



## COVID-19 booster vaccine attitudes and behaviors among university students and staff in the United States: The USC Trojan pandemic research Initiative

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### ABSTRACT

Although authorized mRNA COVID-19 vaccines (BNT162b2 by BioNTech/Pfizer and mRNA-1273 by Moderna) significantly reduce morbidity and mortality, recent evidence suggests that immunity wanes over time, and that a booster dose could further reduce COVID-19 transmission and severe illness. However, research examining attitudes on booster willingness in diverse populations is needed. This study examined COVID-19 booster vaccine attitudes and behaviors among university students and staff in the fall of 2021. In our sample, 96.2% of respondents indicated willingness to get a COVID-19 booster shot at least once per year. In both bivariate and multivariate analyses higher trust in science was associated with having higher odds of booster willingness. Those who identify as Black, on average, reported trusting science less than other racial/ethnic groups. Our findings demonstrate high willingness to receive a COVID-19 booster shot and highlight the importance of educational messages and initiatives that focus on building trust in science to increase willingness to get the COVID-19 booster. More research is needed to better understand the impact of cultural beliefs on booster willingness and vaccine hesitancy. This understanding will help determine what messages and populations to target to increase booster willingness in the future.

### 1. Introduction

Although authorized mRNA COVID-19 vaccines (BNT162b2 by BioNTech/Pfizer and mRNA-1273 by Moderna) significantly reduce morbidity and mortality, recent evidence suggests that the vaccine induced antibody response declines over time (Naaber et al., 2021). Additionally, new COVID-19 variants, such as Delta and Omicron, contribute to declining immunity due to increased transmissibility and evasion of the neutralization effect of antibodies (Planas et al., 2022; Liu and Rocklöv, 2021). However, recent evidence suggests an additional booster dose increases neutralizing antibody levels and reduces both transmission and severe illness from the Delta and Omicron variants (Choi et al., 2021; Bar-On et al., 2021; Mahase, 2021; Chenchula et al., 2022). Given the evidence that boosters provide additional protection against COVID-19, understanding attitudes towards boosters will be key for public health efforts, especially considering the vaccine hesitancy to get the first or second dose worldwide (AlShurman et al., 2021; Cascini

et al., 2021).

While numerous articles have reported on booster willingness internationally, booster rates remain low in the United States (Jørgensen et al., 2022; Rzymiski et al., 2021; Tung et al., 2022; Yadete et al., 2021). Despite the Centers for Disease Control and Prevention (CDC) recommending the booster for all Americans ages 12 years and older who has completed the primary COVID-19 vaccine series, as of May 2022 only 30.5% of the United States population has received at least one booster (COVID-19 vaccine boosters administered per 100 people, 2022). The low uptake of COVID-19 boosters suggests the need for a more in-depth understanding of attitudes and concerns about getting booster doses in diverse populations.

Information about attitudes toward third vaccine doses could inform the design of health communication messages for more hesitant groups. Using data from an ongoing survey of university students and staff, we assessed attitudes toward third vaccine doses and the demographic correlates of these attitudes. We hypothesized an overall high

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willingness to get a COVID-19 booster shot because the sample was from a population of college students and staff/faculty in Los Angeles, where vaccination rates were high. However, we also hypothesized some sub-groups may have lower booster willingness compared to others. For example, the high level of vaccine hesitancy among Black Americans may suggest there will be a lower booster willingness as well (Khubchandani and Macias, 2021).

## 2. Methods

### 2.1. Participants

The participants in our study were students, staff, and faculty at the University of Southern California (USC) in Los Angeles, California who were a part of the Trojan Pandemic Response Initiative (TPRI) Health Cohort. The TPRI Health Cohort was recruited via email from a list of all current students, staff, and faculty at USC in May 2021. Participants were eligible if they were currently employed or enrolled at USC, were at least 18 years of age, and provided informed consent.

### 2.2. Procedure

This study was approved by the University of Southern California Institutional Review Board. In August - November 2021, we conducted a survey of students, staff, and faculty who had participated in the TPRI Health Cohort. We emailed 5,256 enrolled participants (2,876 students, 2,380 staff/faculty) to complete an online survey via a web-based survey platform (REDCap) and received 3,923 responses (75% response rate). Participants were informed about the nature and contents of the study, that their participation was voluntary, that their survey responses were confidential, that they were allowed to skip questions, and could withdraw from participating at any time. Participants provided informed consent electronically and completed the online survey by clicking on a hyperlink link sent via email. Participants received a \$10 gift card at the completion of the survey.

### 2.3. Measures

The main outcome variable was booster willingness, assessed with one question: how often participants would be willing to get a COVID-19 booster vaccination. Booster willingness was coded as “willing” (any response other than “never”) and “unwilling” (“never”). The survey assessed demographic characteristics including self-identified race and ethnicity, gender identity, age, and student/staff status. Several students and staff members who were similar in demographic characteristics to the target sample pilot tested the survey for length and clarity. We also assessed self-reported prior COVID-19 infection status and self-reported vaccination status. We assessed respondents’ trust in science by averaging their responses to the Nadelson’s Trust in Science Scale (Cronbach’s alpha = 0.91). (Nadelson et al., 2014) This 21-item scale contains statements such as “We can trust science to find the answers that explain the natural world” and “We should trust the work of scientists”, rated on a 5-point scale from “Strongly Disagree” to “Strongly Agree”.

### 2.4. Data analysis

The analyses only considered individuals who were fully vaccinated and had completed all the measures of interest (N = 3,668). Bivariate logistic regression models were run to examine the marginal effects of demographic (age, gender, race/ethnicity, division), clinical (prior COVID-19 infection), and psychosocial (trust in science) correlates on booster willingness (At least once per year vs. Never). To determine if statistical significance was maintained after covariate adjustment, we also ran a multivariable model including the aforementioned correlates. Prior COVID-19 vaccination status was omitted from our models because over 98% of our sample self-reported being fully vaccinated. We

reported unadjusted and adjusted odds ratios and their respective 95% confidence intervals. All analyses were performed with R Version 4.1.1. P-values for all analyses were two-sided with a significance level of 0.05.

## 3. Results

Of the 3,668 respondents, 96.2% indicated willingness to get a COVID-19 booster shot at least once per year, and nearly two-thirds were willing to get boosters as often as necessary (after removing those with missing data) (Table 1). In bivariate analyses, those without prior COVID-19 infections had higher odds of booster willingness compared to those with self-reported prior COVID-19 infection (OR = 1.99; 95% CI = 1.24–3.07), and higher trust in science was associated with having higher odds of booster willingness (OR = 8.36; 95% CI = 6.10–11.60) (Table 2).

In multivariate analyses, controlling for confounding by the other variables in the model, Asians had over twice the odds of reporting being willing to get at least one COVID-19 booster compared to Whites (OR = 2.45; 95% CI = 1.46–4.18) and stronger trust in science was associated with higher odds (OR = 8.73; 95% CI = 6.29–12.30) (Table 2). Notably, we did not detect a significant association between Black race and booster willingness in both the bivariate and multivariate analyses, despite our original hypothesis. To examine any racial and ethnic differences in trust in science, we conducted a post hoc Kruskal Wallance test. Black respondents had a significantly lower mean trust in science score compared to all other racial/ethnic groups (p < 0.001). Additionally, those who were willing to get a booster trusted science more, on average, than those who were not willing among all race/ethnicity groups.

## 4. Discussion

While our sample is at a higher education setting, thus limiting generalizability, our results demonstrate high willingness to receive a

**Table 1**  
**Booster Willingness among Students, Staff, and Faculty at a Los Angeles University.** Responses from 3,668 participants to the question: “How often would you be willing to get a COVID-19 booster, if offered?”. Self-identified gender excludes any “other” category.

	Willing (n = 3530)	Unwilling (n = 138)	P-value
<b>Booster Willingness</b>			
<i>As many times as needed</i>	2346 (64.0%)		
<i>Three times a year</i>	23 (0.6%)		
<i>Twice per year</i>	207 (5.6%)		
<i>Once per year</i>	954 (26.0%)		
<i>Never</i>		138 (3.8%)	
<b>Gender</b>			0.09
<i>Ref = Female</i>	2360 (96.6%)	82 (3.4%)	
<i>Male</i>	1170 (95.4%)	56 (4.6%)	
<b>Age Group</b>			0.92
<i>Ref = 18–23</i>	1131 (96.5%)	41 (3.5%)	
<i>24–39</i>	1545 (96.1%)	62 (3.9%)	
<i>40–49</i>	386 (95.8%)	17 (4.2%)	
<i>50+</i>	468 (96.3%)	18 (3.7%)	
<b>Race/Ethnicity</b>			0.004
<i>Ref = White</i>	1220 (96.4%)	45 (3.6%)	
<i>Asian</i>	1123 (97.7%)	27 (2.3%)	
<i>Black</i>	186 (93.9%)	12 (6.1%)	
<i>Latinx</i>	740 (95.1%)	38 (4.9%)	
<i>Other/Multiracial</i>	261 (94.2%)	16 (5.8%)	
<b>Prior COVID Infection</b>			0.002
<i>Ref = Yes</i>	373 (93.7%)	25 (6.3%)	
<i>No</i>	2933 (96.7%)	99 (3.3%)	
<i>Don't Know</i>	224 (94.1%)	14 (5.9%)	
<b>Division</b>			0.32
<i>Ref = Staff</i>	1550 (95.9%)	67 (4.1%)	
<i>Student</i>	1980 (96.5%)	71 (3.5%)	
<b>Trust in Science Score - mean (sd)</b>	4.08 (0.52)	3.39 (0.62)	< 0.001

**Table 2**  
Univariate and Multivariate Correlates of Booster Willingness.

	Bivariate analysis		Multivariate analysis	
	Odds Ratio	95% CI	Odds Ratio	95% CI
<b>Gender (Ref = Female)</b>	0.73	0.51–1.03	0.86	0.59–1.26
<b>Age Group (Ref = 18–23)</b>	1.0 (ref)		1.0 (ref)	
<b>24–39</b>	0.90	0.60–1.34	1.03	0.63–1.67
<b>40–49</b>	0.82	0.47–1.50	1.15	0.54–2.52
<b>50+</b>	0.94	0.54–1.70	1.86	0.86–4.14
<b>Race/Ethnicity (Ref = White)</b>			1.0 (ref)	
<b>Asian</b>	1.53	0.95–2.52	<b>2.45</b>	<b>1.46–4.18</b>
<b>Black</b>	0.57	0.31–1.15	1.12	0.57–2.36
<b>Latinx</b>	0.72	0.46–1.12	1.21	0.74–1.97
<b>Other/Multiracial</b>	0.60	0.34–1.11	0.75	0.41–1.43
<b>Prior COVID Infection (Ref = Yes)</b>			1.0 (ref)	
<b>No</b>	<b>1.99</b>	<b>1.24–3.07</b>	1.35	0.81–2.17
<b>Don't Know</b>	1.07	0.55–2.16	0.91	0.45–1.94
<b>Division = Student (Ref = Staff)</b>	1.21	0.86–1.69	1.26	0.75–2.10
<b>Trust in Science Score</b>	<b>8.36</b>	<b>6.10–11.60</b>	<b>8.73</b>	<b>6.29–12.30</b>

COVID-19 booster shot. Our findings also highlight the importance of trust in science to increase willingness to get the COVID-19 booster. This is especially important in addressing previously reported COVID-19 vaccine hesitancy among African Americans (Khubchandani and Macias, 2021). However, more research is needed to better understand the impact of cultural beliefs on booster willingness and vaccine hesitancy, especially given the historical trauma and legacy of racism African Americans have faced from the scientific/medical field. This understanding highlights the need for educational messages and initiatives that focus on building trust in science to increase booster willingness as the pandemic ensues and new variants continue to arise.

Though previous research has examined booster willingness in the United States and abroad at a national level, understanding the attitudes and beliefs of sub-populations is key to addressing vaccine and booster rates (Jørgensen et al., 2022; Rzymiski et al., 2021; Tung et al., 2022; Yadete et al., 2021). Some researchers have begun to explore the attitudes and beliefs in key populations. Giuseppe et al. examined attitudes of incarcerated people in Italy, where they identified younger incarcerated people, those who do not perceive the severity of the disease, and are not aware of the availability of the vaccine as key target groups for public health vaccination campaigns (Di Giuseppe et al., 2022).

To our knowledge, this study is one of the few to examine the thoughts and opinions about COVID-19 booster shots in a large university setting in the United States. Folcarelli et al. similarly examined willingness to receive the booster dose of the COVID-19 vaccine among a university community in Italy (Folcarelli et al., 2022). Folcarelli found respondents who self-rated a lower general health status after the primary vaccination series, who did not have friends/family members who were diagnosed with COVID-19, who had not received information from official government organizations, and who needed information were hesitant. It is of importance to note that Folcarelli found a lack of information from official government organizations to be associated with booster hesitancy, suggesting Italian people may have a high degree of trust in COVID-19 information that the government disseminates. However, in the United States, much of the pandemic occurred during the presidency of the Trump administration, when the COVID-19 response became politicized, and misinformation was prevalent (Evanega et al., 2020). Understanding the differences in study populations is key to addressing booster willingness as people's opinions on COVID-19 vary greatly. This is especially important given the pivotal role health-care providers and scientific journals play as sources of information to positively impact vaccination attitudes and uptake (Di Giuseppe et al., 2021; Wang et al., 2021).

In this study, we demonstrate almost all students and staff (96.2%) would be willing to receive additional vaccine doses if recommended. Future research should examine the demographic correlates of actually receiving booster doses, which might be lower than willingness and intentions. Conversely, in settings where the vast majority of people are willing to get boosters, it will be important to monitor vaccination records to make sure that people do not obtain boosters more frequently than recommended, which could increase the risk of side effects without providing additional protection from COVID-19.

## 5. Limitations

This analysis was based on cross-sectional data from a non-random sample of university students, staff, and faculty who responded to an online survey. Thus, this study is susceptible to volunteer bias and social desirability bias and only represents the booster willingness of our sample at one point in time during a rapidly changing global pandemic. Findings may not generalize to the general population, especially given the high vaccination rate (98%) in our sample compared to the rest of the United States (66% as of May 2022) (CDC, 2022). It is also important to note that booster willingness is fluid and individuals may change their intentions rapidly. Additionally, individuals may express willingness to get the booster, but this may not directly translate to booster uptake. Finally, side effects from previous vaccine doses have been shown to contribute to booster hesitancy (Rzymiski et al., 2021). However, we did not access participant experience with prior vaccine doses and cannot determine if this influenced booster willingness in our sample.

## 6. Conclusions

This study demonstrates an overall high COVID-19 booster willingness among university students, staff, and faculty and highlights the importance of educational messages and initiatives that focus on building trust in science to increase willingness to get the COVID-19 booster. Future research and public health efforts should be put on fostering trust among people who are wary of science and the COVID-19 pandemic.

### CRedit authorship contribution statement

**Ryan C. Lee:** Investigation, Project administration, Writing – original draft. **Howard Hu:** Conceptualization, Funding acquisition. **Eric S. Kawaguchi:** Data curation, Formal analysis, Methodology, Visualization, Writing – review & editing. **Andre E. Kim:** Data curation, Formal analysis, Methodology, Visualization. **Daniel W. Soto:** Investigation, Project administration. **Kush Shanker:** Data curation, Investigation. **Jeffrey D. Klausner:** Conceptualization, Writing – review & editing. **Sarah Van Orman:** Conceptualization. **Jennifer B. Unger:** Conceptualization, Methodology, Writing – review & editing.

### Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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