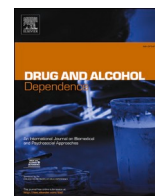




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Short communication

COVID-19 vaccine trust among clients in a sample of California residential substance use treatment programs

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ABSTRACT

Background: Individuals with a substance use disorder (SUD) are at a significantly higher risk for coronavirus disease-19 (COVID-19) and have higher rates of COVID-19 related hospitalization and death than those without SUD. This study assessed COVID-19 vaccine trust, transmission awareness, risk and protective behaviors, and effects of COVID-19 on mental health and smoking among a sample of clients in California residential SUD treatment programs and identified factors associated with vaccine trust.

Methods: A multi-site sample of SUD treatment clients (n = 265) completed a cross-sectional survey. Multivariable logistic regression was used to identify factors associated with COVID-19 vaccine trust.

Results: Participants were predominantly male (82.3 %) and racially/ethnically diverse (33.3 % Non-Hispanic White). Most participants were aware of COVID-19 modes of transmission, however, only 39.5 % trusted a COVID-19 vaccine would be safe and effective. Factors independently associated with trust in a COVID-19 vaccine included age (AOR = 1.03, 95 % CI = 1.02, 1.05, p = 0.0001) and wearing a mask all the time (AOR = 2.48, 95 % CI = 1.86, 3.31, p = 0.0001). African Americans were less likely than White participants to trust that a COVID-19 vaccine is safe and effective (AOR = 0.41, 95 % CI = 0.23, 0.70, p = 0.001).

Conclusion: SUD treatment clients were aware of COVID-19 modes of transmission; however, fewer than half trusted that a COVID-19 vaccine would be safe and effective. Health communication about COVID-19 for people with SUD should use a multipronged approach to address COVID-19 vaccine mistrust and transmission risk behaviors.

1. Introduction

The coronavirus disease-2019 (COVID-19) pandemic has had devastating health consequences for vulnerable populations in the U.S., including people with substance use disorders (SUDs). Individuals with a recent diagnosis of SUD have a significantly higher risk of developing COVID-19 compared to those without a recent SUD diagnosis (Wang et al., 2020). This population also has higher rates of COVID-19 related hospitalization and death than those without SUDs (Wang et al., 2020). With respect to type of SUD, individuals with a recent diagnosis of opioid use disorder were found to have the greatest risk of contracting COVID-19 infection, followed by those with a recent tobacco use disorder diagnosis (Wang et al., 2020). Smoking is a risk factor for

COVID-19 progression, with smokers having 1.91 times the odds of progression in COVID-19 severity than never smokers (Patanavanich and Glantz, 2020). Among patients with chronic obstructive pulmonary disease, current smokers are at high risk of having more severe complications of COVID-19 and have a higher mortality rate than former and never smokers (Alqahtani et al., 2020).

Vaccines offer a promising means of controlling the COVID-19 pandemic. However, to ensure high uptake of the vaccine people must trust that it is safe and effective. In a 2020 survey examining intentions to be vaccinated against COVID-19 in a representative sample of U.S. adults, almost one-third (31.6 %) reported hesitancy about being vaccinated against COVID-19, and 10.8 % did not intend to be vaccinated. Reasons for vaccine hesitancy included vaccine-specific concerns,

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a need for more information, antivaccine beliefs and attitudes, and a lack of trust (Fisher et al., 2020). To realize the potential benefits of the COVID-19 vaccine it is important to understand the potential barriers to vaccine uptake among populations with higher COVID-19 risks such as those with SUD. This study assessed COVID-19 vaccine trust, transmission awareness, risk and protective behaviors (e.g., mask wearing), and impact on mental health and smoking behavior among clients in SUD treatment programs and identified factors associated with vaccine trust.

2. Methods

Data were collected between August 12 and December 13 2020 from clients enrolled in eleven residential SUD treatment programs in California participating in ongoing studies of tobacco use (Guydish et al., 2020). The majority of SUD programs (n = 9) were located in urban counties in California. Eligible participants were all clients enrolled at the program on the day surveys were administered. Program staff distributed paper surveys, including a study information sheet where clients checked a box to consent or decline, and mailed completed surveys back to the study team. Participants were then mailed a \$20 gift card. Over three quarters of participants completed the survey before December 11, 2020 when the FDA announced Emergency Use Authorization (EUA) of the Pfizer-BioNTech COVID-19 vaccine. Response rates by program ranged from 71 % to 100 %, with an overall response rate of 90 %.

Surveys collected information on sociodemographic characteristics, tobacco and substance use, COVID-19 transmission awareness, testing, risk behaviors, mask wearing, effect of COVID-19 on mental health and smoking behavior, and vaccine trust. Awareness of COVID-19 transmission was measured by asking participants to respond (yes/no) if coronavirus was transmitted through: 1) close contact with an infected person with symptoms, 2) close contact with an infected person without symptoms, and 3) contact with surfaces an infected person had touched. COVID-19 testing history was assessed by asking participants if they had ever been tested, if they tested positive or negative, or if they had not received test results. Participants answered a yes/no question to measure risk behavior, "Have you shared the same cigarette or e-cigarette with anyone else in the past month?" Participants reported on their past 30-day history of mask wearing, "In the last 30 days, how often did you wear a protective mask?" (categorized as all the time vs. sometimes/rarely/never). To assess the impact of COVID-19 on mental health and smoking, we asked, "How much if at all has the coronavirus negatively affected your emotional or mental health?" (categorized as not at all/very little vs. very much/extremely), and "Has the coronavirus affected your smoking patterns?" (no change, smoke more, smoke less, or don't know). Finally, participants were asked if a vaccine for coronavirus became available, how much would they trust that the vaccine is safe and effective. Response options were collapsed into somewhat trust/trust completely vs. do not trust at all/slightly trust. All study procedures were approved by the University of California, San Francisco Institutional Review Board.

2.1. Statistical analysis

Participant characteristics and COVID-19 transmission awareness, behaviors, and effects of COVID-19 were summarized by using means and standard deviations (SD) for continuous variables, and frequencies and percentages for categorical variables. We used Pearson's chi-square tests for categorical variables and t-tests for continuous variables to explore associations between vaccine trust (somewhat/completely trust vs. do not trust at all/slightly trust) and sociodemographic characteristics, sharing cigarettes/e-cigarettes, and COVID-19 related variables. Variables that were statistically significant ($p < .10$) in bivariate analyses were entered into a multivariable logistic regression model to identify factors associated with vaccine trust, controlling for

sociodemographic characteristics (gender, race/ethnicity, education). The model accounted for nesting of participants within clinic. The generalized estimating equation (GEE) method was applied for correlated data. SAS software was used to conduct all analyses (SAS version 9.4; Research Triangle Institute).

3. Results

Participants (N = 265) were predominantly male (82.3 %) and racially/ethnically diverse (33.3 % Non-Hispanic White) with a mean age of 37.9 years (SD = 11.5). Of the N = 265, 7 participants had missing data for the vaccine trust variable. The sample size of n = 258 is used for bivariate and multivariable analyses. Only 11.2 % of participants (n = 29) reported they completely trust, 28.3 % (n = 73) somewhat trust, 28.3 % (n = 73) slightly trust, and 32.2 % (n = 83) do not trust at all that a COVID-19 vaccine would be safe and effective. Bivariate comparisons between respondents who trust vs. do not trust a COVID-19 vaccine are presented in Tables 1 and 2.

In the multivariable logistic regression model, age (AOR = 1.03, 95 % CI = 1.02, 1.05, $p = 0.0001$) and mask wearing all the time as

Table 1
Demographics and substance use characteristics among clients in California residential SUD treatment programs (n = 258).

Demographics	Mean (SD)/n (%)			p value
	Total (N = 258)	Not at all/ Slightly trust (N = 156)	Somewhat /Completely trust (N = 102)	
Age^a	37.9 (11.5)	36.6 (11.0)	39.9 (12.1)	0.026^b
Gender^a				0.408
Male	212 (83.1 %)	124 (80.5 %)	88 (87.0 %)	
Female	37 (14.5 %)	26 (16.9 %)	11 (10.9 %)	
Other	6 (2.4 %)	4 (2.6 %)	2 (2.0 %)	
Race/ethnicity^a				0.413
Hispanic/Latino	112 (43.6 %)	69 (44.2 %)	43 (42.6 %)	
African American	34 (13.2 %)	24 (15.4 %)	10 (9.9 %)	
Non-Hispanic White	86 (33.5 %)	47 (30.1 %)	39 (38.6 %)	
Other race/ethnicity	25 (9.7 %)	16 (10.3 %)	9 (8.9 %)	
Education				0.224
< HS or HS/GED	156 (60.5 %)	99 (63.5 %)	57 (55.9 %)	
> HS	102 (39.5 %)	57 (36.5 %)	45 (44.1 %)	
Smoking status^a				0.581
Current smoker	180 (70.0 %)	112 (71.8 %)	68 (67.3 %)	
Former smoker	59 (23.0 %)	35 (22.4 %)	24 (23.8 %)	
Never smoker	18 (7.0 %)	9 (5.8 %)	9 (8.9 %)	
Primary substance^a				0.929
Alcohol	57 (22.9 %)	33 (21.7 %)	24 (24.7 %)	
Stimulants	101 (40.6 %)	66 (43.4 %)	35 (36.1 %)	
Marijuana/Cannabis	10 (4.0 %)	6 (4.0 %)	4 (4.1 %)	
Opioids	36 (14.5 %)	21 (13.8 %)	15 (15.5 %)	
Other	5 (2.0 %)	3 (2.0 %)	2 (2.1 %)	
Multiple substances	40 (16.1 %)	23 (15.1 %)	17 (17.5 %)	

^a Missing data: Age (3), Gender (3), Race/ethnicity (1), Smoking Status (1), Primary Substance (9).

^b The multivariable logistic regression model included variables statistically significant at $p < 0.10$ (bold text), and controlled for sociodemographic characteristics and nesting of participants within clinic.

Table 2
COVID-19 transmission awareness, behaviors, and effects of COVID-19 by vaccine trust (n = 258).^a

	Total (N = 258)	Mean (SD)/n (%)		p value
		Not at all/ Slightly trust (N = 156)	Somewhat/ Completely trust (N = 102)	
Awareness of COVID-19 modes of transmission				
Close contact with infected person with symptoms ^a	223 (91.8 %)	129 (89.6 %)	94 (95.0 %)	0.135
Close contact with infected person without symptoms ^a	224 (91.1 %)	132 (89.8 %)	92 (92.9 %)	0.135
Close contact with surfaces infected person has touched ^a	209 (87.5 %)	122 (85.9 %)	87 (89.7 %)	0.387
Behaviors related to COVID-19				
COVID-19 testing ^a				0.749
Never tested	66 (25.9 %)	43 (27.9 %)	23 (22.8 %)	
Tested negative	168 (65.9 %)	99 (64.3 %)	69 (68.3 %)	
Tested positive	8 (3.1 %)	4 (2.6 %)	4 (4.0 %)	
Did not receive results of test	13 (5.1 %)	8 (5.2 %)	5 (5.0 %)	
Sharing cigs./E-cigs. ^a				0.692
Shared	86 (52.8 %)	51 (51.5 %)	35 (54.7 %)	
Not shared	77 (47.2 %)	48 (48.5 %)	29 (45.3 %)	
Mask usage				0.012 ^b
All the time	185 (71.7 %)	103 (66.0 %)	82 (80.4 %)	
Sometimes/rarely/never	73 (28.3 %)	53 (34.0 %)	20 (19.6 %)	
Effect of COVID-19				
Effect on mental health ^a				0.658
Not at all/Very little	170 (68.3 %)	104 (69.3 %)	66 (66.7 %)	
Very much/Extremely	79 (31.7 %)	46 (30.7 %)	33 (33.3 %)	
Effect on smoking ^a				0.748
No change	108 (64.3 %)	69 (67.0 %)	39 (60.0 %)	
Smoke more	27 (16.1 %)	15 (14.6 %)	12 (18.5 %)	
Smoke less	10 (6.0 %)	5 (4.9 %)	5 (7.7 %)	
Don't know	23 (13.7 %)	14 (13.6 %)	9 (13.9 %)	

^a Missing data: Close contact with infected person with symptoms (15), Close contact with infected person without symptoms (12), Close contact with surfaces infected person has touched (19), COVID-19 testing history (3), Sharing cigs./E-cigs (17), Negative effect of COVID-19 on mental health (9), effect of COVID-19 on smoking (12).

^b The multivariable logistic regression model included variables statistically significant at $p < 0.10$ (bold text), and controlled for sociodemographic characteristics and nesting of participants within clinic.

compared to less frequently (AOR = 2.48, 95 % CI = 1.86, 3.31, $p = 0.0001$) remained positively and significantly associated with vaccine trust. Although race/ethnicity was not significantly associated with vaccine trust in the bivariate analysis, African Americans were less likely to trust that a COVID-19 vaccine is safe and effective than non-Hispanic Whites (AOR = 0.41, 95 % CI = 0.23, 0.70, $p = 0.001$).

4. Discussion

The finding that fewer than half (39.5 %) of participants trust a COVID-19 vaccine is concerning, given the associations between SUD, COVID-19 infections, and worse health outcomes. Independent factors

associated with trust in the safety and effectiveness of a COVID-19 vaccine included age, mask wearing, and African American race. We found that participants who were older and those who wore a mask more frequently were more likely to trust a COVID-19 vaccine. Perceived susceptibility to COVID-19 infection could explain these associations and deserves future investigation. We also found that African American participants as compared to White participants were less likely to trust that a COVID-19 vaccine would be safe and effective. Hesitancy toward a COVID vaccine among African Americans is grounded in current and historical institutional racism in healthcare and mistrust of government (Bogart et al., 2021; Bunch, 2021). In general population samples, African Americans have reported a lower likelihood of intent for COVID-19 vaccination than Whites (Fisher et al., 2020; Grumbach et al., 2021; Guidry et al., 2020) less confidence in the effectiveness of the vaccine in preventing COVID-19, less trust in companies manufacturing the vaccine, and worry that the government rushed the approval process (Grumbach et al., 2021). Future research is needed to better understand the types of messages that may be effective in reducing mistrust and increasing intentions to receive a COVID-19 vaccine among SUD populations.

Skepticism and mistrust about the COVID-19 vaccines may impact uptake and inhibit infection control efforts in this high risk population. To promote vaccine uptake, it will be critical to acknowledge reasons for mistrust and address negative attitudes toward COVID-19 vaccines including concerns about safety and efficacy among this vulnerable group (Fisher et al., 2020; Taylor et al., 2020; Barocas, 2020). It is important to communicate that the COVID-19 vaccines have been rigorously tested, shown to be effective, and that the process of vaccine development has not been rushed (Guidry et al., 2020; Taylor et al., 2020). Furthermore, COVID-19 vaccine messaging and risk reduction communication should be disseminated to people with SUDs through trusted sources (Mellis et al., 2021; Malik et al., 2020) and tailored to address specific transmission risk behaviors such as sharing cigarettes or e-cigarettes. Public health departments could situate vaccination programs at places frequented by substance using populations (Barocas, 2020) and collaborate with community providers to disseminate health information about COVID-19 and vaccine benefits. Multipronged interventions that address individual-level concerns, social norms, vaccine and vaccination-specific issues, and contextual influences will be key to develop trust and vaccine acceptance (Corbie-Smith, 2021; Fisher et al., 2020; Jarrett et al., 2015).

We also found that most residential SUD treatment clients were aware of the known modes of transmission for COVID-19, which may reflect education about risk factors and prevention practices that they received from providers while in treatment through personal communication or signage posted in programs (Mericle et al., 2020). However, among current smokers over half (52.8 %) reported sharing cigarettes or e-cigarettes, increasing the risk of COVID-19 transmission (Kutti-Sridharan et al., 2020; To et al., 2020). This finding could be useful in targeting COVID-19 risk reduction messaging and outreach to smokers with SUD. The pandemic also highlights the importance of promoting evidence-based smoking cessation interventions in SUD treatment programs to reduce the risk of infection and spread of COVID-19 (Kashyap et al., 2020).

The majority of participants (71.7 %) wore a face mask all the time during the past month. Widespread use of face masks by the general public is associated with reductions in COVID-19 transmission (Rader et al., 2020; Chu et al., 2020) and with declines in weekly COVID-19 associated hospitalization growth rates (Joo et al., 2021). Face mask wearing will continue to be necessary until the U.S. population reaches herd immunity. COVID-19 health information disseminated to clients in SUD treatment should include communication about the importance of maintaining mask wearing, social distancing, and use of preventive hygiene practices, such as handwashing to reduce COVID-19 transmission (Centers for Disease Control and Prevention, 2021).

Among vulnerable populations who experience multiple barriers to

receiving preventive care, access to vaccination will remain a concern. Access and adherence challenges may be overcome by integrating COVID-19 vaccination services in residential SUD treatment programs. Because many residential SUD treatment programs may not have the medical infrastructure to offer vaccinations (Pagano et al., 2020), partnerships with pharmacies (Kaplan-Weisman et al., 2018) may offer a model to increase both uptake of and adherence to COVID-19 vaccines in this population.

A limitation of the study is the cross-sectional design. It is possible that COVID-19 related attitudes and risk and protective behaviors may change over time as vaccines become more widely available and people are able to obtain the vaccine. The present study was conducted in residential SUD treatment programs in California, and the results of the study may not generalize to other SUD treatment settings or other regions of the U.S. We did not explore reasons for mistrust of vaccines. Understanding the reasons why people with SUDs are hesitant to be vaccinated is needed to develop tailored vaccine communication to address common concerns about vaccines in this population. Finally, our measure of mask wearing was imprecise as we did not distinguish use of protective masks in public vs. while interacting with staff and clients in residential treatment programs.

5. Conclusion

Clients enrolled in residential SUD treatment were aware about COVID-19 transmission; however, fewer than half trusted that a COVID-19 vaccine would be safe and effective. Health communication about COVID-19 for people with SUD should use a multipronged approach to address COVID-19 vaccine mistrust and transmission risk behaviors.

Contributors

CLM conceptualized the study and wrote the first draft of the paper. CLM, CM, ES, VG, and JG contributed to survey development, and ES contributed to data collection and management. SE and MC contributed to literature searches and provided input in editing the manuscript. JG contributed funding and supervised the study. TL performed all data analyses. All authors contributed to and have approved the final manuscript.

Author agreement

The manuscript is the authors' original work. This manuscript has not been previously published and is not under consideration in the same or substantially similar form in any other peer-reviewed media. All authors have seen and approved the final version of the manuscript being submitted.

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Declaration of Competing Interest

The authors report no declarations of interest.

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