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The Effects of Loneliness and Psychological Flexibility on Veterans' Substance Use and
Physical and Mental Health Functioning During the COVID-19 Pandemic

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The Effects of Loneliness and Psychological Flexibility on Veterans' Substance Use and
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Abstract

During the COVID-19 pandemic, social isolation was a common experience as people were trying to keep themselves and others safe from infection. Veterans with problematic substance use are at particular risk of the consequences of social isolation. This study evaluated the nature of social interactions during the COVID-19 pandemic and the effects of loneliness and psychological flexibility on self-reported substance use and physical and mental health functioning among U.S. veterans who reported problematic substance use. Data from 409 veterans with self-reported substance use concerns were obtained via a cross-sectional online survey. Results showed that many veterans who engaged in problematic substance use during the COVID-19 pandemic reported a number of social supports during this period and frequent communication with others, but still felt lonelier during the pandemic. In regression analyses, higher levels of loneliness were associated with more negative impacts of the pandemic, greater substance use, and poorer physical and mental health functioning. Psychological flexibility demonstrated significant unique variance in explaining mental health functioning during the pandemic after accounting for loneliness, but not for substance use or physical functioning. For veterans with high levels of loneliness, high levels of psychological flexibility were associated with a lower negative impact on quality of life due to the pandemic, but for veterans with low levels of loneliness, differing levels of psychological flexibility were not significantly associated with the negative impact of COVID-19. Overall, loneliness and psychological flexibility appear to be highly associated with the negative impact of COVID-19 on veterans with problematic substance use.

Keywords: veterans, COVID-19, pandemic, mental health, substance use

Introduction

During the COVID-19 pandemic, there were unprecedented levels of social isolation as people grappled with how to keep themselves and others safe from infection. Social isolation is defined as an “objective lack of interactions with others or the wider community” and loneliness is defined as “the subjective feeling of the absence of a companion or social network” (Leigh-Hunt et al., 2017, p.158). As a result of social distancing and quarantines during the COVID-19 pandemic, people found themselves experiencing high levels of loneliness and social isolation, which are associated with negative mental and physical health outcomes (Hwang, Rabheru, Peisah, Reichman, & Ikeda, 2020).

Social relationships buffer people from stress, and improve their mental health (Cohen, Gottlieb, & Underwood, 2001; DeBeer, Kimbrel, Meyer, Gulliver, & Morissette, 2014; Holt-Lunstad, Smith, Baker, Harris, & Stephenson, 2015; Holt-Lunstad, Smith, & Layton, 2010). In addition, being part of a social network provides individuals meaningful roles that promote self-esteem and purpose in life (Cohen, 2004; Thoits, 1983). At the same time, a lack of social relationships is associated with substantially increased mortality risk (Holt-Lunstad et al., 2015). For example, socially isolated men have a 90% increased risk of cardiovascular death and over double the mortality risk of death from accidents and suicide (Kawachi et al., 1996). Regular contact with friends, family, and neighbors increases survival odds comparable in magnitude to quitting smoking and by about twice the magnitude of exercising regularly or being at a healthy weight (Holt-Lunstad et al., 2010). Large and diverse social networks also protect against depression (Litwin, 2011; Santini, Koyanagi, Tyrovolas, & Haro, 2015; Santini, Koyanagi, Tyrovolas, Mason, & Haro, 2015). Even short periods of social isolation (e.g., less than 10 days) have adverse long-term effects on psychiatric symptoms (Brooks et al., 2020).

People who experience increased loneliness may be more likely to engage in problematic and harmful substance use as a way to cope, including smoking and alcohol and drug use (Ingram et al., 2020; Polenick, Cotton, Bryson, & Birditt, 2019; Segrin, McNelis, & Pavlich, 2018). Since they perceive that they have less social contact, they may also continue to use harmful substances if they are not exposed to healthy behavior and health advice. In prior epidemics, quarantines were associated with increased alcohol and substance misuse (Wu et al., 2008). Similarly, a study of 1,008 U.S. young adults (ages 18-35) found that during the COVID-19 pandemic, 30% reported harmful levels of drinking, 38% reported severe drug use, and about 50% of the sample reported high levels of loneliness, which was associated with higher levels of mental health symptoms (Horigan, Schmidt, & Feaster, 2021).

Of particular concern is the effect of loneliness on the substance use of U.S. veterans. Substance use is one of the most common health conditions facing veterans (Hawkins et al., 2012; SAMSHA, 2007), with higher rates of substance use disorders (SUDs) among U.S. veterans than in civilian populations. For instance, rates of alcohol use disorder among Operation Enduring Freedom/Operational Iraqi Freedom (OEF/OIF) veterans (10.5% for men and 4.5% for women; Seal et al., 2011) are higher than in civilians, which ranges between 3.1% to 8.5% (Kessler et al., 2005). Among OEF/OIF veterans, prevalence rates are higher for drug use disorders (4.8% for men and 2.4% for women; Seal et al., 2011), which is higher than civilian estimates of 3.9% (Grant et al., 2016). While a study using the sample from the present study showed a significant increase in substance use among U.S. veterans during the COVID-19 pandemic (Reilly et al., 2021), it is not clear how the COVID-19 pandemic and its subsequent social restrictions affected social interactions, and how social isolation and loneliness impacted changes in substance use and life functioning.

In addition to loneliness, psychological flexibility can affect well-being. Psychological flexibility is an important target for positive well-being (Dawson & Golijani-Moghaddam, 2020; Steenhaut, Rossi, Demeyer, & de Raedt, 2018) and life satisfaction (Lucas & Moore, 2020). It is defined as a person's ability to connect with the present moment, be willing to experience thoughts, feelings, and bodily sensations as they occur and without defense, and to persist or change a behavior so that it is aligned with deeply held values (Chin & Hayes, 2017; Hayes et al., 2012). Psychological flexibility is negatively associated with distress and positively associated with well-being outcomes during the COVID-19 pandemic (Dawson & Golijani-Moghaddam, 2020; Gloster et al., 2020). A recent study showed that higher levels of social isolation during the COVID-19 pandemic were related to poorer mental health outcomes, and that psychological inflexibility moderated this relationship (Smith, Twohy, & Smith, 2020). Results from this study showed that people with lower levels of psychological inflexibility showed a protective effect against anxiety and depression in relation to experiencing social isolation. These studies demonstrate that psychological flexibility is an important factor to consider in understanding the impact of COVID-19 on mental and physical health outcomes, particularly as it relates to the experience of social isolation.

No studies to date have evaluated the relationships between loneliness, psychological flexibility and the impact of COVID-19 on U.S. veterans who engage in problematic substance use, which is a population at particular risk for adverse health impacts. The aim of the present study is to evaluate levels of loneliness and the nature of social interactions during the COVID-19 pandemic among U.S. veterans who reported problematic substance use behaviors or concerns. This study also evaluated the associations between loneliness, psychological flexibility, self-reported substance use, physical functioning, and mental health functioning of

these veterans during the pandemic. This work can shed light on how to prevent and intervene to improve the health and life functioning of U.S. Veterans engaging in problematic substance use for the purpose of identifying underlying constructs that could be targeted in treatment to prevent and reduce problematic substance use. We hypothesized that both psychological flexibility and loneliness would be positively associated with urges and frequency of use of substances, as well as the negative impact of COVID-19, physical functioning, and mental health functioning.

Methods

2.1 Participants

U.S. adult veterans reporting substance use were recruited to participate in this study. A screening survey was used to determine eligibility for participation in the larger survey battery. Screening items included age (minimum age of 18 years old required), the CAGE Adapted to Include Drugs (CAGE-AID; minimum score of 1 required; Brown & Rounds, 1995; see below for more information), and items to assess U.S. veteran status [e.g., employment/veteran status and date of received DD214 (the Certificate of Release or Discharge form)]. All surveys were further reviewed using quality-review criteria informed by online quality review procedures recommended by Heffner et al. (2021). Surveys were deemed ineligible for inclusion in the final analysis when three of the following four criteria were not met: 1) self-reported veteran status could not be validated when reviewed in conjunction with age, reported military service era, and/or DD214 date; 2) open-ended items contained nonsensical responses; 3) total time spent on survey was under 1/3 of median completion time (< 10 minutes); and 4) response patterns flagged by the Qualtrics system as potential bots were reviewed and found to be suspicious by research staff (e.g., answering all survey items as the last Likert scale option). Qualtrics also utilizes various safeguards to prevent multiple attempts to complete the survey by the same

respondent (i.e., IP-based 'Prevent Ballot Box Stuffing' option). Twenty-seven (6.2%) out of 436 surveys were deemed ineligible, leaving a total of 409 participants.

2.2 Procedure

This study utilized cross-sectional nationally representative veteran data, administered using the Qualtrics federal platform. Veterans were identified via a purchased Qualtrics panel between November 24, 2020 and February 2, 2021. Potential panel participants were provided with a link to a description of the study and a screening survey on the Qualtrics platform. Information about the survey and informed consent was provided prior to access of the survey; access to the survey could only occur if the participant checked off the box "I agree to participate in this study." The survey was estimated to take approximately 30 minutes to complete. Procedures and methods for collecting this cross-sectional data were completed in accordance with a protocol approved by the hospital Institutional Review Board.

2.3 Measures

Demographic characteristics. Several survey items were administered to elucidate information on demographic characteristics, including age, gender identity, sexual orientation, race, and ethnicity.

Psychiatric diagnoses. Psychiatric diagnoses were self-reported by participants and included substance use disorders, major depressive disorder, post-traumatic stress disorder (PTSD), anxiety disorder, panic disorder, psychogenic non-epileptic seizures (PNES), schizophrenia, and bipolar disorder.

Measures of social engagement during COVID-19. Several survey items assessed social engagement during COVID-19. Items assessed current relationship status, cohabitation

status and household occupants, sources of social support, frequency of communication with others, and methods of staying in touch during the pandemic.

Loneliness during COVID-19. The UCLA Loneliness Scale-8 (ULS-8; Hays & DiMatteo, 1987) was used to assess self-reported loneliness. The scale instructions were slightly modified to specifically assess pandemic-related loneliness and read, “Indicate how often you have felt the following ways during your COVID-19 experience.” The full 8-item ULS-8 scale was utilized; sample items include “There is no one I can turn to” and “I lack companionship”. Item responses are on a Likert scale ranging from 1 (Never) to 4 (Often). Items were summed to create a total score and higher scores indicate greater levels of loneliness. A single researcher-created question assessed perceived change in loneliness as a result of the pandemic: “Have you felt more lonely during COVID-19, compared to your experience prior to the pandemic?” The internal validity for the current study was satisfactory (Cronbach’s $\alpha = .76$, 95% CI = .72-.79).

Psychological Flexibility. The PsyFlex (Gloster et al., in press) measured overall psychological flexibility with questions asking about the use of acceptance, mindfulness, and values-oriented living in daily living. The PsyFlex aims to measure six domains of the Acceptance and Commitment Therapy Hexaflex purported to capture psychological flexibility (present moment-centeredness, acceptance, cognitive defusion, self-as-context, values, and committed action). Items are rated on a Likert scale from 1 (Very Seldom) to 5 (Very Often) and summed. Higher scores represent higher psychological flexibility. According to Constantinou, Gloster & Karekla (2021) the PsyFlex supported a one factor solution across 4 clinical and non-clinical samples and demonstrated good psychometric properties (reliability: Raykov estimation range .78-.97; convergent, divergent, and incremental validity; Cronbach’s $\alpha = .81$.; Gloster

et al., under review). In the present study, the internal validity was satisfactory (Cronbach's $\alpha = .86$, 95% CI = .84-.88).

Negative impact of COVID-19 on quality of life. A subscale score was created using a modified version of the Pain Management Collaboratory Coronavirus Pandemic (COVID-19) 5-Item Measure (PMC-5), which measured the potential negative impact of COVID-19 on quality of life (Coleman et al., 2021). Items were reported on a Likert scale of 1 (Improved) to 4 (A Lot Worse) and an average score was calculated. The five areas measured by the PMC-5 included finances, emotional health, ability to meet basic needs, and two additional items on physical health and concentration. The internal validity for the current study was satisfactory (Cronbach's $\alpha = 0.82$, 95% CI = .79-.84).

Substance use. Substance use and problematic drinking were assessed in the screening survey and within the main survey. The problematic impact of participants' use of alcohol and other drugs was assessed using the CAGE-AID (Brown & Rounds, 1995), a validated 4-item measure. Per the CAGE-AID protocol, the questionnaire was only given to participants who reported current alcohol or drug use. Participants answered each item with Yes (1) or No (0). A minimum score of 1 or "Yes" on one item of the CAGE-AID was used as a screener to participate in the survey, as recommended by the Consensus Panel to cast a wider net and identify more veterans with substance use or addiction issues (Sullivan & Fleming, 2008). The four items of the CAGE-AID were summed to create a total score.

A modified version of the Alcohol, Smoking, and Substance Involvement Screening Test (ASSIST; Humeniuk et al., 2010) was used to measure substance use frequency, urges, and changes in use during the pandemic. It can identify a range of problems associated with the following addictions: alcohol, tobacco, cannabis, cocaine, amphetamine, inhalants, sedatives,

hallucinogens, and opioids. Each substance had a corresponding module containing five questions. The first question in each module was not modified from the original version and asked about lifetime use of the substance (e.g., “have you ever used tobacco products (cigarettes, chewing tobacco, cigars, etc.?).”). Those who responded “Yes” to lifetime use of the substance were instructed to complete follow-up questions. If they responded “No” to lifetime use of the substance, they were not instructed to complete follow-up questions and moved to the next substance. Examples of modified follow-up questions included, “Since the beginning of the COVID-19 pandemic, how often have you used tobacco products,” “How many cigarettes per day do you smoke,” “Since the beginning of COVID-19, how as your desire or urge to use tobacco products changed?,” and “How has your frequency of tobacco use changed during COVID-19?”

Psychosocial functioning. The Short-Form Health Survey-12 (SF-12; Ware et al., 1996) is a 12-item measure that assesses mental health functioning (6 items) and physical functioning (6 items). The SF-12 has been validated for predicting populations’ mental and physical health without targeting specific health outcomes and has high reliability, including with U.S. veterans (Salyers et al., 2000). Scoring involves using a norm-based algorithm that produces a self-reported mental health composite score (MCS) and physical health composite score (PCS) between 0 and 100 (Jones et al., 2001), with lower scores associated with lower functioning. Test-retest reliability is .80 for the PCS and .76 for the MCS (Ware et al., 1996). In the current study, the internal consistency for the PCS (Cronbach’s $\alpha = .77$, 95% CI = .73-.80) and MCS (Cronbach’s $\alpha = .78$, 95% CI = .75-.81) were satisfactory.

2.4 Statistical analysis

Means, standard deviations, and frequencies were calculated for the full sample (N=409). There were no missing data since responses were required for all items in order to submit the survey. Zero-order correlations were conducted among all measures of interest to assess for initial relationships among model variables. Spearman correlations were conducted between desire to use and frequency of substance use and loneliness and psychological flexibility. Four hierarchical regression analyses were conducted to evaluate associations between loneliness and psychological flexibility and the negative impact of COVID-19 on quality of life, substance use, and physical and mental health functioning during the COVID-19 pandemic. In the first step, demographic variables were entered that showed significant zero-order correlations with the dependent variables (i.e., age, gender identity). In the second step, loneliness (ULS-8) scores were entered. In the third step, psychological flexibility was entered. In the fourth step, the interaction between loneliness and psychological flexibility was entered. All variables were retained in the models at each of the steps. Simple slopes analyses were conducted to examine the interactions between psychological flexibility and loneliness as they related to negative pandemic impacts. There was no evidence for violations of the assumptions of regression analysis. Multicollinearity among predictor variables was low, with no zero-order correlations greater than .50. Continuous outcome variables had an approximate normal distribution with no significant outliers. Analyses were conducted with SPSS v.27.

1. Results

The mean age of the sample was 54.9 years and the majority of the sample identified as male (76.5%; see Table 1). Most respondents identified as White (90.5%), not Hispanic/Latino (91.9%), and heterosexual (91.4%). Respondents also reported a range of substance use and

substance use disorders, with tobacco use disorders, cannabis use disorder, and sedative use disorder being the most prevalent.

Most of the respondents were married (66.7%) and living with a spouse or partner (70.4%; see Table 2). Approximately one-third of the sample were living with their children or their partner's children (35.0%). Only 16.9% of the sample indicated that they lived alone during the pandemic. Major sources of social support during the pandemic included a spouse or partner (65.0%), friends (43.8%), and children or a partner's children (35.5%). During the pandemic, most people were in communication with others either daily or several times a week, but approximately one-quarter of the sample (24.5%) reported only being in contact with someone either once per week, 1-2 times per month, or rarely/never. Most people kept in touch with others by speaking on the phone, text messages, video calls, email, and social media. Only 23.5% reported staying in touch by speaking in person. Almost half (46.7%) of respondents indicated that they felt lonelier during COVID-19 compared to the time prior to the pandemic.

Pearson correlations were calculated between the study measures of loneliness (ULS-8), psychological flexibility (PsyFlex), the impact of COVID-19 (PMC-5), substance use (CAGE-AID), and physical and mental health functioning (SF-12) (see Table 3 for means and standard deviations of study measures and Table 4 for Pearson correlations of these measures). There were significant positive relationships between loneliness and the negative impact of COVID-19 and substance use, such that the lonelier someone reported feeling, the more negative impacts and substance use they had as a result of COVID-19. Significant negative relationships between loneliness and psychological flexibility, physical functioning, and mental health functioning were observed such that higher levels of loneliness were associated with less psychological flexibility and poorer physical and mental health functioning. There were significant positive

relationships between psychological flexibility and physical and mental health functioning, showing that higher levels of psychological flexibility were associated with better physical and mental health functioning. Finally, there were significant negative relationships between psychological flexibility and both the negative impact of COVID-19 and substance use, such that lower levels of psychological flexibility were associated with more COVID-19-related negative impacts and more substance use.

Spearman correlations were conducted to examine the associations between loneliness and psychological flexibility and the change in desire or urge to use substances (i.e., alcohol, cannabis, opioids, and tobacco) and the change in frequency of these substances (see Table 5). Higher levels of loneliness were associated with an increase in desire or urge to use all substances. Loneliness was also associated with an increase in the frequency of alcohol use, opioid use, and tobacco use, but not cannabis use. There was a significant negative relationship between psychological flexibility and the change in desire or urge to use tobacco, such that lower levels of psychological flexibility were associated with an increase in the desire to use tobacco. There was also a significant negative relationship in the change in frequency of alcohol use and tobacco use, such that lower levels of psychological flexibility were associated with increased frequency of alcohol and tobacco use. However, there were no significant associations between either a change in the desire or urge to use cannabis or opioids and a change in the frequency of cannabis or opioid use and psychological flexibility.

Hierarchical linear regression analyses were conducted to determine the effects of loneliness, psychological flexibility, and their interaction on the negative impact of COVID-19 on quality of life, substance use, and physical and mental health functioning. In the first regression, in step 1, both age and gender identity were significantly associated with the negative

impact of COVID-19 on quality of life, being younger and identifying as female were associated with greater negative pandemic-related impacts. In steps 2 and 3, loneliness and psychological flexibility were independently associated with the negative impact of COVID-19. Finally, in step 4, the interaction between loneliness and psychological flexibility was significant. Overall, individuals with low levels of loneliness experienced less pandemic-related impact than individuals with high levels of loneliness. Simple slopes analyses demonstrated variation in the impact of psychological flexibility on this relationship depending on levels of loneliness. For individuals with high levels of loneliness, high levels of psychological flexibility were associated with less of a negative impact on quality of life due to the pandemic (simple slope = -0.04 , $t = -2.47$, $p = 0.014$; see Figure 1). However, for individuals with low levels of loneliness, differing levels of psychological flexibility were not significantly associated with the negative impact of COVID-19 on quality of life (simple slope = 0.00 , $t = 0.08$, $p = 0.934$).

For the two regression analyses with substance use and physical functioning as outcome variables, the pattern of findings was similar with the exception of the first step. The first step of the regression showed that age was significantly associated with substance use (with older individuals reporting less substance use), but not gender identity. In the regression for physical functioning, neither age nor gender identity was associated with physical functioning. In step 2, loneliness was significantly associated with both substance use and physical functioning. In step 3, loneliness continued to be significantly associated with both substance use and physical functioning, whereas psychological flexibility was not. Finally, in step 4, the interaction between loneliness and psychological flexibility was not significant for both substance use and physical functioning.

For the regression analysis with mental health functioning as the outcome variable, the first step of the regression showed that both age and gender identity were significantly associated with mental health functioning. Being younger and identifying as female were associated with poorer mental health functioning. In step 2, loneliness was significantly associated with mental health functioning. In step 3, both loneliness and psychological flexibility were independently associated with mental health functioning. However, in step 4, the interaction between loneliness and psychological flexibility was not significant.

4.0 Discussion

Much of the emerging COVID-19 literature has discussed both high rates of loneliness and substance use. Our study empirically investigated and expanded upon these issues, by investigating the unique relationships between loneliness, negative pandemic impacts, substance use, and functioning. Using a national survey, we discovered that many veterans who engaged in problematic substance use during the COVID-19 pandemic reported a number of social supports during this period, as well as having frequent contact with others. However, a high percentage of these veterans still reported feeling lonelier during the pandemic than before the pandemic. Not surprisingly, feeling lonelier during the pandemic was associated with more negative pandemic-related impacts on quality of life, substance use, and poorer physical and mental health functioning.

There was a consistent pattern of greater substance use cravings being associated with higher levels of loneliness, as well as an increased frequency of reported alcohol, opioid, and tobacco use. However, although respondents reported having more urges to use cannabis during the pandemic if they were lonelier, there was not an actual increase in cannabis use as a result of higher levels of loneliness. These results are consistent with findings from a study of adult

Belgian residents during COVID-19 that showed that although participants reported more alcohol and tobacco use during the pandemic compared to prior to the pandemic, there was no change in cannabis use (Vanderbruggen et al., 2020). The study by Vanderbruggen and colleagues (2020) also indicated that a top motive for cannabis use was boredom (53.9%), and loneliness was reported as a less frequent motive (32.9%). Therefore, there may not be as much of a need to use cannabis to cope with loneliness and social isolation. This finding may also reflect reduced availability of cannabis during periods of lock-down (Vanderbruggen et al., 2020).

In contrast to the correlations for loneliness, psychological flexibility did not have strong significant relationships with urges to use substances or frequency of use during the COVID-19 pandemic, with the exception of tobacco use. There were more people in the present study who endorsed having a tobacco use disorder than any other substance use disorder, which could have led to a higher likelihood of detecting a significant relationship between tobacco use and psychological flexibility than the other substances. Research has demonstrated that people with higher levels of psychological flexibility are more likely to quit smoking than people with lower levels of psychological flexibility (Roales-Nieto et al., 2016). Other research has shown that lower levels of psychological flexibility are associated with increases in substance use craving (Mallik, Kaplan, Somohano, Bergman, & Bowen, 2021), although we did not find that in the current study. More research is necessary to understand the relationship between psychological flexibility and substance use, and how psychological flexibility may play a role in the relationship between specific types of substance use, particularly during a stressful time, like the COVID-19 pandemic. This may be important information to consider when designing interventions that target substance use.

Overall, loneliness was a key variable in all regression analyses, with higher levels of loneliness being associated with more negative impacts of the pandemic on quality of life, greater substance use, and poorer physical and mental health functioning. These findings are consistent with other research showing that during the pandemic, loneliness was associated with poorer mental health (Creese et al., 2021; Groarke et al., 2020, Killgore, Cloonan, Taylor, Lucas, & Dailey, 2020), poorer physical health (Groarke et al., 2020), and increased substance use (Horigian, Schmidt, & Feaster, 2021; Vanderbruggen et al., 2020). Increased loneliness during the pandemic has also been shown to be associated with increased rates of suicidal ideation (Killgore, Cloonan, Taylor, Lucas, & Dailey, 2020). Given higher rates of suicide among veterans than civilians (U.S. Department of Veterans Affairs, 2020), this is a particularly concerning relationship that warrants further investigation and attention as the COVID-19 pandemic continues to be a factor for many across the nation.

In regression analyses, psychological flexibility did not demonstrate significant unique variance for substance use or physical functioning after accounting for loneliness. This result is consistent with the results of the correlations that show that psychological flexibility did not have significant relationships with the desire to use substances or increased substance use. In addition, psychological flexibility may have less of a direct impact on physical functioning over a shorter period of time, like a period of a pandemic. However, both loneliness and psychological flexibility showed unique variance in relation to mental health functioning during COVID-19, but not their interaction. This demonstrates that both of these variables are independently associated with mental health functioning, with higher levels of loneliness and lower levels of psychological flexibility being associated with poorer mental health functioning. The results suggest that psychological flexibility-based interventions that focus on increasing psychological

flexibility, such as Acceptance and Commitment Therapy, may also improve mental health functioning, but they would not necessarily be helpful for targeting the severity of substance use or physical functioning among veterans with problematic substance use. There is a robust literature on psychological flexibility being a key factor in overall mental health functioning (Dawson & Golijani-Moghaddam, 2020), which the results from the present study support.

Taken together, these findings also indicate that interventions that directly target loneliness may be particularly important for helping people with problematic substance use during a pandemic in relation to their substance use and both their physical and mental health functioning.

Interventions that target loneliness may include increasing social contacts in a safe manner (e.g., social bubbles, Leng et al., 2021) and peer support groups (Cheng et al., 2020; Drebing et al., 2018).

Among veterans with problematic substance use, the interaction between loneliness and psychological flexibility was also important to understanding the relationship between these variables and the negative impact of COVID-19 on quality of life. For veterans with problematic substance use who report lower levels of loneliness, psychological flexibility does not appear to be related to the negative impact of COVID-19 on quality of life, likely because overall, there appeared to be much fewer negative impacts on quality of life with lower levels of loneliness. However, for individuals with higher levels of loneliness, psychological flexibility can possibly serve as a protective factor, resulting in fewer negative impacts of COVID-19 on quality of life for those with higher levels of psychological flexibility compared to individuals with lower levels of psychological flexibility. This latter finding builds upon recent work demonstrating the moderating effect of psychological inflexibility on anxiety and depression related to social isolation during the pandemic (Smith, Twohy, & Smith, 2020), suggesting that psychological

flexibility may mitigate the impact of pandemic-related social isolation and loneliness on adverse outcomes. More longitudinal research is necessary on the relationships between psychological flexibility and loneliness in U.S. veterans with problematic substance use. If these relationships are determined to be causal in nature, developing and disseminating psychological flexibility-focused interventions to people with substance use disorders and who are experiencing significant social isolation and are reporting high levels of loneliness could mitigate the negative impact of the pandemic on quality of life. Interventions that target both loneliness and psychological flexibility may be particularly important for their purpose, such as Acceptance and Commitment Therapy approaches to improving social support (e.g., Kelly et al., 2020)

There were a few limitations to the present study. First, since our study was administered via a cross-sectional national survey, all measures were self-reported and therefore, clinical interviews and more objective measures were not obtained and causal relationships cannot be determined. We did not control for comorbid psychiatric diagnoses in the present study. Future research on this topic that delineates the effect of comorbid mental health disorders vs. problematic substance use with more rigorous assessments of mental health disorders is warranted. However, most surveys are limited to similar limitations and given that this survey was anonymous, social desirability and response biases are likely to be low. In addition, the racial and ethnic diversity of the sample was relatively low despite significant efforts to recruit minorities. Most respondents identified as White/Caucasian (90%), which does not reflect the national representation of U.S. veterans (73% White/Caucasian; U.S. Census Bureau, 2017). However, we had a higher percentage of female-identifying participants (23%) than the percentage of female veterans in the general population (10%; Department of Veterans Affairs). Finally, there may be a concern about the use of panel-recruited, web-based survey methodology

that could lead to fraudulent and biased responses. However, standardized quality control reviews and data inclusion screening procedures were used to reduce these concerns, including analysis of click-through behavior and scrubbing methods for web-based panel quality. As a result of these quality control efforts, there is a higher confidence in the quality of survey responses.

In summary, psychological flexibility alone does not appear to have a key role in understanding substance use itself during the COVID-19 pandemic for veterans with problematic substance use, whereas loneliness does have an important effect. However, loneliness and psychological flexibility together appear to be key factors in understanding the negative impact of COVID-19 on veterans with problematic substance use. Particularly for individuals with higher levels of loneliness, interventions that target psychological flexibility may be able to mitigate the negative effects of the pandemic on these veterans. In addition, interventions that target loneliness and psychological flexibility may help to improve these veterans' mental health functioning. More research is necessary to understand the ongoing and long-term impacts of the COVID-19 pandemic on veterans with problematic substance use in order to improve their health and well-being and mitigate pandemic-related sequelae.

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Table 1. *Sample demographics (n = 409).*

Variable	Mean (SD)
Age	54.85 (16.44)
Variable	Frequency (%)
Gender	
Male	313 (76.5%)
Female	94 (23%)
Transgender Male	1 (0.2%)
Preferred not to answer	1 (0.2%)
Race*	
White	370 (90.50%)
Black/African American	22 (5.40%)
Other	7 (1.70%)
Asian	5 (1.20%)
Native Hawaiian or Pacific Islander	5 (1.20%)
American Indian or Alaska Native	5 (1.20%)
Ethnicity	
Not Hispanic/Latino	376 (91.90%)
Hispanic/Latino	33 (8.10%)
Sexual Orientation	
Heterosexual (straight)	374 (91.40%)
Bisexual	19 (4.6%)
Homosexual (gay)	13 (3.2%)
Prefer not to say	3 (0.70%)
Daily or Mostly Daily Substance Use*	
Alcohol	182 (45.8%)

Tobacco	150 (44.9%)
Cannabis	60 (23.5%)
Sedatives	48 (29.8%)
Opioids	29 (26.6%)
Stimulants	16 (15.2%)
Cocaine	12 (12.6%)
Inhalants	6 (14.3%)
Hallucinogens	5 (6.8%)
Substance Use Disorder Diagnoses*	
Alcohol Use Disorder	113 (27.6%)
Other Substance Use Disorders	84 (20.5%)
Tobacco Use Disorder	62 (73.8%)
Cannabis Use Disorder	47 (55.9%)
Sedative Use Disorder	31 (36.9%)
Opioid Use Disorder	26 (31.0%)
Cocaine Use Disorder	22 (26.2%)
Amphetamine-type stimulant Use Disorder	20 (23.8%)
Inhalant Use Disorder	5 (6.0%)
Hallucinogen Use Disorder	2 (2.4%)
Psychiatric Diagnoses*	
Anxiety Disorder	149 (36.4%)
Post-Traumatic Stress Disorder	112 (27.4%)
Major Depressive Disorder	83 (20.3%)
Panic Disorder	48 (11.7%)
Bipolar Disorder	31 (7.6%)
Schizophrenia	9 (2.2%)
Psychogenic non-epileptic seizures (PNES)	7 (1.7%)

Note. *Participants could choose multiple categories.

Table 2. *Relationship status, sources of social support, and methods of communication during the COVID-19 pandemic.*

Variable	Frequency (%)
Relationship Status	
Married	273 (66.7%)
Divorced	47 (11.5%)
Single, never married	39 (9.5%)
In a relationship, not married	24 (5.9%)
Widowed	15 (3.7%)
Separated	11 (2.7%)
Cohabitation Status	
Parents or In-Laws	23 (5.6%)
Spouse or Partner	288 (70.4%)
Friends	11 (2.7%)
Children or Partner's Children	143 (35.0%)
Other Relatives/Family	13 (3.2%)
Others	5 (1.2%)
Living Alone	69 (16.9%)
Sources of Social Support	
Friends	179 (43.8%)
Parents or In-Laws	53 (13.0%)
Spouse or Partner	266 (65.0%)
Children or Partner's Children	145 (35.5%)

Other Relatives/Family	97 (23.7%)
Others	28 (6.8%)
No one	47 (11.5%)

Frequency of Communication with Others

Rarely or never	20 (4.9%)
1-2 times per month	22 (5.4%)
Once per week	58 (14.2%)
Several times per week	149 (36.4%)
Daily	160 (39.1%)

Methods of Staying in Touch

Speaking in Person	96 (23.5%)
Phone Calls	315 (77.0%)
Text Messages	236 (57.7%)
Video Calls	178 (43.5%)
Mail	36 (8.8%)
Email	157 (38.4%)
Social Media	172 (42.1%)

Feeling Lonelier During COVID-19

No	148 (36.2%)
Unsure	65 (15.2%)
Yes	191 (46.7%)

Table 3. *Means and standard deviations of study measures.*

	Mean	SD
ULS-8 Loneliness Scale	18.29	5.45
PsyFlex	38.75	8.57
PMC COVID-19 Measure	2.47	0.58
CAGE-AID	2.37	1.12
SF-12 Physical Composite	43.30	6.80
SF-12 Mental Health Composite	42.44	6.78

Table 4. *Pearson correlations between predictor, moderator, and outcome variables.*

	1	2	3	4	5	6
1. Loneliness	--					
2. Psychological Flexibility	-.29***	--				
3. Negative Impact of COVID-19	.48***	-.29***	--			
4. Substance Use	.28***	-.14**	.30**	--		
5. Physical Functioning	-.24***	.12*	-.24***	-.14**	--	
6. Mental Health Functioning	-.45***	.35***	-.32***	-.24***	-.19***	--

Note. * $p < .05$, ** $p < .01$, *** $p < .001$

Table 5. *Correlations of the changes in the desire to use substances and frequency of their use during the COVID-19 pandemic with loneliness and psychological flexibility.*

	Loneliness	Psychological Flexibility
Change in Desire or Urge to Drink Alcohol	.31**	-.09
Change in Desire or Urge to Use Cannabis	.19*	-.09
Change in Desire or Urge to Use Opioids	.28*	-.12
Change in Desire or Urge to Use Tobacco	.38**	-.20**
Change in Frequency of Alcohol Use	.30**	-.10*
Change in Frequency of Cannabis Use	.11	-.02
Change in Frequency of Opioid Use	.26*	.00
Change in Frequency of Tobacco Use	.34**	-.16*

Note. * $p < .05$, ** $p < .01$, *** $p < .001$

Table 6. *Summary of multiple regression analyses.*

	<i>B</i>	<i>SE</i>	95% CI for <i>B</i>	β	<i>t</i>	<i>p</i>	Change in R^2
Impact of COVID-19							
Step 1							
$R^2 = 0.13, F(2, 405) = 29.74, p < .001$							0.13
Constant	2.660	.138	2.389-2.932		19.289	.000	
Age	-.009	.002	-.013--.006	-.265	-5.547	.000	
Gender Identity	.256	.065	.128-.385	.187	3.930	.000	
Step 2							
$R^2 = 0.27, F(4, 403) = 50.51, p < .001$							0.12
Constant	1.830	.156	1.523-2.138		11.698	.000	
Age	-.006	.002	-.009--.003	.170	-3.797	.000	
Gender Identity	.147	.061	.028-.267	.108	2.419	.016	
Loneliness	.043	.005	.033-.052	.404	8.966	.000	
Step 3							

$R^2 = 0.29, F(3, 404) = 41.01, p < .001$ 0.02

Constant	2.218	.200	1.825-2.611		11.092	.000
Age	-.005	.002	-.008--.002	-.151	-3.375	.001
Gender Identity	.144	.060	.026-.263	.105	2.393	.017
Loneliness	.039	.005	.030-.049	.370	8.052	.000
Psychological Flexibility	-.009	.003	-.015--.003	-.136	-3.064	.002

Step 4

$R^2 = 0.30, F(5, 402) = 35.16, p < .001$ 0.01

Constant	1.354	.354	0.658-2.050		3.825	.000
Age	-.006	.002	-.009--.003	-.160	-3.598	.000
Gender Identity	.127	.060	.009-.245	.093	2.116	.035
Loneliness	.089	.018	.054-.123	.839	5.061	.000
Psychological Flexibility	.014	.008	-.002-.031	.210	1.671	.095
Loneliness x Psychological Flexibility	-.001	.000	-.002-.000	-.509	-2.941	.003

CAGE-AID

$R^2 = 0.11, F(2, 405) = 25.14, p < .001$ 0.11

Constant	3.813	.272	3.279-4.347		14.035	.000
Age	-.023	.003	-.030--.017	-.340	-7.066	.000
Gender Identity	-.135	.129	-.387-.118	-.051	-1.049	.295
Step 2						
$R^2 = 0.16, F(3, 404) = 26.96, p < .001$						0.05
Constant	2.894	.329	2.248-3.540		8.810	.000
Age	-.020	.003	-.026--.013	-.287	-5.941	.000
Gender Identity	-.256	.128	-.507--.004	-.096	-2.000	.046
Loneliness	.047	.010	.028-.067	.230	4.728	.000
Step 3						
$R^2 = 0.16, F(4, 403) = 20.28, p < .001$						0.00
Constant	3.022	.424	2.187-3.856		7.118	.000
Age	-.019	.003	-.026--.013	-.284	-5.812	.000
Gender Identity	-.257	.128	-.508--.005	-.096	-2.005	.046
Loneliness	.046	.010	.026-.067	.224	4.469	.000
Psychological Flexibility	-.003	.006	-.015-.009	-.023	-.475	.635

Step 4

$R^2 = 0.16$, $F(5, 402) = 16.28$, $p < .001$ 0.00

Constant	2.701	.760	1.208-4.195		3.556	.000
Age	-.020	.003	-.026--0.013	-.285	-5.828	.000
Gender Identity	-.263	.129	-.516--0.010	-.099	-2.044	.042
Loneliness	.065	.038	-.009-.139	.313	1.716	.087
Psychological Flexibility	.006	.018	-.030-.041	.043	.310	.757
Loneliness x Psychological Flexibility	.000	.001	-.002-.001	-.097	-.509	.611

Physical Functioning

$R^2 = 0.01$, $F(2, 405) = 2.93$, $p = .055$ 0.01

Constant	42.377	1.730	38.975-45.778		24.491	.000
Age	.038	.021	-.003-.079	.092	1.808	.071
Gender Identity	-.939	.818	-2.548-.670	-.058	-1.147	.252

Step 2

$R^2 = 0.06$, $F(3, 404) = 8.67$, $p < .001$ 0.05

Constant	47.913	2.098	43.788-52.037		22.835	.000
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Age	.016	.021	-.026-.057	.038	.754	.452
Gender Identity	-.211	.816	-1.816-1.394	-.013	-.259	.796
Loneliness	-.285	.064	-.411--.160	-.228	-4.458	.000

Step 3

 $R^2 = 0.06, F(4, 403) = 6.67, p < .001$

0.00

Constant	46.471	2.710	41.145-51.798		17.150	.000
Age	.013	.021	-.029-.055	.032	.630	.529
Gender Identity	-.200	.817	-1.806-1.406	-.012	-.245	.807
Loneliness	.272	.066	-.402--.142	-.218	-4.122	.000
Psychological Flexibility	.034	.040	-.046-.114	.043	.841	.401

Step 4

 $R^2 = 0.06, F(5, 402) = 5.37, p < .001$

0.00

Constant	48.342	4.849	38.809-57.876		9.969	.000
Age	.014	.021	-.028-.056	.034	.659	.510
Gender Identity	-.162	.822	-1.777-1.453	-.010	-.197	.844
Loneliness	-.380	.240	-.852-.093	-.304	-1.579	.115

Psychological Flexibility	-.016	.116	-.244-.211	-.021	-.142	.887
Loneliness x Psychological Flexibility	.003	.006	-.099-.015	.093	.465	.642

Mental Health Functioning

$R^2 = 0.09$, $F(2, 405) = 19.76$, $p < .001$

0.09

Constant	38.540	1.658	35.281-41.799		23.247	.000
Age	.107	.020	.067-.146	.259	5.312	.000
Gender Identity	-1.601	.784	-3.142--.059	-.100	-2.041	.042

Step 2

$R^2 = 0.23$, $F(3, 404) = 39.03$, $p < .001$

0.14

Constant	47.996	1.900	44.262-51.730		25.266	.000
Age	.069	.019	.032-.107	.168	3.621	.000
Gender Identity	-.358	.739	-1.811-1.095	-.022	-.484	.629
Loneliness	-.488	.058	-.601--.374	-.392	-8.412	.000

Step 3

$R^2 = 0.27$, $F(4, 403) = 36.79$, $p < .001$

0.00

Constant	40.672	2.387	35.980-45.364		17.042	.000
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Age	.057	.019	.020-.094	.137	3.013	.003
Gender Identity	-.300	.719	-1.714-1.114	-.019	-.417	.677
Loneliness	-.419	.058	-.534--.305	-.337	-7.217	.000
Psychological Flexibility	.173	.036	.103-.243	.219	4.852	.000

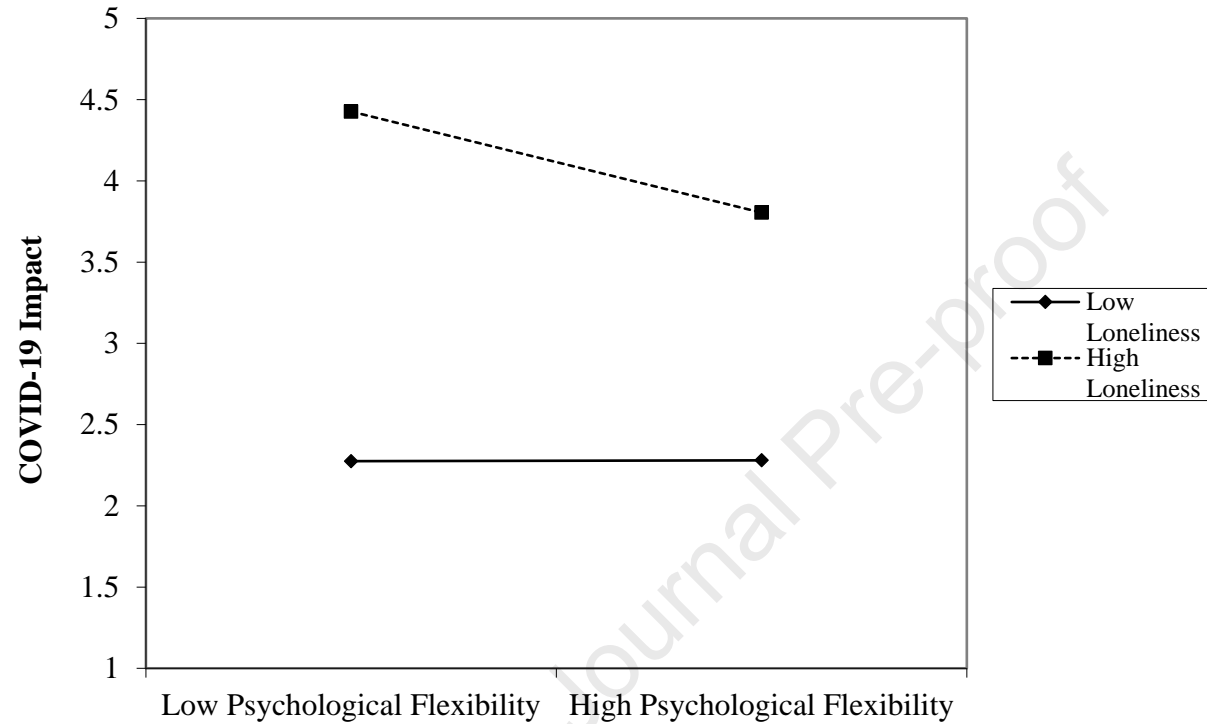
Step 4

$R^2 = 0.27, F(5, 402) = 29.82, p < .001$

0.00

Constant	45.291	4.263	36.910-53.672		10.624	.000
Age	.058	.019	.021-.095	.141	3.097	.002
Gender Identity	-.207	.722	-1.627-1.213	-.013	-.287	.774
Loneliness	-.685	.211	-1.101--.270	-.550	-3.241	.001
Psychological Flexibility	.049	.102	-.151-.248	.061	.477	.634
Loneliness x Psychological Flexibility	.007	.005	-.004-.018	.231	1.307	.192

Figure 1. *The interaction of loneliness and psychological flexibility as it relates to the negative impact of the COVID-19 pandemic.*



Note. Low Psychological Flexibility was one standard deviation below the mean. High Psychological Flexibility was one standard deviation above the mean. The figure was mean-centered for age, with $M_{age} = 54.89$. The reference group for gender identity was male.

Highlights

The Effects of Loneliness and Psychological Flexibility on Veterans' Substance Use and Physical and Mental Health Functioning During the COVID-19 Pandemic

- Many veterans who engaged in problematic substance use during the COVID-19 pandemic reported a number of social supports and frequent contact with others during the pandemic, but a high percentage of these veterans still reported feeling lonelier during the pandemic than before the pandemic.
- There was a consistent pattern of greater substance use cravings being associated with higher levels of loneliness, as well as an increased frequency of reported alcohol, opioid, and tobacco use.
- Loneliness and psychological flexibility together appear to be key factors in understanding the negative impact of COVID-19 on veterans with problematic substance use.

Conflict of Interest

The Effects of Loneliness and Psychological Flexibility on Veterans' Substance Use and Physical and Mental Health Functioning During the COVID-19 Pandemic

Given her previous role as an Editorial Board Member and a member of the ACBS Publications Committee, Megan Kelly had no involvement in the peer-review of this article and had no access to information regarding its peer-review. No other authors report conflicts of interest.

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