

COVID-19 Vaccine Hesitancy in Adult Emergency Department Patients

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Abstract. Vaccine hesitancy is a nationally resonant issue that must be evaluated to address the spread and overwhelming complications of COVID-19 in the United States. Emergency departments (EDs) often serve disadvantaged populations who may experience disproportionate pandemic complications. We sought to gain an updated understanding of vaccine hesitancy levels in a single ED, especially following wide-scale distribution of COVID-19 vaccines and during the spread of the COVID-19 Delta variant. We surveyed a convenience sample of non-COVID-19 positive ED patients at a Level 1 urban trauma center to measure patients' vaccination rates for COVID-19 and influenza. Utilizing a previously published questionnaire, we obtained demographics and perspectives on reasons why COVID-19 vaccination was or was not obtained. Among 100 patients enrolled, 78% were vaccinated against COVID-19 and 22% were unvaccinated. The sample of participants was majority white, middle-aged, educated beyond high school, and medically-insured. Vaccine hesitancy was not significantly linked to any demographic groups, other than slightly a significant relationship with those with lower education levels or those who identified as white. Among the unvaccinated participants, the most frequent reason for refusing the vaccine was concern about the side effects or safety. Our data suggests vaccine hesitancy persists

I. Introduction

Since late 2019, a global outbreak of the SARS-Cov-2 virus, also known as COVID-19, has caused turmoil and uncertainty for much of the world's population. As of January 27, 2022, the total number of reported COVID-19 cases in the United States had surpassed 74 million, and the total number of COVID-related deaths was over 870,000 (Centers for Disease Control and Prevention [CDC], n.d.a) A major goal since the beginning of the pandemic has been population-level herd immunity, which is the point at which the population achieves resistance to the virus spread due to high rates of immunization (Rodriguez et al., 2021; Sallam, 2021). It is estimated that 67-90% of the population must be immune, either by contracting the virus naturally or by vaccination, for herd immunity to be achieved (Rodriguez et al., 2021). Currently, a two-dose Pfizer vaccine se-

ries has full approval for use by the Food and Drug Administration (FDA), while a two-dose Moderna series and a single-dose Johnson & Johnson vaccine have emergency use approval (Food and Drug Administration [FDA], 2021a; Food and Drug Administration, 2021b). Vaccine distribution occurred first on a rollout basis, but by April 19, 2021 all adults in the United States were eligible to receive the vaccine (Schumaker, 2021). As of January 2022, over 63.5 % of the United States population had been fully vaccinated for COVID-19, meaning that they received both doses in a two-dose vaccine series or one dose in a single-dose vaccine (Mayo Foundation for Medical Education and Research, n.d.). The most common reported side effects of the COVID-19 vaccine include pain at the injection site, headache, fatigue and tiredness, joint and muscle pain, and fever (Syed Alwi et al., 2021). Rarely, more severe side effects have been reported such as anaphylaxis, blood clot-

ting disorders, and Guillain Barré Syndrome, but the occurrence rates are closely followed and investigated by the Centers for Disease Control and Prevention (CDC) and the FDA (CDC, n.d.b).

Currently, both national data from the CDC (2022) and state-level data from the Tennessee Department of Health (2022) suggest those who are fully vaccinated are less likely to be infected with COVID-19, be hospitalized due to COVID-related issues, or die from COVID-related issues. According to the CDC (2022), unvaccinated adults in the United States are at four times higher risk for testing positive for COVID-19 and are at fifteen times higher risk of dying from COVID-19 than vaccinated adults.

Despite a national push in the United States for individuals to be vaccinated against COVID-19, hesitancy toward receiving the vaccine is still high. As defined by the World Health Organization (WHO) (2019), vaccine hesitancy is “the reluctance or refusal to vaccinate despite the availability of vaccines,” and in 2019, it was placed within the WHO’s top ten threats to global health. Vaccine hesitancy spans other types of vaccines as well. For instance, each year, an influenza vaccine is distributed, but the vaccination rates in the United States are consistently low, rarely surpassing 50% (Grochowksa et al., 2021; Lytle et al., 2021). The factors that often lead to vaccine hesitancy at the individual-level are complacency, convenience, and confidence (Sallam, 2021). Complacency relies on the perception of disease risk, suggesting individuals will not opt to get vaccinated if they believe they don’t need it or are satisfied without it. Convenience is the ease and ability to receive the vaccine, which can be based on vaccine availability, accessibility, affordability, and efficiency. Finally, confidence is trust in the safety and efficacy of the vaccine. The circulation of information by government authorities, the scientific community, the media, and the general public heavily influence these three factors and the levels of vaccine hesitancy.

Our study was inspired by the survey adapted from The Rapid Evaluation of COVID-19 Vaccination in Emergency Departments for Underserved Patients Study (Rodriguez et al., 2021). The investigators surveyed 2,301 patients across 15 United States EDs, and among those enrolled, the overall hesitancy rate for the COVID-19 vaccine was 39%. The primary reasons for hesitancy included having concerns

about side effects or safety, needing more information about the vaccine, and hearing stories in the media or online about the vaccine. The most hesitant groups from the sample were young individuals, females, those who had no regular access to health care, and those who were black or latinx. Also, those who had not received a flu shot in the last five years were more hesitant than those who had. While all of these results are insightful, this study was conducted before March 7, 2021, prior to the widespread distribution of the COVID-19 vaccine and the COVID-19 Delta variant. Thus, the purpose of the current study was to provide an updated representation of ED patients’ vaccine rates and perspectives. The ED is a unique survey setting because it is often the most direct pathway for the general population to access medical care. It serves as a medical “safety net” by delivering health care to the underserved, uninsured, and other vulnerable populations (Rodriguez et al., 2021; Kellermann et al., 2013). Annually, EDs receive 140 million visits and serve as the primary access to health care for about 20% of the United States population (Rodriguez et al., 2021). Emergency physicians and staff care for patients with a wide range of health conditions, reasons for visiting the hospital, and demographics, including the uninsured and underserved (Raven et al., 2017; Rodriguez, 2019; Arnett et al., 2016; Walls et al., 2002; Weber et al., 2005; CDC, 2018; Agency for Healthcare Research and Quality, n.d.; National Center for Health Statistics, 2017). Not only did we aim to measure vaccine hesitancy among these patients, but we also sought to understand how hesitancy and beliefs correlate with other determinants such as education level, race, age, and gender.

II. Methods

This study was conducted at the Vanderbilt University Medical Center (VUMC) Adult Emergency Department, a Level 1 Urban Trauma Center with an annual census of 70,000 patients per year. The protocol was approved by the Vanderbilt University Medical Center Institutional Review Board. Data was collected in-person by the authors, assisted by VUMC emergency medicine clinical trial associates, between September 1, 2021 and Decem-

ber 1, 2021. Participants were patients in the ED, willing and able to undergo an interview. We excluded those under the age of 18, non-English speakers, COVID-19 positive patients, and trauma patients. Exclusion criteria were designed to ensure that interviewers were interacting with patients safely, clearly, and respectfully. Patients were pre-screened using information in the ED electronic health record, and if they appeared to meet criteria, researchers approached them at the bedside to confirm eligibility (EPIC, n.d.). Verbal consent was acquired, and then patients were surveyed verbally at the bedside while research personnel recorded answers on a tablet. Data was inputted and stored in a REDCap database. REDCap (Research Electronic Data Capture) is a secure, web-based application designed to support data capture for research studies, providing: 1) an intuitive interface for validated data entry; 2) audit trails for tracking data manipulation and export procedures; 3) automated export procedures for seamless data downloads to common statistical packages; and 4) procedures for importing data from external sources (Harris et al., 2009).

The questionnaire was adapted from a previous vaccine hesitancy study (Rodriguez et al., 2021). It consisted of 26 questions, collecting demographic information (Questions 1-7, 10), details about participants' access to medical care (Questions 8, 9, 12), influenza vaccine history and perspectives (Questions 13-17), and COVID-19 vaccine history and perspectives (Questions 18-26). Vaccination

status was self-reported for both vaccines. Patients were given the opportunity to report why they refrained from receiving the vaccine. Based on patient responses, we categorized their reasons into the following options: "I have already had COVID-19;" "I have concerns about vaccine side effects or safety;" "I don't believe the COVID-19 vaccine will work;" "I am not worried about getting COVID-19;" "I have heard stories on media that give me doubts about the vaccine;" "I need more information about the vaccine;" "I did not know it was recommended for me;" "Other". The enrollment and survey completion took an average of 5-10 minutes for each participant. In addition to survey answers, information about each participant's medical history was obtained from EPIC chart reviews for the purpose of potentially informing future hypotheses.

III. Results

I. Demographics

A total of 100 patients were enrolled. The majority of these patients (55%) were between the ages of 31 and 65, 32% were above 65, and 13% were between the ages of 18 and 30. Sex assigned at birth was split between 47% female and 53% male. Of the enrolled patients, 77% were White, 19% were Black, 2% were Asian, 2% were Native American or Alaskan, and 1% was Hispanic. The education level of our sample population was widely varied, with the highest grade of school completed (%): grades 1-8 (1%), grades

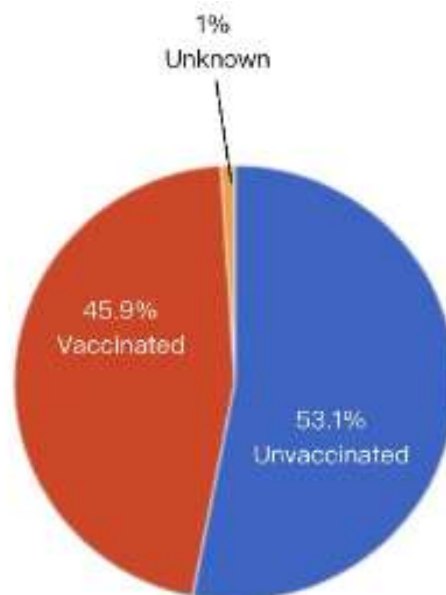


Figure 1. Distribution for patients receiving the Flu vaccine in 2021

9-11 (10%), grades 12 or GED (26), some college or technical school (27%), and four years of college or more (34%). Of the patients enrolled, 85% had a regular clinic or doctor for medical care, and 15% did not. The majority (60%) of those who did not have a regular clinic or doctor reported that they seek care in the ED when they need medical advice. Regarding health insurance, 91% had health insurance, 8% did not have health insurance, and 1% had an unknown insurance status.

II. Influenza vaccination and perspectives

Of the 100 patients enrolled, 45 had received a flu vaccine in the past year, 52 had not received a flu vaccine in the past year, and the remaining 3 patients either did not answer or were unsure (Figure 1). Those who had not received the flu vaccine were asked for the primary reason they did not get it. The most common reason, given by 33% of participants, was that they meant to get it but did not get around to it. The next most common reason, given by 31% of participants, was “Other,” which included descriptions such as previous adverse reactions to the flu, the politicization of vaccines, and mistrust in the government. The third most common reason (21%) for not receiving the influenza vaccine was that the participant did not believe it to be important for their health.

III. COVID-19 Vaccine Hesitancy

This study then determined what percentage of the patients enrolled had received the COVID vaccination.

Out of the 22% who had not yet obtained the vac-

cine (Figure 2), 19% were willing to receive it soon. The remaining 71% of hesitant participants did not wish to ever receive it. This group had varying reasons for their decision (Figure 3), but the most common (50%) was concerns about vaccine side effects or safety. The reasons documented as “Other,” which accounted for about 44% of surveyed vaccine hesitant patients, included mistrust in the government, not feeling like they needed it, and wanting more clinical or biological research done before receiving it. The third most common reason was the desire for more information about the vaccine and wanting to do more research themselves.

IV. COVID-19 Vaccine Acceptors

Halfway through data collection, we added an additional question asking participants who had received the COVID-19 vaccine to detail reasons why they had chosen to take it. Of the 49 participants that were asked this question, 33% said they believed it to be safe, 27% believed the COVID-19 vaccine would work, and 35% were worried about getting COVID-19. Other reasons, detailed by 39%, included that it was required for their workplace or that they chose to simply because people around them were.

After basic statistical analysis in R-studio there was not found to be significant differences ($p > 0.05$) in vaccination status based on differing age, employment, health insurance, access to regular clinic/doctor, or gender. Slightly significant differences ($p < 0.05$) in vaccine hesitancy existed for varying race and schooling levels of the participants. Vaccine hesitancy was slightly higher within participants who identified as white or completed a high school degree

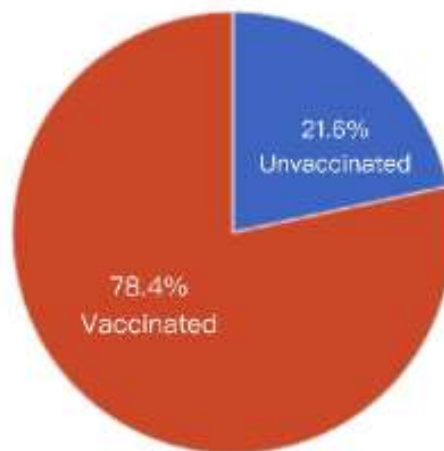


Figure 2. Distribution of patients receiving the COVID vaccine

or lesser (Figure 4). However, these tests did not control for all demographics or other such confounding variables such as habitation status, caregiver support, living conditions, and socioeconomic status.

stance, the study had a lower percentage of African Americans as well as other ethnic minorities compared to the overall US population. Additionally, this study chose to look at a single center, the Vander-

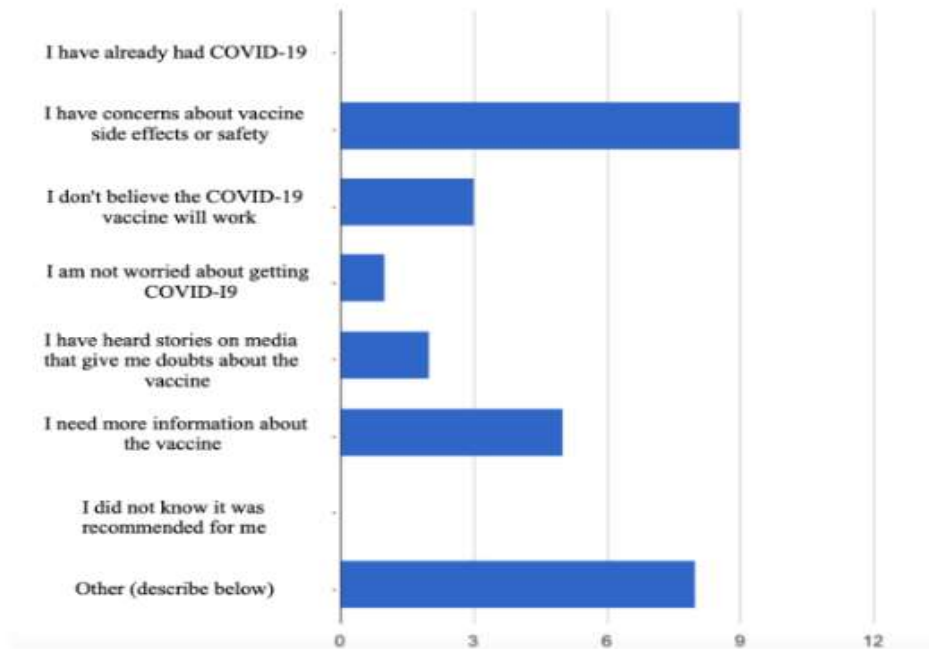


Figure 3. Distribution of responses from unvaccinated participants for why they refrained from receiving the COVID-19 vaccine.

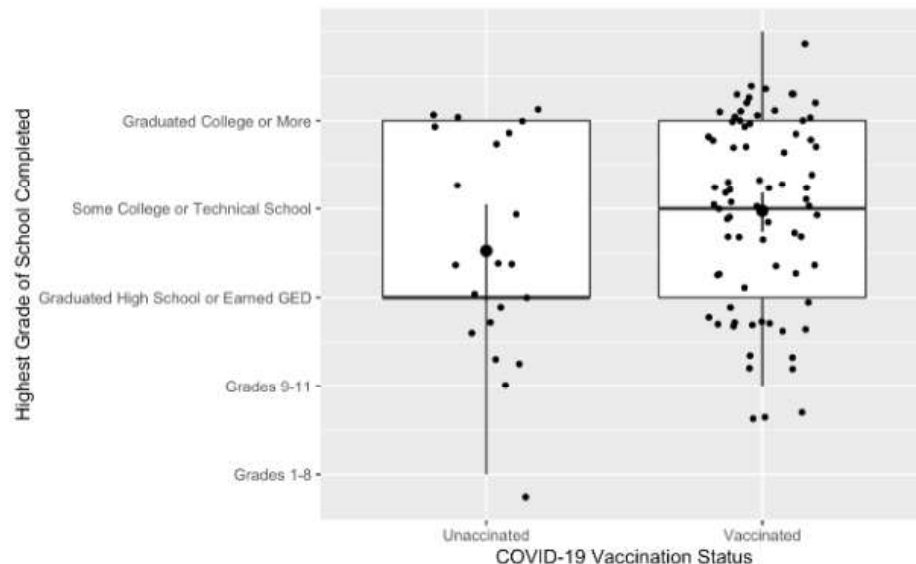


Figure 4. The average level of education of participants grouped by vaccination status ($p>0.05$).

IV. Limitations

This study is subject to limitations, some of which were inherent to the type of convenience sample survey-study we conducted. A total of 100 patients were enrolled, which is a rather small sample size and may not be representative of the local population from which the study aimed to gauge perspectives. For in-

bilt University Medical Center, and solely enrolled patients from the ED. Further narrowing exclusion criteria included severe trauma, any kind of altered mental status, and a positive COVID-19 test within 48 hours of our screening process. This meant attempted enrollment occurred solely among the moderately ill, alert, and COVID-19 negative patients in the VUMC ED. Selection bias is inherently present

due to the enrollment setting of an ED. Among those approached, some refused, were unavailable due to medical procedures, or were asleep for the duration of enrollment shifts which led to a convenience sample bias. Thus, our pool of participants was rather narrow, and a further step to this study would be increasing sample size and demographic range of participants. There were also various confounding variables such as habitation status, caregiver support, living conditions, and socioeconomic status that were not differentiated upon through the initial demographic questions.

Additionally, there was also no measure of honesty among the participants, which could be another source of bias. Given that the issue of COVID-19 vaccination is politically and socially charged in the United States, it is reasonable to assume that some participants tailored their answers to fit the situation. Interviewers attempted to remain completely neutral and took a standardized approach to asking participants survey questions, but nonetheless, the survey occurred in an academic, scientific setting. Furthermore, the interviewers were dressed in scrubs and represented Vanderbilt with ID badges. Participants may have been hesitant to express vaccine hesitancy due to a social desirability bias, out of fear that honesty would negatively impact the way they were viewed or the quality of care given to them. They also may have altered their answers based on the presence of a caregiver or family member in the room listening. One solution to minimize the bias could be a stronger, clearer assurance to participants during the interview that all answers are anonymous and confidential within the study. Another solution could be implementing an online survey, in which interactions with the participant are limited. Finally, honesty could be verified by using electronic health records to find information about vaccination status, demographics, and history with COVID-19.

Finally, this research was conducted prior to the distribution of booster vaccinations and the spread of the COVID-19 Omicron variant. Therefore, the collection and analysis of patients' perspectives were conducted through a pre-Omicron, pre-booster lens. These factors have likely impacted vaccine hesitancy in some way, and an updated study may provide a more comprehensive understanding of patients' opinions. This is another limitation of this study, and it is

a point that could be addressed by a similar study in the future.

V. Discussion

This study took place at a major hub for emergency care and followed many larger studies which considered people's opinions on receiving potential COVID-19 and flu vaccines. However, these results are unique when compared to such older studies because enrollment for the current study occurred at a time of complete and easy access to vaccines, as well as the new threat of the COVID-19 Delta variant. It provides an intriguing look into the perspectives of patients and the thought processes behind vaccine acceptance and hesitancy. This study had the ability to investigate whether availability of vaccines and the presence of new variants altered complacency and convenience of vaccination enough to shift levels of vaccine hesitancy for a specific population.

As compared to the rates of vaccinations in Tennessee (60%), and the United States (76%), the participants in the current study had lower vaccine hesitancy (Mayo Foundation for Medical Education and Research, n.d.). However, because this study had a narrow pool for participants (patients in the Vanderbilt University Medical Center Emergency Department that passed our screening requirements), it is important to consider how this difference may be due to study-specific conditions. A small sample size of ED patients could account for inconsistencies and varying perspectives. Having conducted the study in a central hub for patients from various parts of the state also suggests there is likely a degree of variety in participants that is representative of the population. Additionally, excluding COVID-19 positive patients from enrollment prevented the study from being able to gauge how battling the virus at the time of the interview could have changed patients' opinions on the vaccine. It would be interesting to learn how perspectives and results would have differed if the study had not excluded COVID-19 patients.

Moving forward, if herd immunity and mass vaccination are the goals, then scientists, health care workers, and politicians must use insights from research on vaccine perspectives to better combat hesitancy. For instance, among those in this study who chose not to receive the vaccine, the most common

reason was concern about vaccination side effects or safety, and the third most common reason was that they needed more information about it. This suggests that one of the most effective ways to combat vaccine hesitancy might be to increase education and awareness about vaccine safety. Additionally, the results indicated no significant relationships between vaccination status and age, gender, employment status, health insurance, or regular access to health care. A logistic regression model could be used to further evaluate the overlap of some of these demographic categories, although a larger sample size would be desirable.

One demographic factor that was found to be slightly significant was race. Prior research studies conducted (Rodriguez et al., 2021; Lytle et al., 2021) have shown higher vaccine hesitancy rates among participants in non-white groups. However, our statistical analysis showed that hesitancy was higher among white participants compared to non-white participants. This may be indicative of the changes that occurred with the distribution of vaccines and the development of the COVID-19 Delta variant, such as increased availability of the vaccine to minority populations and increased risk perception of the disease. Another slightly significant difference in vaccination levels was found with respect to varying levels of education. Specifically, there was an overlap between participants who refused the vaccine and those who had equivalent to a high school diploma or lesser. This suggests vaccine information may need to be more digestible to laypersons and non-scientists, so that hesitancy isn't compounded by inability to understand scientific jargon and academic writing. A larger sample size would likely provide a stronger basis for these analyses. Though the sample size may not have been representative of the entire population of Nashville, it may have been rather representative of the subsection that an education-based intervention in the ED would target. This study is valuable as a starting point but highlights the need for further correlative studies regarding vaccine hesitancy.

Finally, many of the participants in this study, both those against and in favor of receiving the vaccine, reported having confirmed their opinions and information via Google search, social media, or news outlets. Interviewers noticed these participants were able to validate their opinions using their sources of

choice, regardless of whether the information was factual or scientific. Social media platforms and confirmation bias appear to be influential in forming opinions on both sides of the vaccine debate. Therefore, it may be beneficial for future studies to ask participants where specifically they were getting their information about vaccines to determine whether there is a correlation with social media or online marketing algorithms. This could help target needs regarding the circulation and regulation of vaccine-related information.

VI. Conclusion

COVID-19 vaccine hesitancy is a national phenomenon, persisting in about one in five emergency department patients. Attention to the circulation and presentation of information related to the vaccine, its safety, and its efficacy is likely important in the progression toward herd immunity against COVID-19.

VII. Acknowledgements and Disclaimers

This publication was supported by CTSA award No. UL1 TR002243 from the National Center for Advancing Translational Sciences. Its contents are solely the responsibility of the authors and do not necessarily represent official views of the National Center for Advancing Translational Sciences or the National Institutes of Health.

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