Factors Associated With Increased Opioid Use During the COVID-19 Pandemic: A Prospective Study of Patients Enrolled in Opioid Agonist Treatment

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Objectives: The opioid use disorder (OUD) crisis in North America has become "an epidemic within a pandemic" in the context of the COVID-19 virus. We aimed to explore the association between the COVID-19 pandemic and changes in opioid use patterns among patients receiving treatment for OUD.

Methods: We used prospectively collected data from 456 patients attending 31 opioid agonist clinics across Ontario, Canada. All included participants underwent routine urine drug screens (UDSs) both before and after the onset of the COVID-19 pandemic. A paired sample *t*-test was used to compare the proportion of opioid-positive UDSs collected pre- and post-pandemic, and linear regression analysis was used to explore factors associated with this change.

Results: Participants had a mean age of 39.9 years (standard deviation = 10.9), 52%were male, and 81%were receivingmethadone treatment. The percentage of opioid-positive UDSs increased significantly during the pandemic, on average by 10.6% (95% confidence interval [CI] 8.17, 12.95, $P < 0.001$). Continued opioid use before the pandemic was associated with 9.43% increase, on average, in the percentage of opioid-positive UDSs during the pandemic (95% CI 3.79, 15.07). Self-reported past-month cocaine (adjusted betacoefficient 6.83, 95% CI 0.92, 12.73) and amphetamine (adjusted beta-coefficient 13.13, 95% CI 5.15, 21.1) use at study entry were also associated with increases in opioid-positive UDSs.

Conclusions: Increased opioid use is one measure of the negative impact the COVID-19 pandemic has had on individuals with OUD, an already marginalized population. Understanding factors associated with worse outcomes is essential to ensuring that treatment programs appropriately adapt to better serve this population during the pandemic.

Key Words: buprenorphine, COVID-19, methadone, opioid use disorder, SARS-COV-2

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TR, LN, NS, LT, DM, AW, and ZS are responsible for the study concept and design. TR, LN, LT, and ZS developed the methods and data analysis. TR conducted the statistical analyses and wrote the first draft of the manuscript, and LN, NS, LT, DM, AW, and ZS contributed to writing and critically revising the final manuscript. All authors reviewed and approved the final manuscript.

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The opioid crisis has become "an epidemic within a pandemic,"[1,2] with increases in overdose deaths during the COVID-19 pandemic exceeding rates documented in 2019.[3,4] Numerous studies over the last 12 months have attempted to quantify the impact of the pandemic on individuals with opioid use disorder (OUD), finding increases in opioid overdoses,[5,6] increased rates of fentanyl and heroin use,[7,8] decreases in referrals for treatment,[9] and fewer patients initiated on opioid agonist therapies.[10]

Medication-assisted treatment (MAT) with buprenorphine-naloxone or methadone, is the mainstay of treatment for OUD, and its administration has been heavily dependent on regular in-person care at substance use treatment clinics and pharmacies. Due to the concerns of COVID-19 spread, this model of care has been largely overturned and virtual care services for the treatment of OUD have been adopted.[11,12] The pandemic has led to innovation in the way OUD treatment services are accessed and provided, including the development of "buprenorphine hotlines,"[13] online 12-Step and Recovery Support meetings,[14] and the use of "Peer Recovery Coaches."[15] Important policy changes have been made in response to restrictions placed by the pandemic; in the United

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States the Drug Enforcement Administration has allowed initiation of buprenorphine treatment following virtual or telemedical care appointments[16] and similar changes have been implemented for methadone and buprenorphine prescribing in Canada.[17] In some jurisdictions, increased carries or take-home doses have been permitted[18] and home delivery of medications has been initiated.[19] Experts have recommended favoring initiation of buprenorphine over methadone for its safety profile and, in the United States, increasing the use of intramuscular naltrexone therapy for OUD.[18] Despite these adaptations in service delivery, patients with OUD seem to face greater challenges in accessing services compared to patients with other substance use disorders.[20] There also exist significant racial and ethnic disparities in access to MAT, both preceding,[21] and further exacerbated by, the pandemic.[22]

Clinicians and scientists have already begun advocating for the use of data-driven approaches to care to guide future OUD treatment policies and practices.[23–25] The need for conducting rigorous analyses of the impact of the pandemic on outcomes and health service use for patients with OUD is clear. Methodological limitations related to the use of non-linked patient data, examining different groups of individuals before and during the pandemic, will be important to consider.

As Haley and Saitz noted in an editorial published in JAMA, "a more definitive answer to the question of whether opioid use has increased during the COVID-19 pandemic will require linked patient data (before and after COVID-19)."[1] To address this question, we examined the association between the COVID-19 pandemic and opioid use within a prospective cohort of patients receiving MAT for OUD using a repeated measures design. Our study objectives were:

1. To determine whether opioid use increased, decreased, or remained unchanged during the COVID-19 pandemic for patients already enrolled in MAT;
2. To explore factors associated with a change in the percentage of opioid-positive urine drug screens (UDSs) for patients followed both before and during the COVID-19 pandemic.

METHODS

We used prospectively collected data from the Pharmacogenetics of Opioid Substitution Treatment Response (POST) study conducted across outpatient substance use treatment clinics in Ontario, Canada.[26] The POST study was designed to explore the influence of bio-psycho-social factors on treatment outcomes among individuals with OUD.[26] Study procedures were approved by and followed in accordance with the ethical standards of the Hamilton Integrated Research Ethics Board (ID#4556) and in accordance with the Helsinki Declaration, as revised in 2004. All participants provided verbal and written informed consent. Individuals at least 16 years of age receiving methadone or buprenorphine-naloxone for a diagnosis of OUD, made by treating physicians, as per the Diagnostic and Statistical Manual of Mental Disorders, fifth edition, were eligible to participate, regardless of their stage in treatment.[27] At study entry, participants completed semi-structured interviews with trained research staff to collect information on their sociodemographic characteristics, treatment history, and substance use.[26] Participants self-reported their past-month substance use, including intravenous drug use, alcohol, cannabis, cocaine and crack-cocaine, amphetamine, and non-prescribed benzodiazepine use when they entered the study; this information was collected using the Maudsley Addiction Profile questionnaire.[28]

Participants were followed for 12 months with routine UDSs, conducted per clinic protocol, to identify opioid use including morphine, oxycodone, fentanyl, methadone metabolite, and buprenorphine using the FaStep Assay (Trimedic Supply Network Ltd, Concord, Ontario, Canada).[29] UDSs were recorded as the percentage of opioid-positive screens every 3 months. To compare the results of UDSs sampled during the pandemic with results of UDSs sampled before the pandemic, we had to ensure that individuals had available urine data during both time periods. Therefore, data could be analyzed for individuals recruited after June 17, 2019 and before March 15, 2020, the day before Canada closed its borders to nonresidents in response to the pandemic (see Fig. 1 for study timeline). Participants recruited after June 17, 2019 were ensured to have at least 3 months of UDS collection occurring after our pandemic start date of March 16, 2020 (those UDS results would be pooled from March 17, 2020 through June 16, 2020). In contrast, if a participant was recruited before June 17, 2019, for example on June 1, 2019, their final 3 months of UDS data would be pooled from March 1, 2020 through May 31, 2020, an interval which would include results both before and after the pandemic start date of March 16, 2020. Note that because participants were recruited into the study at different times, they contribute different

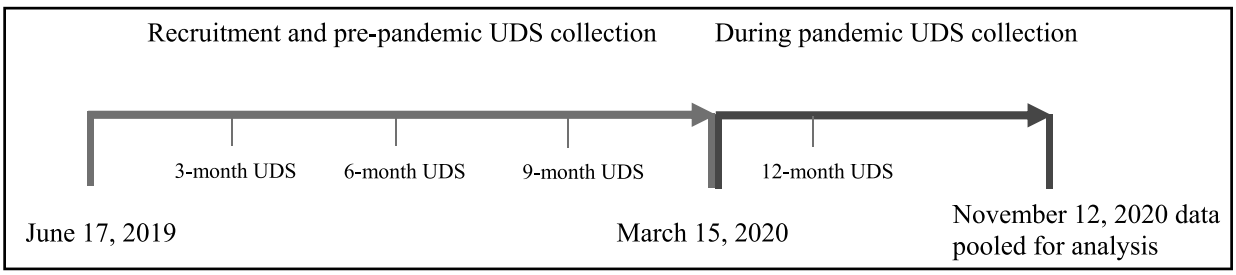

FIGURE 1. Study recruitment and example of follow up timelines.

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durations of follow up pre-pandemic to the pooled results. Similarly, participants contribute different durations of follow up during the pandemic.

For each eligible study participant, UDSs collected before March 16, 2020 were used to calculate the percentage of opioid-positive UDSs pre-pandemic, whereas those collected afterwards were used to calculate the percentage of opioid-positive UDSs during the pandemic. Change in the percentage of opioid-positive UDSs was calculated by subtracting the percentage of opioid-positive UDSs pre-pandemic from the percentage of opioid-positive UDSs during the pandemic. We also calculated the rate of UDSs conducted per month pre-pandemic and post-pandemic.

Statistical analyses were conducted using Stata Version 15.1 (StataCorp LP, College Station, TX, USA). We report categorical variables using frequencies and percentages and continuous variables using mean values and standard deviations, or median values with quartiles and interquartile range.

We used a paired t-test to estimate the impact of COVID-19 on the percentage of opioid-positive urines before and after March 16, 2020. Furthermore, we employed linear regression analysis to explore the association between demographic and clinical factors measured at the time of study entry and the change in participants' percentage of opioid-positive UDSs during the pandemic. Sociodemographic covariates explored in our model included biological sex, age, ethnicity (which was dichotomized into Caucasian ethnicity vs other due to small numbers of individuals reporting different ethnic backgrounds), marital status (married or common-law vs other), living with children (vs not), and receiving social assistance in the form of welfare or disability support (vs other source of income). Clinical covariates included type of treatment (methadone vs buprenorphinenaloxone), length of time in treatment in years, and the total number of UDSs taken during the COVID-19 pandemic. Finally, we also explored substance use factors including non-abstinence from opioids pre-pandemic (defined as at least 1 opioid-positive UDSs in the period before March 16, 2020), experience of any opioid overdose requiring ED visit in the 12 months before study entry, and self-reported intravenous drug use, alcohol, cannabis, non-prescription benzodiazepine, cocaine (including both cocaine and crackcocaine), and amphetamine use in the month before study entry. Results are presented using beta-coefficients with 95% confidence intervals (CI).[30]

We calculated the percentage of missing data for our primary outcome, UDSs, and for each baseline variable of interest in Table 1. We used multiple imputation methods using Markov Chain Monte Carlo procedures to handle all missing data. Altogether, there were 9 variables with missing data: change in percentage of opioid-positive UDSs (n = 173 individuals with missing data), years in treatment (n = 1), type of treatment (n = 2), intravenous drug use (n = 4), non-abstinence pre-pandemic (n = 8), self-reported alcohol use (n = 3), cocaine use (n = 4), amphetamine use (n = 4), non-prescribed benzodiazepine use (n = 4), and cannabis use (n = 3). We included the following variables without missing data in the imputation

TABLE 1. Participant Characteristics at the Time of Study Enrollment

Characteristic	Total Sample N = 629	Complete UDS Data n = 456	Missing UDS Data n = 173
Male sex; n (%)	328 (52.2%)	230 (50.4%)	102 (59%)
Age (years); mean (SD)	39.9 (10.9)	41.0 (11.0)	37.0 (10.2)
Married or common-law; *n* (%)	192 (30.5%)	135 (29.6%)	57 (33%)
Unemployment; n (%)	445 (70.8%)	312 (68.4%)	133 (76.9%)
Social assistance recipient; n (%)	372 (59.1%)	262 (57.5%)	110 (63.6%)
Living with children; n (%)	202 (32.1%)	161 (35.3%)	41 (23.7%)
Methadone treatment; n (%)	505 (80.5%)	371 (81.5%)	138 (77.9%)
Buprenorphine treatment; n (%)	122 (19.5%)	84 (18.5%)	38 (22.1%)
Dose (mg/day)			
Methadone; mean (SD)	69.9 (38.2)	74.3 (38.1)	57.7 (35.7)
Buprenorphine; mean (SD)	11.6 (6.6)	12.1 (6.7)	10.7 (6.4)
Years in treatment; median (IQR)	3 (6)	4 (6.8)	1.5 (3.6)
Opioid overdose requiring ED visit in the last year before study entry; n (%)	62 (9.9%)	31 (6.8%)	31 (17.9%)
Self-reported access to naloxone kit; n (%)	492 (78.5%)	353 (77.4%)	139 (81.3%)
Self-reported past-month alcohol use at the time of study entry*; n (%)	217 (34.7%)	154 (33.9%)	63 (36.8%)
Self-reported past-month cannabis use at the time of study entry*; n (%)	340 (54.3%)	238 (52.3%)	102 (59.7%)
Self-reported past-month non-prescribed benzodiazepine use at the time of study entry*; n (%)	55 (8.8%)	42 (9.2%)	13 (7.7%)
Self-reported past-month cocaine use at the time of study entry*; n (%)	186 (29.8%)	116 (25.5%)	70 (41.2%)
Self-reported past-month amphetamine use at the time of study entry*; n (%)	108 (17.3%)	62 (13.6%)	46 (27.1%)
Self-reported past-month intravenous drug use at the time of study entry*; n (%)	119 (19.0%)	66 (14.5%)	53 (31.2%)
Rate of UDSs per month conducted pre-COVID-19; median (Q1, Q3)	2.5 (1.3, 4)	2.35 (1.2, 4)	2.67 (1.5, 3.87)
Rate of UDSs per month conducted during COVID-19; median (Q1, Q3)	n/a	2.33 (1.6, 3.3)	n/a
Non-abstinence from opioid use pre-COVID-19†; n (%)	468 (75.4%)	335 (73.5%)	133 (76.9%)
Percentage of opioid-positive urine test results pre-COVID-19; mean (SD)	11.7 (22.8)	7.5 (17.2)	23.4 (30.8)
Non-abstinence from opioid use during COVID-19†; n (%)	n/a	211 (46.3%)	n/a
Percentage of opioid-positive urine test results during COVID-19; mean (SD)	n/a	18.1 (26.5)	n/a

*Self-reported use in the last month at the time of study entry assessed using the Maudsley Addiction Profile questionnaire. †Non-abstinence is defined as any opioid-positive UDSs during the period before March 16, 2020.

IQR indicates interquartile range; n/a, not available; Q1, quartile 1; Q3, quartile 3; SD, standard deviation; UDS, urine drug screen.

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model: sex, age, ethnicity, marital status, living with children, receiving social assistance, and history of overdose requiring ED visit in the last year. We created 20 imputed datasets, based on simulation studies recommending 20 imputations for 10% to 30% missing data,[31] and the rule of thumb that the number of imputed datasets should be similar to the proportion of missing cases.[32,33] We present the results of both analyses using complete case analysis and sensitivity analyses using multiple imputation to handle missing data.

We report methods and quantitative results in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology guidelines.[34]

RESULTS

Participants' Baseline Characteristics

Altogether, 2,406 participants were recruited into the POST study since its inception in 2018 (Fig. 2); however, as described, participants were excluded from the present analyses if they were recruited before June 17, 2019 or after March 15, 2020 as they would not have UDS results available during the distinct pre- and during-pandemic periods of interest (Fig. 1). There were ultimately 629 participants, recruited from 22 different clinics, eligible for inclusion in the present analyses, of whom 456 (72%) had complete UDS data. The reasons for missing UDS data are tracked in Figure 2 and include treatment drop-out, transfer to a different treatment clinic, and incarceration, among other reasons.

Participants had a mean age of 39.9 years (standard deviation [SD] = 10.9) and 52% were male (Table 1). Methadone was the most common treatment (81%) and the median duration of time in treatment was 3 years (interquartile range = 6).

Participants with missing UDSs during the pandemic, who were not included in the final analyses, had, on average, shorter time in treatment (median 1.5 years vs 4 years), lower medication doses (mean methadone dose 57.7mg/day vs

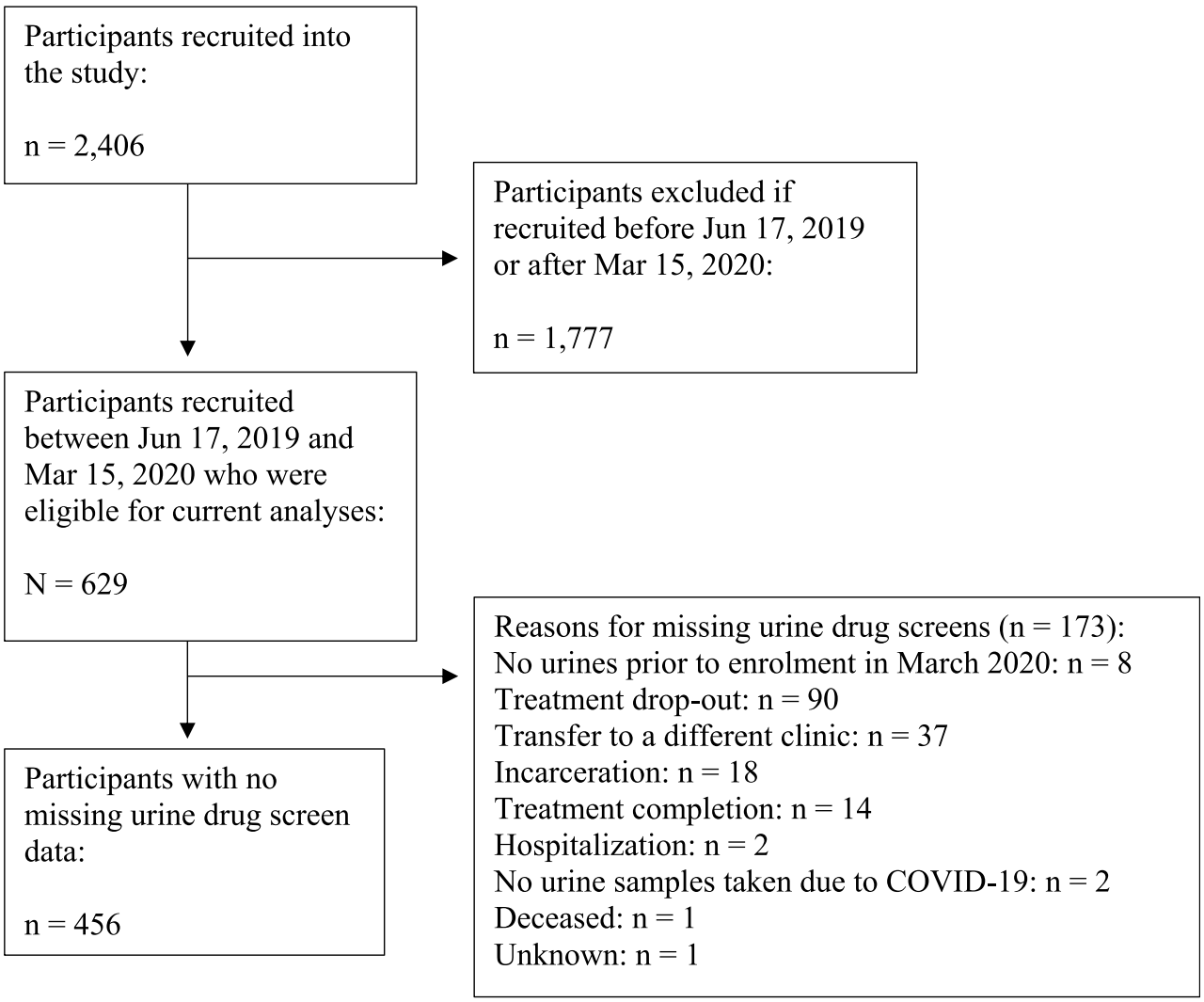

FIGURE 2. Study flow diagram.

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74.3mg/day; mean buprenorphine dose 10.7mg/day vs 12.1mg/day), and more opioid use pre-pandemic (mean 23.4% opioid-positive urines [SD = 30.8] vs 7.5% [SD = 17.2]).

Primary Analyses: Assessing the Association Between COVID-19 and Opioid Use Patterns

The median rate of UDSs conducted before the pandemic was 2.50 per month (Q1 = 1.3, Q3 = 4), while the median rate of UDSs conducted during the pandemic was 2.35 (Q1 = 1.6, Q3 = 3.3). Approximately 75% of participants were identified to be non-abstinent from opioids during the pre-pandemic period, with at least 1 opioid-positive UDS (Table 1). The percentage of participants who were non-abstinent from opioids during the pandemic decreased to 46.3%, suggesting that for some patients, abstinence was achieved during the pandemic (Table 1). However, the percentage of opioid-positive UDSs increased significantly in the context of the pandemic, on average by 10.56% (95% CI 8.17, 12.95, $P < 0.001$).

Factors associated with change in the percentage of opioid-positive UDSs during the pandemic are presented in Table 2. Measures of opioid and non-opioid substance use at study entry were most strongly associated with a change in opioid-positive tests during the pandemic. Non-abstinence from opioids before the pandemic was associated with 9.43% increase, on average, in the percentage of opioid-positive UDSs during the pandemic (95% CI 3.79, 15.07). Participants who self-reported past-month cocaine use when they entered the study experienced, on average, a 6.83% increase in their opioid-positive UDSs during the pandemic (95% CI 0.92, 12.73). Participants who self-reported past month amphetamine use at study entry experienced, on average, 13.13% increase in their opioid-positive UDSs during the pandemic (95% CI 5.15, 21.11). This association was not seen for participants who self-reported alcohol or cannabis use at the time of study entry. Self-reported intravenous drug use was not independently associated with a statistically significant change in opioid-positive UDSs (adjusted betacoefficient −5.54, 95% CI −13.55, 2.47).

Sensitivity Analysis Using Multiple Imputation

The results of sensitivity analysis using multiple imputation are presented in Table 3. When multiple imputation for missing data is applied, the length of time in treatment before study recruitment is revealed to be statistically significant in its association with increased percentage of opioid-positive UDSs during the pandemic. For each 1 year longer in treatment, there is a 0.53% increase in opioid-positive UDSs during the pandemic, on average (95% CI 0.01, 1.06). The magnitude of effect is marginally different from the complete case analysis (Table 2), which revealed that for each 1 year longer in treatment, there is a 0.51% increase in opioidpositive UDSs, on average (95% CI −0.02, 1.04). No other findings were significantly different compared to complete case analysis.

DISCUSSION

Our findings join a growing literature indicating the deleterious impact of the COVID-19 pandemic on outcomes for some patients with OUD.We found, on average, increased rates of opioid use amongst patients with OUD receivingMAT since the onset of the pandemic, as indicated by increased rates of opioid-positive UDSs. These findings are strengthened by within-individual analyses that use participants as

TABLE 2. Linear Regression Analysis of Factors Associated With Change in Percentage of Opioid-positive Urine Drug Screens During the COVID-19 Pandemic

Covariate	Unadjusted Beta-coefficient (95% CI)	Adjusted Beta-coefficient (95% CI)
Male sex	[reference]	[reference]
Female sex	−0.01 (−4.79, 4.78)	1.04 (−3.86, 5.94)
Age (for each 5-year increase in age)	−0.20 (−1.30, 0.85)	0.21 (−1.01, 1.45)
Non-Caucasian ethnicity	−0.98 (−6.16, 4.21)	−0.97 (−6.18, 4.25)
Married	−1.11 (−2.47, 0.25)	−1.26 (-2.72, 0.20)
Living with children	−3.55 (−8.54, 1.44)	−1.64 (−6.94, 3.66)
Receiving social assistance Type of treatment	2.24 (−2.59, 7.07)	−0.81 (−5.84, 4.23)
Methadone	[reference]	[reference]
Buprenorphine-Naloxone	−4.87 (−11.03, 1.29)	−1.75 (−8.13, 4.63)
Years in treatment (for each 1-year increase in length of time in treatment)	0.46 (−0.03, 0.95)	0.51 (−0.02, 1.04)
Opioid overdose requiring ED visit in the last year before study entry	5.14 (−4.34, 14.63)	0.93 (−8.89, 10.76)
Non-abstinence from opioids pre-COVID-19	10.82 (5.49, 16.14)	9.43 (3.79, 15.07)
Total number of UDSs during COVID-19 pandemic	0.41 (−0.10, 0.91)	0.O2 (−0.51, 0.54)
Alcohol use*	2.13 (−2.93, 7.19)	1.76 (−3.31, 6.82)
Cannabis use*	0.98 (−3.82, 5.77)	0.52 (−4.36, 5.40)
Non-prescription Benzodiazepine use*	7.84 (−0.40, 16.09)	0.18 (−8.56, 8.92)
Cocaine use*	9.70 (4.28, 15.13)	6.83 (0.92, 12.73)
Amphetamine use*	14.27 (7.41, 21.12)	13.13 (5.15, 21.11)
Intravenous drug use*	5.88 (−0.90, 12.66)	−5.54 (−13.55, 2.47)

Mean variance inflation factor = 1.19.

*Self-reported use in the last month at the time of study entry assessed using the Maudsley Addiction Profile questionnaire.

CI indicates confidence interval; ED, emergency department; UDS, urine drug screen.

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TABLE 3. Sensitivity Analysis Using Multiple Imputation for Missing Data

Covariate	Adjusted Beta-Coefficient (95% CI)
Male sex	[ref]
Female sex	1.22 (−3.96, 6.41)
Age (for each 5-year increase in age)	0.335 (−0.82, 1.49)
Non-Caucasian ethnicity	−0.71 (−5.88, 4.46)
Married	−1.39 (−2.89, 0.12)
Living with children	−1.53 (−6.66, 3.61)
Receiving social assistance Type of treatment	−1.01 (−5.87, 3.87)
Methadone	[ref]
Buprenorphine-Naloxone	−1.56 (−7.80, 4.68)
Years in treatment (for each 1-year increase in length of time in treatment)	0.53 (0.01, 1.06)
Opioid overdose requiring ED visit in the last year before study entry	0.87 (−7.77, 9.52)
Non-abstinence from opioids pre-COVID-19	8.74 (2.88, 14.60)
Total number of UDSs during COVID-19 pandemic	0.04 (−0.50, 0.58)
Alcohol use*	1.80 (−3.41, 7.00)
Cannabis use*	0.48 (−3.84, 4.80)
Non-prescription Benzodiazepine use*	0.06 (−8.56, 8.69)
Cocaine use*	7.08 (1.82, 12.34)
Amphetamine use*	13.20 (6.03, 20.37)
Intravenous drug use*	−5.04 (−12.59, 2.51)

*Self-reported use in the last month at the time of study entry assessed using the Maudsley Addiction Profile questionnaire.

CI indicates confidence interval; ED, emergency department; UDS, urine drug screen.

their own controls. Increased opioid use may be attributed to worsening mental health in the context of physical distancing, stay-at-home orders, and psychosocial stressors related to the pandemic.[35,36] Individuals with OUD are more likely to face precarious housing and unstable employment and may lack a network of social supports.[35] Furthermore, the pandemic has led to increased rates of depression and anxiety,[37,38] comorbidities commonly seen in patients with OUD.[39] These challenges are compounded by the notable decrease in access to services experienced across the healthcare system as a result of pandemic measures and overwhelmed hospitals. This included a reduction in available supports at the sites providing MAT as clinics initially reduced frequency of visits to enable social distancing within the clinic space. Taken together, the consequences of the COVID-19 pandemic have resulted in further marginalization of an already vulnerable population.[36] Considering that opioid use seems to have increased for patients enrolled in MAT during the pandemic, some physicians and researchers have argued for access to safer opioids to reduce the risks associated with illicitly produced fentanyl.[40,41]

We identified pre-existing opioid, cocaine, and amphetamine use as having the strongest association with increased opioid use during the pandemic. Meanwhile, sociodemographic factors including age, sex, ethnicity, and marital status did not seemto have a clear association with a change in opioid use. Notably, too, the length of time for which participants were enrolled in MAT before study entry did not seem to confer protective advantage from increased opioid use. As healthcare delivery models adapted to pandemic-related measures, many programs and clinics considered how to best provide care and identify individuals who may require higher levels of care. In one report, Wilson and colleagues explain their triage system for providing more frequent or in-person care, despite pivoting to a largely telemedicine MAT model.[42] The authors defined patient acuity on the basis of past-month substance use, being new to care, or being pregnant.[36] Our present findings provide some support for this model and may suggest that opioid use and stimulant use (cocaine and amphetamines) may be important to consider in assessing patients' risk of worsened outcomes during the pandemic.

Although we found an increase, on average, in the percentage of opioid-positive UDS during the pandemic, when we examined the overall rates of abstinence and non-abstinence from opioid use, we found that there was an increase in the rate of abstinence from 26.5% to 53.7% during the pandemic. This suggests that, while some individuals experienced increased opioid use, others avoided opioid use or achieved abstinence while receiving treatment, despite the pandemic. The generalizability of this study is limited to individuals enrolled in MAT for OUD and may not apply to individuals who have OUD but are not receiving treatment or individuals who have an undiagnosed OUD. Although missing UDS data during the pandemic is a limitation, our use of sensitivity analysis with multiple imputation corroborates the primary findings. Additionally, the fact that our model adjusts for duration of time in treatment mitigates concerns about patients' stability in treatment potentially biasing outcomes. To conduct pre- and post-pandemic analyses, we employed the cut-off date of March 16, 2020 as a marker for when the pandemic impacted participants. Although the pandemic is a continuous rather than a discrete event, occurring in waves and affecting different geographical regions to different extents, the magnitude of the social and political changes introduced almost overnight upon Canada's border closing allows our cut-off date of March 16, 2020 to mark a stark distinction between the pre-pandemic and during-pandemic periods of interest, and has been employed by other studies.[4,6] In addition to abstinence from opioid use, we considered length of time in treatment as a marker for treatment stability in this study, which has limitations as duration in the program does not necessarily imply stability. In future studies, assessment of stability based on whether or not the patient has carries (take home doses of MAT earned by abstinence from opioids and other drugs) would be more suitable. Future studies that examine dynamic changes to participant employment, housing, and non-opioid substance use may provide further information on risk factors for increased opioid use during the COVID-19 pandemic. Given the increasing contamination of other substances with illicitly manufactured fentanyl, it is possible that opioid-positive UDSs may reflect unintentional opioid use. Additional outcomes including quality of life, opioid overdoses, healthcare service utilization, and mortality should be considered.

Calls have been made to preserve some of the systems changes borne out of the necessity for adaptation and innovation during the pandemic, including maintaining regulatory changes that allow for increased access to buprenorphine,[43,44] further advancing our virtual care capacity,[45] and improving

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access to safe drug supply for individuals who continue to use.[40,41] Evidence for the effectiveness of infection control measures such as personal protective equipment and physical distancing within the clinic environment would be helpful in guiding decisions concerning whether to reduce the frequency of clinic visits, and thus reduce available supports during a time of increased stress, based on the need to prevent infection transmission. Clinicians, researchers, and policy-makers must ask themselves, how can we harness the knowledge gained during this unprecedented time to better the care patients receive in the future?

CONCLUSIONS

Patients treated for OUD have experienced increases in opioid use in the context of the COVID-19 pandemic. This is occurring in the midst of significant psychological and economic stressors faced by this population, and during a time in which the delivery of healthcare services has changed dramatically in response to the pandemic. Our study provides an assessment of some factors associated with worse opioid use outcomes during the pandemic, including opioid, cocaine, and amphetamine use before the pandemic. As the pandemic unfolds, we will have opportunities to adapt our clinical programs to better meet the needs of patients with OUD and our understanding of risk factors for worse outcomes may serve to inform these.

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