Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.
Increased solitary drug use during COVID-19: An unintended consequence of social distancing

Kristin E. Schneider, Sean T. Allen, Saba Rouhani, Miles Morris, Katherine Haney, Brendan Saloner, Susan G. Sherman

Keywords: Solitary drug use, Drug use during COVID-19, Social distancing, Harm reduction

ABSTRACT

Background: During the COVID-19 pandemic, overdose rates substantially increased in the United States. One possible contributor to this phenomenon may be solitary drug use resulting from social distancing efforts to prevent COVID-19 transmission.

Methods: We surveyed 458 people who use drugs (PWUD) who were recruited from harm reduction and drug treatment providers located in nine states and the District of Columbia. We assessed if solitary drug use had increased since the start of COVID-19. Associations between increased solitary drug use and sociodemographic characteristics, drug use characteristics, and COVID-19 prevention behaviors were examined using multiple logistic regression.

Results: Half the sample identified as men (52.7%), White (49.7%), and single (49.3%). The average age was 43.2 (SD:11.8) years. Two-thirds (66.8%) recently injected drugs. 44% reported increased solitary drug use since COVID-19. Significant correlates of increased solitary drug use included being single (adjusted Odds Ratio [aOR]=1.99, 95% Confidence Interval [CI]: 1.33, 2.98), increasing drug use (aOR=2.74, 95% CI: 1.72, 4.37), using more in private locations (aOR=1.91, 95% CI: 1.34, 2.72), and social distancing behaviors (aOR=1.31, 95% CI: 1.11, 1.54). Experiencing homelessness (aOR=0.45, 95% CI: 0.31, 0.65) and identifying as a sexual minority (aOR=0.53, 95% CI: 0.31, 0.93) were associated with being less likely to increase solitary drug use.

Conclusions: Solitary drug use increased during the COVID-19 pandemic. Increases in solitary drug use, in the context of a drug market increasingly permeated by fentanyl, indicates an urgent need for comprehensive harm reduction interventions to reduce overdose mortality.

Introduction

During the COVID-19 pandemic, overdose rates increased substantially in North America (Intiaz et al., 2021; Special Advisory Committee on the Epidemic of Opioid Overdoses, 2022). In the United States, there were an estimated 30% increase in overdose fatalities between 2019 and 2020, and there was a further 15% increase in 2021 resulting in 107,622 lives lost to overdose that year (Ahmad et al., 2022). Canada also saw large increases in overdose, as opioid-involved overdose deaths doubled between 2019 and 2021 (Special Advisory Committee on the Epidemic of Opioid Overdoses, 2022). These trends contrast from the more stable rates in Europe (11.5% increase from 2019 to 2020 in the European Union, Turkey, and Norway) and Australia (<1% change) (Australian Institute of Health & Welfare, 2022; EMCDA, 2021, 2022).

Non-fatal overdoses have also increased in the US during the pandemic, with emergency department encounters for non-fatal drug overdoses having risen, despite overall decreases in total emergency department encounters (Centers for Disease Control & Prevention & National Center for Injury Prevention & Control, 2021; Czeisler, Lane et al., 2020; 2020b; Holland et al., 2021; Ochalek et al., 2020). Understanding why overdoses have risen so dramatically in the US during the pandemic is essential for crafting effective public health responses in the future.

There are several factors that may have contributed to increases in overdose. Initial evidence has indicated that the drug market has been volatile during the pandemic, as trafficking routes and supply chains were disrupted (Grebely et al., 2020). This has likely driven changes in the availability, price, and potency of drugs since the start of the pandemic and subsequent changes in individual drug use.

https://doi.org/10.1016/j.drugpo.2022.103923

0955-3959/© 2022 Elsevier B.V. All rights reserved.
behaviors (Ali et al., 2021). Individual-level drug use has also been exacerbated during this period with research highlighting increased substance use associated with pandemic-related stress (Czesler, Lane et al., 2020). Interruptions to harm reduction and treatment systems that serve people who use drugs (PWUD) also occurred. Initial research suggests that approximately 15–25% of syringe services programs (SSPs) discontinued services completely during COVID-19 (Bartholomew et al., 2020; Glick et al., 2020). An additional 72% of SSPs that remained open during the COVID-19 pandemic had reduced hours for operation (Bartholomew et al., 2020). Research has further documented a 26% decline in pharmacy naloxone prescription fills during the pandemic, without any evidence that there has been a recovery in this trend as the pandemic continues (O’Donoghue et al., 2021). While some services have been restored, as of early 2022, many services remain diminished, and concerns regarding COVID-19 exposure while accessing services could deter future service use.

Another potential contributor to increased overdose mortality is increased solitary drug use induced by social distancing efforts. Solitary drug use or using drugs alone is a risk factor for fatal opioid overdose, as it means that no bystanders will be nearby to administer naloxone or call for assistance if an overdose were to occur (Wojcicki, 2019). Prior to the pandemic, studies estimated that 40–76% of PWUD engage in solitary drug use (Mattson et al., 2018; Papamihali et al., 2020; Park et al., 2019), and it is yet unknown how this has changed during the pandemic. PWUD have many reasons for using alone, including safety from robbery or assault, convenience, and better psychological experiences (Papamihali et al., 2020; Project SAFE, 2020). Most recently, COVID-19 has emerged as an additional reason for using drugs alone as PWUD adhere to social distancing guidelines. While social distancing is undoubtedly an essential COVID-19 prevention strategy, it is at odds with the overdose risks associated with solitary drug use for PWUD. Public health messaging during the pandemic has been clear on the importance of social distancing, but there has been a lack of communication for PWUD regarding how to balance the risks of COVID-19 and solitary drug use.

We explore changes in solitary drug use during the COVID-19 pandemic among a sample of PWUD from the US, and measure how these changes vary by sociodemographic characteristics, drug use, and COVID-19 prevention behaviors. We expect that COVID-19 social distancing behaviors will be key drivers of increased solitary drug use during the pandemic. We further assessed substance use characteristics and changes in personal drug use during the pandemic to determine if increased drug use during the pandemic also contributed to increased solitary drug use and to understand if multiple overdose risk factors are occurring in concert.

Methods
The COVID Harm Reduction and Treatment programs Survey (COVID-HARTS) study

The full details of the COVID-HARTS study have been reported previously (Saloner et al., 2022). Here we provide a summary of the methods. Recruitment occurred from August 19, 2020 to January 29, 2021. Participants were referred from 21 drug treatment and harm reduction programs across 9 states (Maine n = 36, Maryland n = 14, Michigan n = 40, New Jersey n = 83, New Mexico n = 61, New York n = 11, Pennsylvania n = 114, Tennessee n = 44, and West Virginia n = 41) and the District of Columbia (n = 14). Program staff distributed recruitment cards, with a phone number and unique study identifier, to clients who expressed interest in the study. Interested individuals called the study phone number to be screened for eligibility. Eligible participants were: 18 years or older, a client of a participating organization, able to provide informed consent, and able to provide a valid study identifier (from the recruitment card). Eligible participants then completed the 1-hour survey via telephone and received a $40 incentive for participating (N = 587). For this analysis, we restricted the sample to participants who had used drugs in the past 6 months (n = 100 removed) and who reported information about using alone during COVID-19 (n = 25 missing). We also removed 4 transgender participants from the analytic sample, as gender was a correlate of interest, and the sample size was too small. This process yielded a final sample of 458. The COVID-HARTS Study was approved by the Johns Hopkins School of Public Health Institutional Review Board.

Measures
Solitary drug use
The main outcome of interest was increased solitary drug use since COVID-19. Participants were asked to agree or disagree (binary) with the statement, “Since COVID-19, I try to only use drugs alone more than before”. We used this question as an indicator of increased solitary drug use.

Sociodemographic characteristics
We ascertained participants’ age (in years), gender (man/male or woman/female), sexual orientation (categorized as heterosexual vs sexual minority), race/ethnicity (categorized as non-Hispanic white, non-Hispanic Black, Hispanic/Latinx, and Other), relationship status (single vs in a relationship), education (less than high school, high school diploma or equivalent, or some college or more), employment status (full time, part time, or not working), if they were currently homeless (self-identified based on the question “Are you currently homeless? yes/no), and if they experienced hunger at least once a week (yes/no). Finally, participants reported their state and county, which we coded according to the National Center for Health Statistics Rural Classification Scheme (codes range from 1– large central metro to 6 – non-core) (Ingram & Franco, 2013). We created three categories of urbanicity: large metropolitan (codes 1 and 2), small metropolitan (codes 3 and 4), and non-metropolitan (codes 5 and 6).

Drug use in the past 6 months
Participants reported if they had used each of 14 drugs/combinations of drugs in the past 6 months, including cocaine, heroin, fentanyl, heroin and fentanyl simultaneously, speedball (cocaine and heroin simultaneously), methamphetamine, methamphetamine and heroin simultaneously, prescription opioids, tranquilizers, buprenorphine/suboxone, hallucinogens, other medications (not as prescribed), and other stimulants. Participants also reported if they had injected drugs in the past 6 months. To measure changes in drug use during COVID-19, we used two binary questions asking participants if they had used drugs more or used drugs less during COVID-19. From these questions, we created a three-category variable indicating whether a participant had used more, the same, or less during COVID-19. We recoded responses as missing from participants who reported both increasing and decreasing drug use (n = 16 missing). Finally, we asked participants about the physical spaces in which they used drugs. Participants indicated if they used drugs in private locations (e.g., private houses) more than before the pandemic.

Drug treatment in the past month
We included three binary measures of past month drug treatment: any drug treatment, any medication for opioid use disorder (MOUD; buprenorphine, methadone, or naltrexone), and any non-medication treatment (e.g., individual or group counselling, 12 step meetings, doctor consultations).

COVID-19 prevention behaviors
We included measures of six COVID-19 prevention behaviors. Participants were asked to indicate which of the following they had done because of the COVID-19 pandemic: avoided crowded places, kept a 6-foot distance from others, worn a face mask, washed hands with soap/used hand sanitizer several times per day, canceled/postponed personal or
social activities, and avoided contact with people who could be high-risk. We also created a sum score (range 0–4) of the social distancing measures (avoided crowded places, kept a 6-foot distance from others, canceled/postponed personal or social activities, and avoided contact with people who could be high-risk).

Analysis

We first estimated the overall prevalence or mean of each variable. We then used Chi Square tests (or a t-test in the case of age) to assess relationships between each variable and solitary drug use. Based on these results, we included all variables associated with solitary drug use at the p<0.1 level in multivariable logistic regression analyses, except for the individual distancing items. We included the sum score of distancing measures in the regression analyses instead of individual distancing items. Included variables were checked for multicollinearity using variance inflation factors (VIFs); all VIFs were low (VIF<1.5). We clustered standard errors by the recruitment organization from to account for study design in the regression model. Statistical analyses were performed using Stata 17 (StataCorp, College Station, TX).

Results

Overall, approximately half the sample identified as male (52.7%), White (49.7%), and single (49.3%) (Table 1). The average age was 43.2 (SD:11.8). Among participants, 12.5% identified as a sexual minority. Participant education varied: 28.4% of participants had less than a high school education, 42.8% had a high school diploma or equivalent, and 28.8% had some college education or more. About one quarter of the sample reported experiencing homelessness (25.1%) or weekly hunger (28.2%). More than half the sample live in large metropolitan areas (53.5%), 29.8% lived in small metropolitan areas, and 16.7% lived in non-metropolitan areas. Heroin (76.4%) and cocaine (50.1%) were the most commonly used drugs. Two-thirds (66.8%) reported injecting drugs in the past 6 months. During COVID-19, 29.4% of participants reported using drugs less than before the pandemic, while 41.6% reported using drugs more. Two-thirds reported using drugs in private locations more (64.7%). About half of the sample had received any drug treatment (57.6%), MOKtreatment (49.9%), or non-MOK treatment (52.8%) in the past month. Most participants reported engaging in each COVID-19 prevention behavior, ranging from 96.7% reporting mask wearing and hand washing to 85.4% avoiding high risk individuals to 75.3% reporting cancelling plans.

Increased solitary drug use was reported by 43.9% of the sample. In the bivariate analyses, participants who reported being a sexual minority or experiencing homelessness were less likely to report increased solitary drug use, while persons who were single were more likely to report increased solitary drug use. Of the substances measured, only prescription opioid and other stimulant use were marginally associated with changes in solitary drug use. Increased overall drug use during COVID-19 was also associated with increased solitary drug use. Using more in private locations was further associated with increased solitary drug use. Drug treatment was not significantly associated with changes in solitary drug use. Of the six COVID prevention behaviors, cancelling plans was significantly associated with increased solitary drug use, and social distancing and avoiding high-risk people were marginally associated with increased solitary drug use. The social distancing sum score was significantly associated with solitary drug use, such that those who reported increased solitary drug use had higher average distancing scores.

In the multivariable logistic regression model (Table 2), experiencing homelessness (adjusted Odds Ratio [aOR]=0.45, 95% CI: 0.31, 0.65) and identifying as a sexual minority (aOR= 0.53, 95% CI: 0.31, 0.93) were associated with being less likely to have reported increased solitary drug use. Being single (aOR=1.99, 95% CI: 1.33, 2.98) was associated with more solitary drug use. Using more drugs during COVID-19 (aOR=2.74, 95% CI: 1.72, 4.37) was associated with increased solitary drug use. Using more in private locations (aOR=1.91, 95% CI: 1.34, 2.72) was further associated with increased solitary drug use. Finally, higher social distancing scores (aOR=1.31, 95% CI: 1.11, 1.54) were also associated with increased solitary drug use.

Discussion

Using data from a sample of PWUD from nine states and the District of Columbia, we found that there were substantial increases in solitary drug use during the COVID-19 pandemic. Solitary drug use is a known risk factor for experiencing a fatal overdose (Wojicki, 2019), so these findings are consistent with the increases in overdose fatalities during the pandemic. Individuals experiencing homelessness were less likely to report using alone more, likely due to their socioeconomic vulnerabilities limiting access to stable private locations in which to do so. Being single was associated with more solitary drug use, which is may be due to PWUD often use drugs with their romantic or sexual partners. Participants who identified as sexual minorities were also less likely to report increase solitary drug use. It is not clear from this data why sexual minority individuals would have used alone less, so additional research is needed to explore this phenomenon and its possible implications for COVID-19 and overdose risk among sexual minority populations.

Individuals who reported increased drug use during COVID-19 also reported more solitary drug use. This is worrying as increasing substance use confers substantial risk for experiencing an overdose, especially in the context of a toxic drug supply. Illicitly manufactured fentanyl and its analogs have become increasingly prevalent in the drug supply, resulting in substantial increases in overdose mortality (Ciccarone, 2017; Han et al., 2019). Combining amplified substance use and a toxic drug supply with solitary drug use likely results in increased mortality risks beyond those of each individual factor. These findings indicate the need for expanded interventions that specifically address the toxicity of the drug market to reduce overdose risks, such as drug checking programs or fentanyl test strips distribution.

Similarly, using drugs in private locations increases the risk of an overdose being fatal, as a person would be less likely to be found and helped by a bystander. While related, using drugs alone and using in private locations have separate and additive effects on the risk of an overdose being fatal. PWUD who use alone often report using in public or semi-public places so that they can be found and revived in case of an overdose as part of their safety plan (Dovey et al., 2001). Our finding that more individuals report using both alone and in private in the context of COVID-19 represents a challenge for overdose prevention initiatives in this new landscape of drug use habits.

Unfortunately, social distancing efforts to reduce COVID-19 transmission may have had the unintended consequence of increasing solitary drug use during the pandemic. Increased solitary drug use was higher among individuals who reported more social distancing behaviors, suggesting that concern about COVID-19 was a driver of using alone during the pandemic. This finding is consistent with previous qualitative reports from service providers (Frost et al., 2022). With this potential consequence in mind, public health messaging to PWUD needs to be amended to balance the risks of COVID-19 and overdose using creative harm reduction strategies to reduce overdose risks. For example, “spotting,” or remotely monitoring someone’s drug consumption, may be particularly valuable in the COVID-19 context. Spotting has been used by PWUD for year via several modalities (e.g., phone, video calls) to intervene by calling for help if the person experiences an overdose (Perri et al., 2021). Initial evidence suggests that spotting during COVID-19 is a viable strategy to help fill service gaps and maintain social distancing will preventing solitary drug use (Perri et al., 2021). Spotting interventions using technology are limited to PWUD who have access to cell phones or the internet and should be paired with further overdose prevention strategies.

Structural solutions to mitigate overdose risks compliment and facilitate individual behavior changes. One potential structural solution
Table 1
Sample characteristics and correlates of increased solitary drug use during COVID-19.

| Sociodemographic Characteristics                  | Total          | Increased Solitary Drug Use |
|---------------------------------------------------|----------------|------------------------------|
|                                                   | n = 458        | No (56.1)  | Yes (43.9)  | p     |
| Age, M (SD)                                       | 43.2 (11.8)    | 42.6 (11.6) | 44.0 (12.0) | 0.205 |
| Gender                                            |                |              |              |       |
| Man/Male                                          | 241 (52.7)     | 138 (53.9)  | 103 (51.2)  | 0.571 |
| Women/Female                                      | 216 (47.3)     | 118 (46.1)  | 98 (48.8)   |       |
| Sexual Minority                                   | 57 (12.5)      | 39 (15.2)   | 18 (9.0)    | 0.047 |
| Race/Ethnicity                                    |                |              |              |       |
| Non-Hispanic white                                | 227 (49.7)     | 130 (50.6)  | 97 (48.5)   | 0.616 |
| Non-Hispanic Black                                | 105 (23.0)     | 58 (22.6)   | 47 (23.5)   |       |
| Hispanic or Latinx                                | 110 (24.1)     | 63 (24.5)   | 47 (23.5)   |       |
| Other                                             | 15 (3.3)       | 6 (2.3)     | 9 (4.5)     |       |
| Single                                            | 225 (49.3)     | 117 (45.7)  | 108 (54.0)  | 0.079 |
| Education                                         |                |              |              |       |
| <HS                                               | 130 (28.4)     | 71 (27.6)   | 59 (29.4)   | 0.843 |
| HS or equivalent                                  | 196 (42.8)     | 113 (44.0)  | 83 (41.3)   |       |
| Some college +                                    | 132 (28.8)     | 73 (28.4)   | 59 (29.4)   |       |
| Employment                                        |                |              |              |       |
| Full time                                         | 27 (5.9)       | 15 (5.8)    | 12 (6.0)    | 0.165 |
| Part time                                         | 43 (9.4)       | 30 (11.7)   | 13 (6.5)    |       |
| Not working                                       | 388 (84.7)     | 212 (82.5)  | 176 (87.6)  |       |
| Homeless                                          | 114 (25.1)     | 75 (29.4)   | 39 (19.5)   | 0.015 |
| Weekly Hunger                                     | 129 (28.2)     | 68 (26.5)   | 61 (30.4)   | 0.358 |
| Urbanicity Categories                             |                |              |              |       |
| Large Metropolitan Area                           | 244 (53.5)     | 136 (53.1)  | 108 (54.0)  | 0.941 |
| Small Metropolitan Area                           | 136 (29.8)     | 78 (30.5)   | 58 (29.0)   |       |
| Non-Metropolitan Area                             | 76 (16.7)      | 42 (16.4)   | 34 (17.0)   |       |
| **Past 6-Month Drug Use**                         |                |              |              |       |
| Cocaine                                           | 229 (50.1)     | 122 (47.7)  | 107 (53.2)  | 0.237 |
| Heroin                                            | 349 (76.4)     | 200 (77.8)  | 149 (74.5)  | 0.407 |
| Fentanyl                                          | 155 (34.1)     | 89 (34.9)   | 66 (33.0)   | 0.671 |
| Heroin & Fentanyl                                 | 190 (41.5)     | 106 (41.3)  | 84 (41.8)   | 0.906 |
| Speedball                                         | 65 (14.2)      | 37 (14.4)   | 28 (13.9)   | 0.887 |
| Methamphetamine                                  | 168 (36.8)     | 100 (39.1)  | 68 (33.8)   | 0.250 |
| Methamphetamine & Heroin                         | 88 (19.2)      | 48 (18.7)   | 40 (19.9)   | 0.742 |
| Prescription Opioids                              | 117 (25.7)     | 58 (22.7)   | 59 (29.5)   | 0.097 |
| Tranquilizers                                     | 141 (30.8)     | 77 (30.1)   | 64 (31.8)   | 0.686 |
| Buprenorphine/Suboxone                            | 63 (13.8)      | 32 (12.5)   | 31 (15.4)   | 0.560 |
| Hallucinogens                                     | 34 (7.4)       | 17 (6.6)    | 17 (8.5)    | 0.446 |
| Other Medications                                 | 71 (15.5)      | 39 (15.2)   | 32 (15.9)   | 0.827 |
| Other Stimulants                                   | 32 (7.0)       | 13 (5.06)   | 19 (9.50)   | 0.065 |
| Injected Drugs                                    | 306 (66.8)     | 175 (68.1)  | 131 (65.2)  | 0.510 |
| **Drug Use Changes During COVID**                 |                |              |              |       |
| Change in Using Drugs                             |                |              |              |       |
| Decreased Use                                     | 130 (29.4)     | 83 (33.7)   | 47 (24.0)   | <0.001 |
| Maintained Use                                    | 128 (29.0)     | 87 (35.4)   | 41 (20.9)   |       |
| Increased Use                                     | 184 (41.6)     | 76 (30.9)   | 108 (55.1)  |       |
| Used More in Private Locations                    | 293 (64.7)     | 144 (56.7)  | 149 (74.9)  | <0.001 |
| **Past Month Drug Treatment**                     |                |              |              |       |
| Any treatment, past month                         | 264 (57.6)     | 147 (57.2)  | 117 (58.2)  | 0.828 |
| MOUD treatment, past month                        | 226 (49.9)     | 125 (48.8)  | 101 (51.3)  | 0.606 |
| Non-MOUD treatment, past month                    | 239 (52.8)     | 134 (52.6)  | 105 (53.0)  | 0.919 |
| **COVID Prevention Behaviors**                    |                |              |              |       |
| Avoid crowded places                               | 418 (91.3)     | 231 (89.9)  | 187 (93.0)  | 0.236 |
| Kept a 6-foot distance                             | 430 (93.9)     | 237 (92.2)  | 193 (96.0)  | 0.092 |
| Wore a face mask                                   | 443 (96.7)     | 248 (96.5)  | 195 (97.0)  | 0.758 |
| Washed Hands/Sanitizer                             | 443 (96.7)     | 247 (96.1)  | 196 (97.5)  | 0.402 |
| Cancel Plans                                       | 345 (75.3)     | 181 (70.4)  | 164 (81.6)  | 0.006 |
| Avoid high risk people                             | 391 (85.4)     | 213 (82.9)  | 78 (88.6)   | 0.088 |
| Social Distancing Score, M (SD)                   | 3.5 (0.9)      | 3.4 (1.0)   | 3.6 (0.8)   | 0.007 |

Note. Change in drug use during COVID-19 was missing for 16 records. All other variables had <5 records missing.

* Indicates variables included in the social distancing score.

that can simultaneously address the risks associated with solitary drug use, while maintaining rigorous COVID-19 prevention protocols, is the implementation of overdose prevention sites (OPS). OPS provide a safe and hygienic space for PWUD to consume previously acquired drugs using sterile equipment while supervised by medical or case management staff who can respond during overdose (Pauly et al., 2020; Wallace et al., 2019). OPS are often co-located with other treatment and supportive services for PWUD, including case management, housing programs, drug checking, wound care, and vaccination initiatives. Such facilities have a wealth of empirical support for their effectiveness at preventing fatal overdose and infectious disease transmission (European Monitoring Centre for Drugs & Drug Addiction, 2016; Marshall et al., 2011; Medically Supervised Injection Centre Evaluation Committee, 2005; Otter, 2016; Wood et al., 2006). During the pandemic, OPS in other
countries have maintained operations, though capacity has been reduced to ensure COVID-19 safety. Implementation of OP5 in the US is even more critical in the context of COVID-19, given the notable increases in solitary drug use and overdose.

This study has the following limitations to consider. First, the sampling method used in the COVID-HARTS Study only recruited participants who were engaged with at least one type of service. As many PWUD do not utilize treatment or harm reduction services, our sample is not representative of the broader PWUD populations. Second, as this study uses cross-section self-reported data, it is subject to potential recall biases. Some of the measures used lack the specificity needed to provide additional nuance to our findings. For example, we do not have information about how frequently each COVID-19 prevention behavior was done. Recall periods also varied for variables used in this analysis. It is also worth noting that the pandemic severity and associated public health guidance did vary during the course of data collection. Further, we did not ascertain the frequency in which participants used drugs alone and if, and to what extent, they implemented additional measures to reduce overdose when using alone (e.g., going slow). We also did not collect information about the frequency of police practices, which may have implicated solitary drug use. These data were collected near the beginning of the pandemic, so it is also possible that behavioral patterns changed with time. We also do not have explanatory data (e.g., qualitative interviews) to determine if solitary drug use increased as a direct result of COVID-19 prevention efforts, though this explanation is consistent with the results and our hypotheses.

Conclusions

Increased solitary drug use during COVID-19 was common among this sample of PWUD. This change may be due to social distancing efforts to prevent COVID-19, indicating an unintended and potentially deadly consequence of public health efforts to stop the pandemic. Multi-level solutions are needed to prevent fatal overdoses when solitary use occurs, such as spotting programs and overdose prevention sites. Public health messaging for PWUD needs to balance the risks of solitary drug use with other health topics, including COVID-19 prevention.

Ethics approval

The authors declare that they have obtained ethics approval from an appropriately constituted ethics committee/institutional review board where the research entailed animal or human participation.

Funding sources

The study was supported by Bloomberg Philanthropies. STA is also supported by the National Institutes of Health (K01DA046234). The funders were not involved in the collection of study data, the drafting of the manuscript, or the decision to submit the study for publication.

Table 2

Bivariate and multivariable logistic regression results for increased solitary drug during use during COVID-19 (n = 428).

|                               | Crude Odds Ratio | p-value | 95% CI     | Adjusted Odds Ratio | p-value | 95% CI     |
|-------------------------------|------------------|---------|------------|---------------------|---------|------------|
| Single                        | 1.39             | 0.061   | 0.99, 1.97 | 1.99                | 0.001   | 1.33, 2.98 |
| Homelessness                  | 0.58             | 0.001   | 0.42, 0.80 | 0.1049              | <0.001  | 0.31, 0.65 |
| Sexual Minority               | 0.55             | 0.009   | 0.35, 0.86 | 0.53                | 0.027   | 0.31, 0.93 |
| Prescription Opioids          | 1.43             | 0.109   | 0.92, 2.21 | 1.19                | 0.515   | 0.70, 2.03 |
| Other Stimulants              | 1.97             | 0.153   | 0.78, 4.99 | 2.06                | 0.108   | 0.85, 4.98 |
| Change in Drug Use During COVID-19 |               |         |            |                     |         |            |
| Decreased Use                 | REF              |         |            |                     |         |            |
| Maintained Use                | 0.83             | 0.465   | 0.51, 1.36 | 0.96                | 0.873   | 0.56, 1.65 |
| Increased Use                 | 2.51             | <0.001  | 1.67, 3.77 | 2.74                | <0.001  | 1.72, 4.37 |
| Used More in Private Locations| 2.28             | <0.001  | 1.57, 3.30 | 1.91                | <0.001  | 1.34, 2.72 |
| Social Distancing Score       | 1.33             | <0.001  | 1.14, 1.57 | 1.31                | 0.001   | 1.11, 1.54 |

Declarations of Interests

The authors have no potential conflicts of interest to report.

References

Ahmad, F. B., Cieievski, J. A., Rosson, L. M., & Sutton, P. (2022). Provisional drug overdose death counts. National Center for Health Statistics.

Ali, F., Russell, C., Nafeh, F., Rehm, J., LeBlanc, S., & Elton-Marshall, T. (2021). Changes in substance use and supply characteristics among people who use drugs (PWUD) during the COVID-19 global pandemic: A national qualitative assessment in Canada. International Journal of Drug Policy, 93, Article 102327.

Australian Institute of Health and Welfare. (2022). Alcohol, tobacco & other drugs in Australia. Retrieved from https://www.aihw.gov.au/reports/alcohol/alcohol-tobacco-other-drugs-australia

Bartholomew, T. S., Nakamura, N., Metsch, L. R., & Tookes, H. E. (2020). Syringe services program (SSP) operational changes during the COVID-19 global outbreak. The International Journal of Drug Policy, 83, Article 102821.

Centers for Disease Control and Prevention. National Center for Injury Prevention and Control, (2021). Suspected nonfatal drug overdoses during COVID-19. https://www.cdc.gov/drugoverdose/nonfatal/states/covid-19.html. (Accessed March 30, 2022).

Ciccarone, D. (2017). Fentanyl in the US heroin supply: A rapidly changing risk environment. International Journal of Drug Policy, 46, 107–111. 10.1016/j.drugpo.2017.06.010.

Czeisler, M. É., Lane, R. I., Petrosky, E., Wiley, J. F., Christenssen, A., Njai, R., et al., (2020). Mental health, substance use, and suicidal ideation during the COVID-19 pandemic—United States, June 24–30, 2020. Morbidity and Mortality Weekly Report, 69(32), 1049.

Czeisler, M. É., Marynak, K., Clarke, K. E., Salah, Z., Shakyi, I., Thierry, J. M., et al., (2020). Delay or avoidance of medical care because of COVID-19-related concerns—United States, June 2020. Morbidity and Mortality Weekly Report, 69(36), 1250.

Dovey, K., Fitzgerald, J., & Choi, Y. (2001). Safety becomes danger: Dilemmas of drug use in public space. Health & Place, 7(4), 319–331.

European Monitoring Centre for Drugs and Drug Addiction. (2016). Drug consumption rooms: An overview of provision and evidence, perspectives on drugs. European Monitoring Centre for Drugs and Drug Addiction.

European Monitoring Centre for Drugs and Drug Addiction. (2021). European drug report 2021. Luxembourg: Trends and Publications, Publications Office of the European Union.

European Monitoring Centre for Drugs and Drug Addiction. (2022). European drug report 2022. Luxembourg: Trends and Publications, Publications Office of the European Union.

Frost, M. C., Sweek, E. W., Austin, E. J., Corcorran, M. A., Juarez, A. M., Frank, N. D., et al., (2022). Program adaptations to provide harm reduction services during the COVID-19 pandemic: A qualitative study of syringe services programs in the US. AIDS and Behavior, 26(1), 57–68.

Glick, S. N., Prohaska, S. M., LaKosky, P. A., Juarez, A. M., Corcorran, M. A., & Des Laurel, D. C. (2020). The impact of COVID-19 on syringe services programs in the United States. AIDS and Behavior, 24(9), 2466–2468.

Grebel, J., Jerda, M., & Rhodes, T. (2020). COVID-19 and the health of people who use drugs: What is and what could be? International Journal of Drug Policy, 83, Article 102958.

Han, Y., Yan, W., Zheng, Y., Khan, M. Z., Yuan, K., & Lu, L. (2019). The rising crisis of illicit fentanyl use, overdose, and potential therapeutic strategies. Translational Psychiatry, 9(1), 1–9.

Holland, K. M., Jones, C., Vivolo-Kantor, A. M., Idhakkad, N., Zwald, M., Hoots, B., et al., (2021). Trends in US emergency department visits for mental health, overdose, and violence outcomes before and during the COVID-19 pandemic. Jama Psychiatry, 78(4), 372–379.

Imtiaz, S., Nafeh, F., Russell, C., Ali, F., Elton-Marshall, T., & Rehm, J. (2021). The impact of the novel coronavirus disease (COVID-19) pandemic on drug overdose related deaths in the United States and Canada: A systematic review of observational studies and analysis of public health surveillance data. Substance Abuse Treatment, Prevention, and Policy, 16(1), 1–14.
Ingram, D. D., & Franco, S. J. (2013). NCHS urban-rural classification scheme for counties. National Center for Health Statistics. Vital Health Stat, 2(166).

Marshall, B. D., Milloy, M. J., Wood, E., Montaner, J. S., & Kerr, T. (2011). Reduction in overdose mortality after the opening of North America’s first medically supervised safer injecting facility: A retrospective population-based study. Lancet (London, England), 377(9775), 1429-1437.

Mattson, C. L., O’Donnell, J., Kariisa, M., Seth, P., Scholl, L., & Gladden, R. M. (2018). Opportunities to prevent overdose deaths involving prescription and illicit opioids, 11 states, July 2016–June 2017. Morbidity and Mortality Weekly Report, 67(34), 945.

Medically Supervised Injection Centre Evaluation Committee. (2003). Final report of the evaluation of the Sydney medically supervised injection centre. Sydney, Australia: MSC Evaluation Committee.

Ochalek, T. A., Cumpton, K. L., Wills, B. K., Gal, T. S., & Moeller, F. G. (2020). Nonfatal opioid overdoses at an urban emergency department during the COVID-19 pandemic. JAMA, 324(16), 1673-1674.

O’Donoghue, A. L., Biwas, N., Dechen, T., Anderson, T. S., Talmor, N., Punnamaraju, A., et al., (2021). Trends in filled naloxone prescriptions before and during the COVID-19 pandemic in the United States. JAMA Health Forum, 2(5), e210393. 10.1001/jamahealthforum.2021.0393.

Otter, D. (2016). Safe consumption facilities: Evidence and models. Seattle, WA: King County Heroin and Opiate Addiction Task Force.

Papamihali, K., Yoon, M., Graham, B., Karamouzian, M., Slaunwhite, A. K., Tsang, V., et al., (2020). Convenience and comfort: Reasons reported for using drugs alone among clients of harm reduction sites in British Columbia, Canada. Harm Reduction Journal, 17(1), 1-11.

Park, J. N., Sherman, S. G., Rouhani, S., Morales, K. B., McKenzie, M., Allen, S. T., et al., (2019). Willingness to use safe consumption spaces among opioid users at high risk of fentanyl overdose in Baltimore, Providence, and Boston. Journal of Urban Health, 96(3), 353-366.

Pauly, B., Wallace, B., Pagan, F., Phillips, J., Wilson, M., Hobbs, H., et al., (2020). Impact of overdose prevention sites during a public health emergency in Victoria, Canada. PloS One, 15(5), Article e0229208.

Perri, M., Kumasinski, N., Bonn, M., Kolla, G., Guta, A., Bayoumi, A. M., et al., (2021). A qualitative study on overdose response in the era of COVID-19 and beyond: How to spot someone so they never have to use alone. Harm Reduction Journal, 18(1), 1-9.

Project SAFE, (2020). Survival strategies while using drugs alone from people who use drugs. https://www.vitalstrategies.org/wp-content/uploads/PWUD-ServiceProvider-Guide-07142021.pdf

Saloner, B., Krawczyk, N., Solomon, K., Allen, S. T., Morris, M., Haney, K., et al., (2022). Experiences with substance use disorder treatment during the COVID-19 pandemic: Findings from a multisite survey. International Journal of Drug Policy, 101, Article 103537.

Special Advisory Committee on the Epidemic of Opioid Overdoses. (2022). Opioid- and stimulant-related harms in Canada. Ottawa: Public health agency of Canada; https://health-infobase.canada.ca/substance-related-harms/opioids-stimulants/

Wallace, B., Pagan, F., & Pauly, B. B. (2019). The implementation of overdose prevention sites as a novel and nimble response during an illegal drug overdose public health emergency. International Journal of Drug Policy, 66, 64-72.

Wojcicki, J. M. (2019). Dying alone: The sad irrelevance of naloxone in the context of solitary opiate use. Addiction, 114(3), 574-575.

Wood, E., Tyndall, M. W., Montaner, J. S., & Kerr, T. (2006). Summary of findings from the evaluation of a pilot medically supervised safer injecting facility. CMAJ: Canadian Medical Association Journal = Journal de l'Association Medecale Canadienne, 175(11), 1399-1404.