jonsson et al., 2014; Poole et al., 2016).

Pregnant individuals experiencing higher symptoms of depression were using more cannabis and tobacco, but only the association with tobacco remained significant after controlling for confounders before and during pregnancy. As well, pregnant individuals co-using more substances were experiencing more symptoms of depression, which also remained significant after accounting for confounders. Thus, associations between tobacco and multi-substance use with depression symptoms appear to be specific to the pandemic. Extensive data has shown that a greater proportion of pregnant individuals are experiencing more severe symptoms of anxiety and depression during COVID-19 than before (Durankuş and Aksu, 2020; Lebel et al., 2020; Mappa et al., 2020; Moyer et al., 2020). Physical distancing and other restrictions have limited access to family, friends, and community organizations, contributing to feelings of loneliness, coupled with uncertainty around health and finances (Brooks et al., 2020). Recent Canadian data shows that those with worse self-perceived mental health during the pandemic report increases in tobacco and cannabis use (Bartel et al., 2020; Rotermann, 2020). Substance use may be a coping mechanism in response to newly emerged or worsened symptoms of depression during the pandemic. It remains critical to safely maintain relationships in health and social systems to manage symptoms of mental health problems as well as increase self-efficacy and alternative coping tools among pregnant individuals (Chamberlain et al., 2017; Chou et al., 2018; Latuskie et al., 2019; Volkow, 2020).

Greater concern about not receiving care for themselves and their baby, more feelings of social isolation, and concerns about COVID-19 threatening the baby’s life were associated with more marijuana and/or tobacco use, as well as a higher number of substances used during pregnancy. These associations, however, did not remain significant after controlling for potential confounders such as age, income, education, mental health during pregnancy, and other COVID-19 concerns. This suggests that these variables likely played a role in the amount of substances used. Findings also did not remain significant after controlling for mental health and substance use before pregnancy, suggesting that the initial associations may reflect broader, ongoing concerns instead of concerns specifically related to the COVID-19 pandemic.

On the other hand, pregnant individuals experiencing COVID-19-related financial difficulties reported using more marijuana and tobacco as well as co-using more substances, after controlling for confounders, highlighting that this is a pandemic-specific association. There have been significant disruptions to employment and the economy due to COVID-19, which have triggered new onset financial difficulties or exacerbated ongoing financial difficulties for some individuals (Brooks et al., 2020). As previous studies have shown, it is possible that substance use is a coping mechanism in response to financial stress and/or an accessible opportunity because of more time spent at home and blurring weekday versus weekend routines (Canadian Centre on Substance Use and Addiction, 2020b; Vanderbruggen et al., 2020; Wardell et al., 2020). Data collected in Canada suggested a lack of regular schedule, boredom, and stress were associated with increased alcohol use during the pandemic (Canadian Centre on Substance Use and Addiction, 2020a). Financial relief during the pandemic is an essential consideration; wrap-around supports that reduce socioeconomic sources of stress and uncertainty may correspond with reduced consumption of cannabis and tobacco during pregnancy (Wilson et al., 2020).

Limitations of this study include potential under-reporting of alcohol and substance use due to social desirability, stigma, and/or fear of consequences. Some studies have shown agreement between self-report and biological samples (e.g. urinalysis, meconium testing) of prenatal alcohol or substance exposure (Eichler et al., 2016; Yonkers et al., 2011), while others have indicated disagreement (Markovic et al., 2000), with the meconium markers of alcohol use during pregnancy nearly 4 times higher than self-reported use (Lange et al., 2014). Our anonymous online survey likely helped minimize under-reporting due to perceived stigma. Moreover, questions about use during pregnancy were asked prospectively, minimizing recall bias. Nonetheless, studies confirming self-report data with biological samples would help to better understand use patterns. This sample is not representative of all pregnant Canadian individuals, with participants more likely to be married or co-habiting as well as have higher education and income compared to the general Canadian population (Provencher et al., 2018; Statistics Canada, 2017).
2019). Thus, pregnant individuals with more sociodemographic risks (e.g., low education, low income) or those who have substance use disorders may have different patterns of use. This sample does not have data related to financial difficulties and social isolation prior to the pandemic as a baseline to compare to results obtained during the pandemic. The fluctuating circumstances with COVID-19, including social distancing policies and healthcare accessibility, specifically contextualize these findings to Canada and may not be representative of other regions.

5. Conclusions

Alcohol and substance use in pregnancy can result in poor perinatal and neurodevelopmental outcomes for children. Here, we found lower or comparable overall rates of alcohol and substance use among pregnant individuals during the pandemic compared to previous estimates in other samples. We also demonstrated that symptoms of depression and financial difficulties, likely specific to the pandemic, were associated with increased tobacco use, cannabis use, and co-use of substances in pregnancy. No mental health factors or COVID-19 concerns were associated with alcohol use in pregnancy. These results suggest it remains important to maintain access to perinatal, mental health, and financial supports during the pandemic to reduce use in pregnancy and mitigate the potential of challenging outcomes for children.

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Contributors

PK analyzed the data and wrote the manuscript. LTM, GG and CC acquired funding, conceptualized and designed the study, and reviewed and edited the manuscript. MB administered the project and edited the manuscript.

Declaration of Competing Interest

The authors report no declarations of interest.

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