



COVID-19 Vaccine Acceptance Among Construction Workers

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The COVID-19 pandemic has affected all industries, including the construction industry. In addition to being a hazard-prone environment, construction also has the highest number of occupational fatalities. Construction workers have been affected more severely by this disease than the general public. The availability of vaccines has fueled optimism, with vaccination considered the safest and most effective method of protecting against COVID-19. However, vaccinating the workforce to achieve herd immunity has been difficult as the acceptance rate appears to be a significant hurdle. The purpose of this study is to assess construction workers' acceptance of the COVID-19 vaccine after it became widely available. A two-step research methodology was used in this research that included: 1) a comprehensive literature review looked at COVID-19 vaccination rates in the U.S. and construction workers' unwillingness to get vaccinated and 2) a qualitative questionnaire survey to assess worker acceptance. Results showed 43% of construction workers have not received the COVID-19 vaccine, while 41% refused the vaccine. To increase vaccination acceptance among construction workers, construction stakeholders should supply safety training and improve the safety culture within their organizations.

Keywords: COVID-19, Construction Industry, COVID-19 vaccine, Hazard, Pandemic

Introduction

The construction industry has a substantial impact on the economic growth in the United States (Jeon et al., 2022). Approximately 4.3 % of the overall Gross Domestic Product (GDP) of the United States is contributed by this sector that accounts for approximately \$1.87 trillion in the first quarter of 2021 (BEA, 2020). According to the U.S. Bureau of Labor Statistics, there are 7.41 million persons employed in the industry. Despite its importance, the construction industry is one of the most injury-prone industries (Agwu and Olele 2014). There have been over 1,061 confirmed fatalities in the U.S. construction industry in 2019, which translates into approximately one construction worker's death in an accident every eight hours (U.S. Bureau of Labor Statistics (BLS), 2021). Construction workers are already exposed to a considerable number of injuries, illnesses, and fatalities; however, the COVID-19 pandemic has further increased the level of safety concerns. COVID-19, or Coronavirus disease, is caused by SARS-CoV-2, or severe acute respiratory syndrome coronavirus (Acter et al. 2020). It is a

highly infectious disease that can lead to symptoms such as fever, dry cough, fatigue, and shortness of breath (CDC 2021a). Unlike other industries, the construction industry could not adopt telecommuting to mitigate the safety challenges and productivity disruptions caused by the COVID-19 pandemic (Daniels et al., 2020). These difficulties compounded the maintenance of safety measures while delivering construction projects on time (Al-Mhdawi et al., 2022). The industry relies significantly on the ability of individuals rather than machines. Therefore, all employees, technicians, and engineers on the job site are essential to completing tasks and overseeing the job properly (Gamil & Alhagar, 2020). A recent analysis of COVID-19 tests results of 730,000 construction workers revealed that 5.7% were asymptomatic, and 10.1% were found to have symptoms (Allan-Blitz et al., 2020). COVID-19 has affected a substantial number of workers, and that number will invariably increase. Although the BLS and OSHA compiled some early statistics, they are not yet publicly available. It is uncertain how many construction workers have been affected by COVID-19 and their willingness to get vaccinated. This study aims to investigate the severity of COVID-19 experienced by construction workers, explore the workers' vaccination rate, and explore workers' COVID-19 vaccination attitude.

Research Methodology

A two-step approach was adopted in this research for data collection and analysis, as presented in Figure 1.

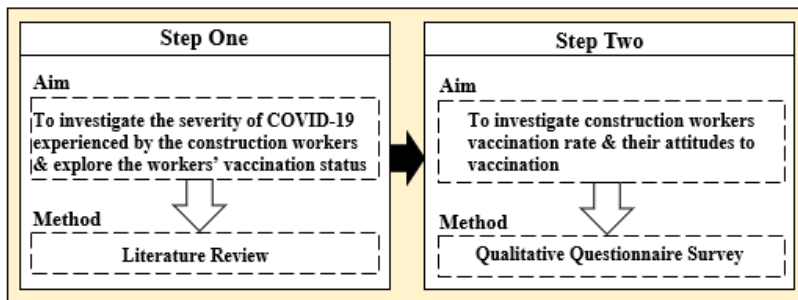


Figure 1. Adopted methodology

Step One: Literature Review

In this research, the authors conducted a literature review to gain a better understanding of COVID-19 (1) vaccination rate and (2) level of severity for the construction workforce. The approach used for the literature review for the study follows:

- 1) Database search engine: The database search was conducted using ASCE, Google Scholar, Tylor and Francis, Emerald Insight, and Science Direct.
- 2) Journal selection and keywords identification: the articles selected in the search included ASCE-Journal of Management in Engineering, ASCE-Journal of Construction Engineering and Management, Safety Science, and Analytic Methods in Accident Research. The keywords that were used for the search included COVID-19 pandemic, coronaviruses, workforce vaccination rate, and COVID-19 and construction safety. Preliminarily, 15 articles were qualified for literature review. Finally, 10 articles were reviewed in this literature. This study supplies an

overview of the COVID-19 immunization rate, severity, and hesitation among construction workers by presenting the facts in a descriptive way.

Step Two: Qualitative Questionnaire Survey

The authors developed a qualitative questionnaire survey (i.e., open-ended questionnaire) to investigate the construction workers' COVID-19 vaccination rate and attitude. The questionnaire was prepared and submitted to IRB for approval. This survey type did not supply predetermined answers as participants were asked to answer using their own responses. This helps keep the data exact by allowing the workers to respond in a genuine manner. The survey included nineteen questions and was grouped into two categories. No personal identifiers were used in the survey questionnaire. The category one of the survey was the demographic section, and the category two dealt with the COVID-19 contraction questionnaire. A sample of questions used in the survey is shown in Table 1.

Table 1.

Example questions for COVID-19 severity and vaccination acceptance.

Section	Example questions
COVID-19 contraction	“Q 2.15 Have you ever been tested positive with COVID-19?” “Q 2.16 How severe was your COVID-19 symptoms?” “Q 2.18 Have you received your COVID-19 vaccine?”

The survey was distributed to 44 construction workers in North Carolina state who were actively engaged in construction work during the COVID-19 pandemic. Participants were approached randomly at construction sites, and the study was conducted in person. The survey was conducted between the period of July 28, 2021, to October 15, 2021. Participants' demographic information age and years of experience are shown in Table 2.

Table 2

Demographic information of research participants.

Variable	Min	Max	Med	Avg
Age (years)	21	65	34.5	35.5
Experience (years)	0.25	36	10	11.6

Table 3 represents the type of projects where participants were actively engaged in and participants' work experience in another state. Participants worked on institutional and commercial buildings (39%) and residential buildings (32%).

Table 3

Surveyed projects' information

Type of Project	Number
Institutional and commercial building	17 (39%)
Residential building	14 (32%)

Other	6 (14%)
Infrastructure and heavy construction	4 (9%)
Specialized industrial construction	3 (7%)

Results and Discussion

The literature review and qualitative survey provided crucial information about Covid-19 severity, Vaccination status, and COVID-19 Vaccination attitude.

Literature Review

COVID-19 Severity Level

COVID-19 affects construction workers in a variety of ways. The experience is similar to being involved in a workplace accident. A worker who tests positive for COVID-19 may be absent from work for several days as part of the illness, and in some cases, recovery can take several months. The National Institutes of Health reported that patients with COVID-19 can have no symptoms of life-threatening illnesses (NIH, 2021). Table 4 illustrates how the severity of the disease is classified. COVID-19 cases and fatalities are reported throughout the country to the national surveillance network.

Nevertheless, there is a chance of underestimating the number of cases and deaths in the general population. Infections with COVID-19 disease symptoms, hospitalizations, and fatalities are likely to be underreported for assorted reasons. As an example, individuals with asymptomatic symptoms may not be detected. Furthermore, there is still no accurate assessment of the impacts of COVID-19 severity levels. As a result, COVID-19 may carry a more significant illness burden than reported due to underreporting (Angulo et al., 2021).

Table 4

COVID-19 Severity Classification adopted from (NIH, 2021).

Severity of Illness	Description of the Severity
Asymptomatic	People who are infected with COVID-19 yet do not show any
Mild Illness	People with COVID-19 symptoms such as fever, cough, sore throat, and malaise but no other signs or symptoms such as shortness of breath or dyspnea or abnormal chest x-rays, including loss of taste or smell.
Moderate Illness	People with oxygen saturation (SpO2) of 94% in room air at sea level and show lower respiratory ailment symptoms after a clinical evaluation or imaging.
Severe Illness	People who experienced an arterial partial pressure of oxygen to inspired oxygen fraction (PaO2/FiO2) ratios less than 94% on room air at sea level.
Critical Illness	People who have experienced Septic shock or multiple organ dysfunction with respiratory failure with COVID-19 symptoms.

The Centers for Disease Control and Prevention (CDC) uses statistical models to adjust for instances not captured by national surveillance networks, such as infections, hospitalizations, and fatalities (CDC, 2021b). Figure 2 illustrates the Percentage of COVID-19 conditions which the CDC reported across the U.S.

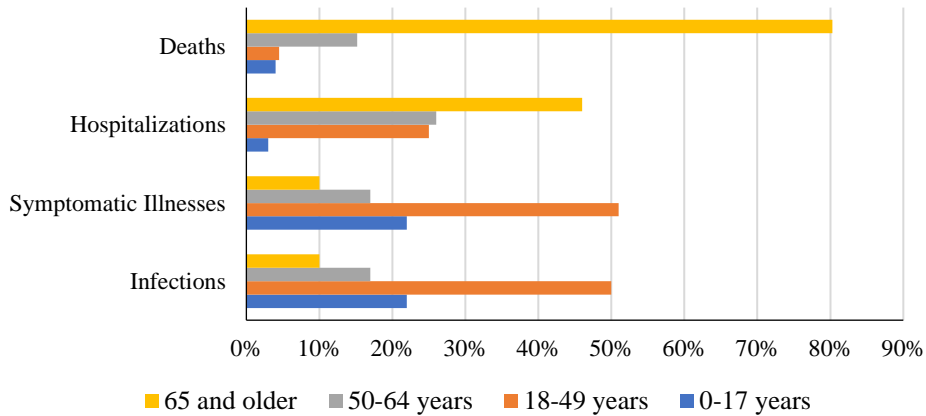


Figure 2. Percentage of reported COVID-19 infections, symptomatic illness, hospitalizations, and deaths, by age group from February 2020- May 2021(CDC, 2021b).

Vaccination Status

The COVID-19 vaccination is essential for ensuring safety and health in the construction industry. Unfortunately, only 53% of construction workers are vaccinated (CPWR, 2021). The United States has one of the lowest COVID-19 vaccination rates among the wealthiest nations (The New York Times, 2021). To encourage citizens to get vaccinated, some states have started to offer incentives such as gift cards or entries into a raffle (NGA, 2021). However, COVID-19 vaccination numbers remain lower than the government desires due to individual decisions by workers and employees. Superstitious beliefs are also traced back to a negative attitude towards safety (Namian et al., 2020). In addition, the Center for Construction Research and Training (CPWR) collects weekly information on the barriers to COVID-19 vaccination and vaccination hesitancy in all other occupations and construction (see Figures 3 and 4).

According to the COVID-19 vaccination dashboard, construction workers are not receiving the COVID-19 vaccine for three main reasons (CPWR, 2021a): distrust of government, vaccination inefficacy, and vaccination side effects. According to their data, as of September 2021, 60.1% of the workers distrust the government, 56% of workers are still hesitating about the vaccine's side effects, and 30.4% of workers think the vaccine is ineffective; the total percent of hesitant in construction was 41.8% which is 25.2% higher than all other occupations in the U.S. (CPWR, 2021 a).

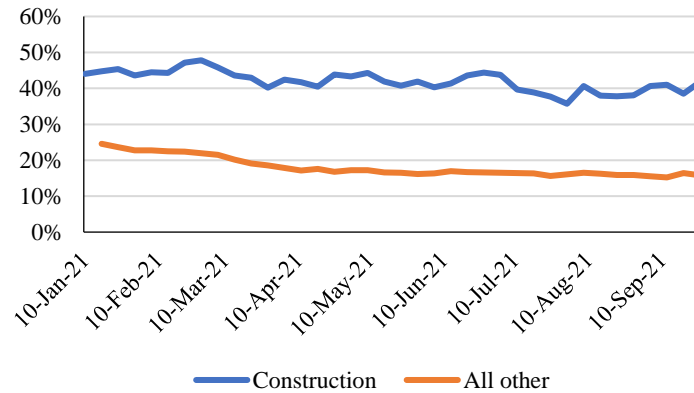


Figure 3. Vaccination hesitancy in construction and all other industries adopted from (CPWR, 2021a).

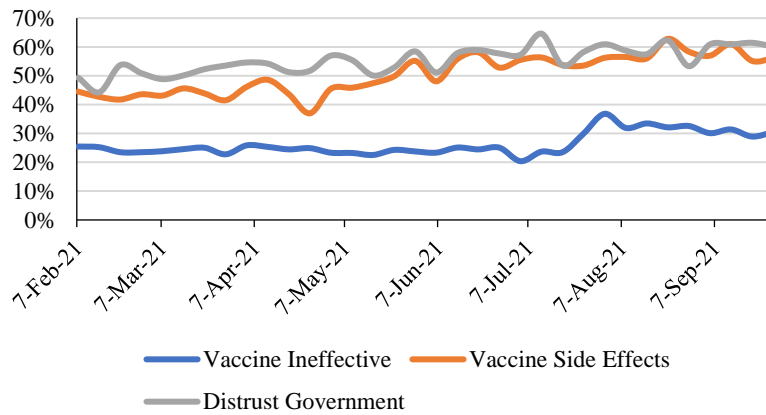


Figure 4 Common obstacles to immunization adopted from (CPWR, 2021a).

COVID-19 Vaccination Attitude

The results of this investigation showed that over half of the construction workers were already vaccinated. The study showed 57% of workers were vaccinated, and 43% of workers were unvaccinated. Additionally, participants who did not receive vaccinations were asked about their willingness to receive vaccinations. Of these participants, 41% expressed a refusal to get vaccinated, while only 2% expressed a willingness to get vaccinated (see Figure 5). Only 14% of the workers tested positive, despite other research studies suggesting a higher COVID-19 positivity rate among construction workers (see Figure 6). Furthermore, participants were asked to assess the severity of COVID-19 that they had experienced. There were 5% of workers who reported no symptoms, 2% reported mild symptoms, 5% reported moderate symptoms, and 2% reported severe symptoms (see Figure 6).

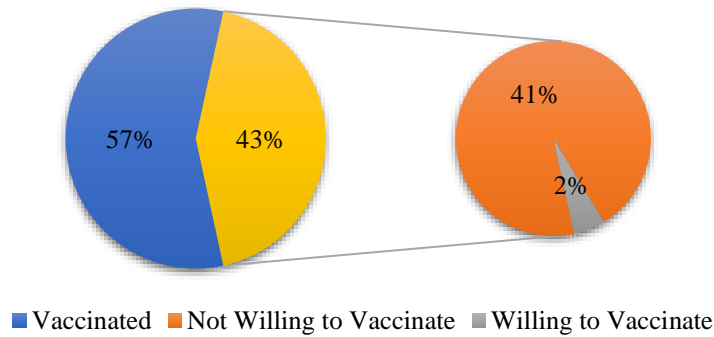


Figure 5. Vaccination and hesitancy status among construction workers.

Lack of safety training might be the reason behind the worker's unwillingness to get COVID-19 vaccine.

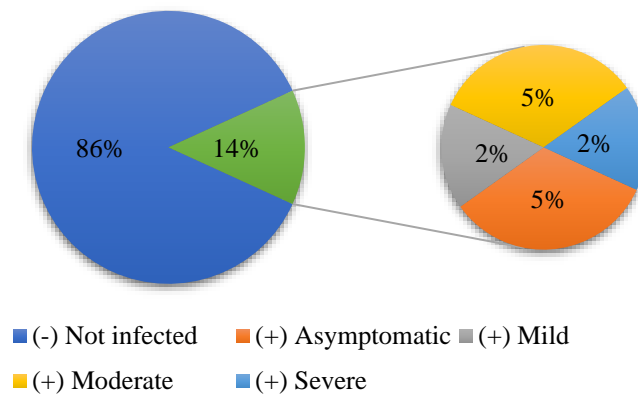


Figure 6. COVID-19 infection among construction workers.

Conclusions

The construction industry is a hazardous industry due to its unique nature. Injuries, sickness, and even death can happen to construction workers at any time. Unfortunately, COVID-19 has made construction workers more susceptible to injury, disease, and death due to the pandemic. The authors investigated the severity of COVID-19 experienced by the construction workers and explored the workers' vaccination rates. The authors used a two-step research method using literature review and qualitative questionnaire survey with 44 construction workers in North Carolina, United States. The results in our study showed that the vaccination rate in North Carolina is 4% higher than the national average reported vaccination rate for construction workers. 14% of the participants mentioned they had been COVID-19 positive during the pandemic. Our study implies that construction workers might have been cautious about COVID-19 at the workplace and followed preventive measures, which is why COVID-19 did not infect 86% of workers. On the other hand, the unwillingness of unvaccinated construction workers to receive vaccines is alarming for construction researchers and practitioners.

This study found that of the 43% of unvaccinated workers, 41% are not willing to get vaccinated. This may happen due to the disbelief about the COVID-19 vaccines or lack of knowledge about vaccines and their efficacy.

According to the OSHA COVID-19 Emergency Temporary Standard (ETS) on Vaccination and Testing, it is a requirement for employers to create, implement, and enforce a formal policy for mandatory vaccinations. Therefore, this study will help OSHA's mandatory vaccination policy implementers to get an idea about the worker's attitude towards the vaccination. The results show an urge to take practical actions to alter the construction workers' safety attitude to accept vaccines. This study illustrates the post-pandemic situation faced by workers in the construction industry. In addition, the findings of this study aim to provide government agencies and organizations with a clear picture of the post-pandemic COVID-19 vaccination scenario among unvaccinated construction workers.

Limitations

Despite its merits, this study has some limitations. Although the research collects crucial facts about the vaccination, acceptance rate, and severity of the COVID-19 pandemic in the construction industry, this study's sample size was small. The study may have missed a significant scenario of immunization, acceptability of vaccination, and severity of COVID-19 among construction workers due to various causes. In addition, because of the exploratory character of the study, the vaccination rate, acceptance rate, and severity of COVID-19 were only captured by the participants, who may not reflect the industry. Second, all surveyed workers were in North Carolina. Different states have different vaccination and acceptance rates. For example, the vaccination rate in North Carolina, published by the center for construction research and training, is 57% (CPWR, 2021a). In the study, the vaccination rate is the same as CPWR reported rate. It might happen due to the location we have conducted the study. Another reason for this could be the smaller sample size.

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