# Safety and Health Implications of COVID-19 on the United States Construction Industry

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**Abstract:** The construction industry is an essential U.S. business sector, yet it suffers from an elevated risk for work-related fatalities and injuries. The COVID-19 pandemic has only exacerbated this risk, as well as shone a light on the severe economic/financial/labor burdens and safety/health concerns the sector has faced. As such, the purpose of this review paper is to synthesize the safety and health issues associated with COVID-19 pandemic in the construction industry, and summarize the challenges and opportunities for construction stakeholders in implementing COVID-19 safety and health measures in the construction industry. This paper has explored the challenges in construction and COVID-19; COVID-19 knowledge, preventative behaviors, and risk perception among construction workers; recommendations/practical implications/preventive measures; and COVID-19 education in compliance/guidance, strategies to combat impacts of COVID-19 pandemic, smart digital technologies, and worker wellbeing and work-related quality of life (e.g., mental health). It is warranted that the construction industry needs to take better steps in preparing for future, man-made or natural disaster events, and subsequent acute and chronic disease risk, in order to yield a healthier and safer construction workplace.

*Keywords:* Covid-19, Safety, Health, Construction industry, Vulnerable workers

## 1. Introduction

The construction industry is one of the most vital U.S. industries for the national development, consisting of subsectors of construction buildings, heavy and civil engineering construction, and specialty trade contractors, employing approximately 7.4 million workforce (U.S. BLS, 2021). Regrettably, the construction industry is also one of the most dangerous and high-risk industries, as the fatality rate in construction has recorded a 6% increase in 2019 to 1,066 which is the highest number since 2007 (U.S. BLS, 2020). The U.S. construction sector has been adversely impacted by the COVID-19 pandemic (CPWR, 2020). For instance, in the early stage of COVID-19 pandemic in 2020, a significant number of construction workers reportedly tested positive for COVID-19 (Alsharef et al., 2021; Allan-Blitz et al., 2020), and the risk of COVID-19 infections among construction workers were about *five time* more likely to be hospitalized as a result of COVID-19 then workers in other industries (Pasco et al., 2020, *emphasis added*). According to the CDC's COVID Data Tracker (February 24, 2021), the U.S. COVID-19 total cases were over 28 million and the total deaths were 501,181. The coronavirus disease also known as COVID-19 is caused by the virus named severe acute respiratory syndrome coronavirus 2 (i.e., SARS-CoV-2) (WHO, 2021). The coronavirus is confirmed as being transmitted from human to human and results in symptoms including fever, dry cough, fatigue, and shortness of breath (CDC, 2021). The CDC webpage (cdc.gov/coronavirus/2019-ncov/community/organizations/construction-workers.html) on *What Construction Workers Need to Know about COVID-19* stated that, "recent studies indicate that the virus can be spread by people who are not showing symptoms. Older adults and people of any age who have serous underlying medical conditions may be at higher risk of severe illness from COVID-19" (CDC, 2021, np). In the COVID-19 pandemic era, the U.S. construction businesses (CPWR, 2020) and other countries (Denny-Smith et al., 2021; Al Amri & Marey-Perez, 2020; Esa et al., 2020) have been experiencing their economic slowdowns, financial and labor burdens associated with the project delays, cost escalations,


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lack of supplies, and worker's safety and health problems (Kaushal & Najafi, 2021). CPWR-The Center for Construction Research and Training (2020) reported on the economic impacts to the U.S. construction industry that nearly one million construction workers became unemployed from March to April 2020, and also the unemployment rate in construction has been increasing from 6.8% in October 2020 to 9.4% in January 2021 (U.S. BLS, 2021). Specifically, the U.S. job loss figure among Hispanic construction workers was higher than non-Hispanic workers, and small (construction) businesses were more likely to report moderate negative effects (CPWR, 2020; Sorensen et al., 2007).

### 1.1 Objective

The purpose of this review paper is to synthesize the safety and health issues associated with the COVID-19 pandemic in the construction industry, and summarize the challenges and opportunities for the construction stakeholders in implementing COVID-19 safety and health measures in the construction industry.

## 2. Methods

The research team conducted a review of the scholarly peer-reviewed and grey literatures to identify current scientific findings on primary issues on COVID-19 in the construction industry (See Figure 1). We utilized the GreyNet International (2020) definition of grey literature in our search, which encompasses "*a field in library and Information science that deals with the production, distribution, and access to multiple document types produced on all levels of government, academics, business, and organization in electronic and print formats not controlled by commercial publishing*" (p. 1). Grey literature includes, but is not limited to, documents such as reports, theses, conference proceedings, technical specifications and standards, technical and commercial documentation, as well as official documents not published commercially, e.g. government reports and documents (Alberani, 1990). These include sources like white papers and reports from government agencies, e.g., CDC, FDA, NIOSH, EPA, as well as construction-centric organizations and data sources, e.g., CPWR, Construction Dive, Dodge Data and Analytics. Scholarly peer reviewed sources were identified using the following databases- Google Scholar, Global Health, Proquest, and SafetyLit. We searched these two categories of literature using the following keywords in the search: *COVID-19, SARS-CoV-2, construction worker, health literacy, pandemic, risk perception, safety, and vulnerable populations*. COVID specific sources encompassed the period of December 2019 (when health officials in Wuhan, Hubei, China first reported cases of the SARS-CoV-2 virus) to March 2021. We only included sources prior to this date to build the background on general safety issues within the industry.


Figure 1. Literature and Resource Search Strategy

Utilizing the findings of our search, we then summarized the general and COVID-19 specific challenges that exist in the construction industry, and how COVID-19 knowledge, preventive behaviors, and risk perception come into play


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concerning construction workers. We then conclude with COVID-19 recommendations for the industry, including essential and underserved workers e.g., gender/ethnicity minority groups.

## 3. Challenges in Construction and COVID-19

Numerous studies have highlighted how the construction industry is rapidly changing and dealing with a variety of issues. As noted in Figure 2, this includes a mobile and transient workforce, aging workers and entrance of "Gen Z" into the workplace, technological modernization, improving efficiency, and use of sustainability and renewable products (Ayodele et al., 2020; Brown, 2019; Rodriguez, 2019; Choi et al., 2018; Heigl, 2018; Zidan et al., 2013). In addition to these challenges, there are ever-present safety, health and well-being concerns that have stretched construction company resources long before the pandemic hit the U.S. in early 2020. Physical, chemical, ergonomic and other safety hazards highlights the inherent danger of the construction industry (Helander, 1991; Wang et al., 2017), reflected in the highest rate of fatalities among risky professions (U.S. BLS, 2019). Many of these issues have only risen to a salient level among the public due media highlighting the importance of protecting essential and underserved workers to ensure the economic survival of businesses. Yet, the reality is that this also requires a dialog between employers, safety professionals, and the healthcare sector, including behavioral (mental) health resources for those at most risk for infection and early death. For example, supply chain issues were considerable in terms of the supply of (or lack thereof) of building materials and personal protective equipment (PPE) for the construction workforce, mirroring other industry challenges and shortages across the U.S. and globally. This included a shortage of masks/face coverings, N95 respirators, protective gloves and hand sanitizer. Additionally, there remains continued confusion over the regulatory requirements for PPE that differ according to mask/face covering use, versus that of a conventional respirator. Outside of local or state ordinances requiring use, a mask/face covering has no regulatory requirements, whereas the use of N95s, ½ face, PPAR or other respirators require a written respiratory protection program, exposure assessment of the workforce, fit testing and other protocols per applicable OSHA regulations for respiratory protection (29 CFR 1910.134).

This potential for a lack of compliance, compounded with potential confusion concerning use or reuse of PPE is a concern. When combined with conflicting information on when and where to social (physical) distance, create work barriers, identify symptomatic coworkers, or employees who potentially came in contact with a confirmed case, it's unsurprising that rates of SARS-CoV-2 infection and COVID-19 disease are higher in the construction workforce than many other occupations. This is particularly evident among racial and ethnic minorities, as well as overall impact on the industry (Allan-Blitz et al., 2020; Bui et al., 2020; Brown et al., 2020).

This increased risk for infection and COVID-19 disease takes place in a profession that is inherently dangerous, despite extensive guidance from governmental agencies such as the U.S. Department of Labor (www.osha.gov) and the U.S. Centers for Disease Control and Prevention (www.cdc.gov), as well as research training centers such as the Center for Construction Research and Training (www.cpwr.com). Guidance includes important procedures for reducing transmission risk among workers (e.g., safe handwashing/hand sanitizer practices, sanitizing construction materials/tools/equipment, and installation of shields or barriers). Implementing these procedures is predicated upon conducting a workplace hazard assessment that identifies the hazards present in the potential multiple work settings of a construction site. When implementing these procedures the construction work setting is a dynamic, ever-changing environment. Many employees share tools and equipment, car/truck pool or take public transportation to the worksite, and engage in many activities that may increase transmission risk. Still, safety procedures can work, contingent upon careful employer planning, education and employee buy in of the respective measures needed to protect the workforce.



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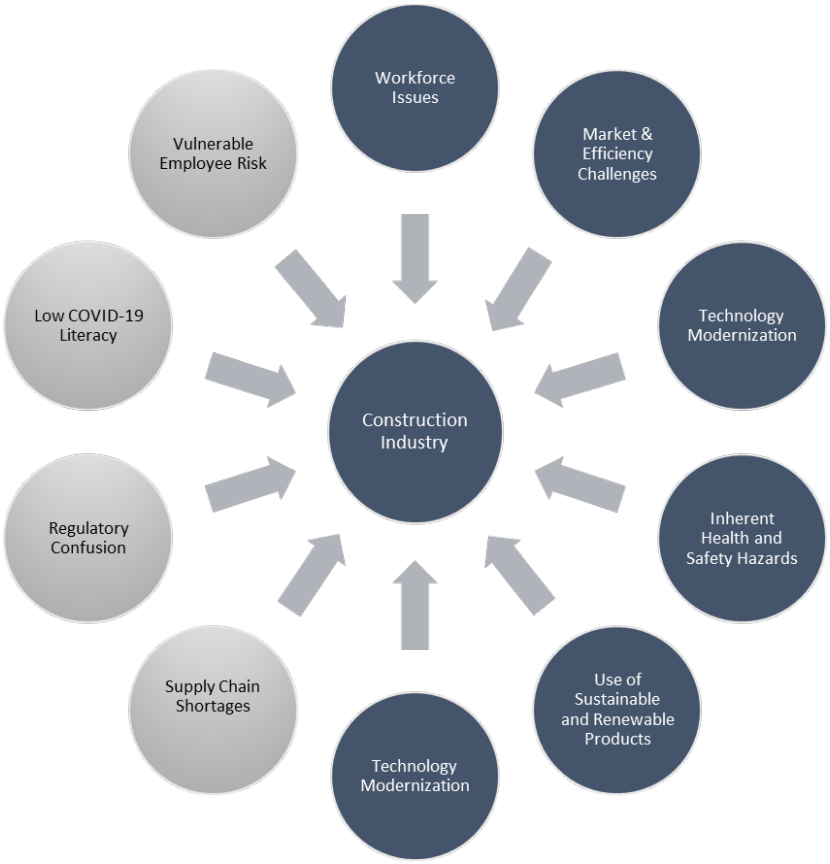


Note: Dark circles denote existing challenges in the industry, while gray circles denote challenges exacerbated by COVID-19

Figure 2. Construction Industry Challenges Before and During COVID-19

## 4. COVID-19 Knowledge, Preventive Behaviors, and Risk Perception

An important component of a COVID-19 protection plan is to educate workers with information on the most current science and protective practices to reduce disease spread. A starting point is identifying the baseline level of COVID-19 knowledge and perceived risk among the construction workforce. For the purpose of this paper, we define workplace safety literacy as *having the skills to complete job tasks safely, including a recognition of established hazards, and the level of measures needed to protect oneself on the job, e.g., safe practices, personal protective equipment use, etc.* In turn, workplace COVID-19 literacy would align with this definition, but also include *the specific measures needed to reduce or prevent infection among oneself, or his/her co-workers*. In the construction industry, research has found that levels of workplace safety literacy and risk perception (and likelihood of injury) are influenced by factors such as safety training, hazard recognition, risk-taking behaviors, attitudes, and the dynamic nature of the profession (Namian et al., 2016; Gunduz & Ahsan, 2018; Pandit et al., 2019; Loosemore & Malouf, 2019; Uddin et al., 2020). In the United States, this issue should be a particular concern for protecting ethnic minorities, e.g., Hispanic and LatinX workers. This occupational group often holds many low/unskilled, high-risk construction jobs, and suffer a higher risk of occupational injury and death when compared to the Non-Hispanic workforce (NIOSH, 2015; Al-Bayati et al., 2016; Velasco-Mondragon et al., 2016; Moyce & Schenker, 2018). This is compounded by the challenge of workers who may speak little or no English, and lack the communicative skills for discussing and recognizing COVID-19 risk in the construction workplace.

In terms of workplace COVID-19 literacy, risk perception (perceived or actual), and the likelihood of infection, evidence from a construction industry perspective is limited. Most research has focused on 1) front-line health care workers, and 2) vulnerable individuals most at risk for severe COVID-19 disease. In terms of front-line health care workers, international researchers were quick to study risk factors and disease of workers outside the United States (Peres et al., 2020; De Leo et al., 2021; Karasneh et al., 2021; Lam et al., 2020). Similarly, research on COVID-19 knowledge and perceived risk in construction


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workers has focused primarily on workers outside the United States. Yet, this research provides important insights into these issues. Zheng, Chen and Ma (2021) found that Chinese construction workers had the correct knowledge about COVID-19, but lacked clear understanding of virus transmission. Lan et al. (2020) found construction laborers had a higher risk of work-related transmission, and other studies found issues with lack of COVID-19 spread and lack of compliance with protective measures to reduce disease spread.

Be it within or outside the construction workforce, a key concern we gleaned from our study is the risk among vulnerable populations. Vulnerable workers are more likely to have lower health literacy and perceived risk of infection, particular vulnerable, racial and ethnic minorities and people living in poverty (Bailey et al., 2020; Block et al., 2020; McCaffery et al., 2020; Wolf et al., 2020). Factors like age, race/ethnicity, income, and comorbidities such as asthma, heart disease, obesity and diabetes place vulnerable populations at increased risk for COVID-19 disease complications (Cuschieri & Grech, 2020; Dennison Himmelfarb & Baptiste, 2020; Raifman & Raifman, 2020). Therefore, it is important that this be a focal point for key, construction industry stakeholders, including researchers, occupational safety and health professionals, and labor organizations. Nearly 60% of the construction workforce has at least one risk factor that makes them vulnerable for severe illness from COVID-19, including older age, racial and/or ethnic minorities, comorbidities, and smoking and e-cigarette use (Brown, Brooks, & Dong, 2020). Construction workers are also more likely to be hospitalized for COVID-19 as compared to other non-construction occupations (Pasco et al., 2020). COVID-19 knowledge and perceived risk among the construction workforce, particularly among those at most risk for illness or death is a critical issue now, but also when considering emerging, more infectious variants of the SARS-CoV-2 virus, as well as preparing for future disaster/emergency events. Future studies must better determine the full spectrum of knowledge, attitudes, and perceived risk among the construction workforce, particularly those at most risk for illness, to assist employers with targeted education for these workers.

## 5. Recommendations

### 5.1 Practical Implementation and Preventive Measures

COVID-19 researchers and practitioners are constantly learning new things about the SARS-CoV-2 virus. This includes mode of transmission, particularly with new, emerging virus variants. Early in the pandemic, there was considerable concern about spread of the virus via contaminated fomites (e.g., countertops, desks, door knobs), but this focus shifted primarily to contact and droplet transmission, and most recently, airborne transmission. Therefore, it is important that construction industry employers (and vendors) frequently check key resource sites for updates on virus transmission, identify current data on the best personal protective equipment and disinfection practices, and new information they should share with their employees. Employers should be particularly mindful of local and state mandates for when/if masks and face coverings are required, or quarantine and work closure is required in local communities, e.g., refer to the CDC's *"Construction COVID-19 Checklists for Employers and Employees"* (cdc.gov/coronavirus/2019-ncov/community/organizations/construction-worker-checklists.html). Additional consideration should be the variability in how essential workers and activities differ across counties and states and what additional safety requirements exist. If possible, employers should perform a task-based risk assessment to determine which employees are at highest risk. Important factors in this regards include if work occurs in close proximity to other workers, if workers fall within a high-risk group, or if work takes place in an area without good airflow. They may need to put in place additional engineering/redesign (barriers, ventilation) or administrative controls (social or 6 feet of "physical distancing", shift changes, reducing the time in an area with poor air flow, and reducing the number of employees in confined areas).

As such, if the employer does not already have a workplace exposure plan in place, they should create a plan that outlines key roles and responsibilities for ensuring a safe worksite (and as appropriate, multiple worksites). As a starting point, the employer should identify a gatekeeper- an individual that keeps abreast with new updates or information, monitors the spread of COVID-19 among the community and employees, and acts as the check in person and whom restricts access for vendors, contractors, and visitors to the worksite. It may be the organization's occupational safety and health professional, a site supervisor, or another trusted member of the leadership team. This person ensures that all who enter the construction worksite are wearing masks or face coverings (and doing so correctly) and know the rules of the site, e.g., practice physical distancing, washing hands, and how and where to access hand sanitizer and extra masks if needed. This person is also the site's "mythbuster" to combat misinformation with clear, concise, accurate information. The workplace exposure plan must also detail how the employer will handle employees who develop COVID-19 symptoms or have a potential exposure to a person with COVID-19. The plan should include education in plain language for employees, and in Spanish or other languages when applicable to the workforce.


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## 5.2 COVID-19 Education: Moving the Needle Forward

There are many resources available and easily accessible for construction employers to develop and provide education on SARS-CoV-2 spread, risk of exposure, and reducing transmission in the workplace. Despite how quickly the data on the virus is changing, one thing is clear- the best way to prevent spread is proper wearing of masks or face coverings. Additionally, there are now multiple vaccine options approved for emergency use by the U.S. Food and Drug Administration to reduce the likelihood of severe COVID-19 disease (FDA, 2021). However, as concerns and misinformation regarding vaccine safety and other protective measures continue to spread, it is important for employers to hold frequent "toolbox talks" on control measures like proper mask use, good hand hygiene, not sharing equipment, and vaccination. Additional education should include guidance if work necessitates shared equipment use among workers or across shifts, such as proper tool and equipment wipe down before and after use with an EPA List N approved disinfectant (U.S. EPA, 2021). Toolbox talks should also include education on proper hand washing, and employers should provide 60% ethanol or 70% isopropyl alcohol in vehicles and workstations. Employees may require frequent reminders to create a COVID-19 safety culture for these important measures, including social, or rather, physical distancing whenever possible. Resources should be provided in languages as applicable to the workforce.

As noted in Table 1, important education topics include an overview of applicable U.S. Occupational Safety and Health Administration (OSHA) regulations in the time of a pandemic. While individual states may have slightly different requirements based on state mandates, all normal construction safety requirements per OSHA regulations are in effect for personal protective equipment (29 CFR 1926 Subpart E), including a formal written program when respirators are used per 29 CFR 1910.134. Applicable OSHA regulations are also in play for typical construction activities, e.g., fall protection, confined space activities, etc. per 29 CFR 1910 and 29 CFR 1926, as well as OSHA reporting requirements for certain work-related injuries and illnesses on the OSHA 300 log (29 CFR Part 1904). It is also important that construction employers remember that the General Duty Clause of the OSH Act is always in effect. The General Duty Clause requires employers to provide a workplace to all workers that is "free from recognized hazards that are causing or are likely to cause death or serious physical harm" (Occupational Safety and Health Administration [OSHA], 1970). Additionally, recent changes per President Biden's Executive Order on Protecting Worker Health and Safety on (EO 14014, 2021) requires OSHA to take additional measures during the pandemic. This includes providing workplaces revised guidance on workplace safety, reviewing their own internal enforcement efforts, and in particular, focusing on COVID-19 violations that put the largest number of employees at risk for contracting COVID-19.

Table 1. Key education topics and resources for pandemic planning in construction projects

| Education Topic | Organization | Item | Resources |
|---|---|---|---|
| Safety Compliance and Guidance | U.S. OSHA | Personal Protective Equipment (PPE) - Written program when respirators are used per "respiratory protection": 29 CFR 1910.134 | OSHA: 29 CFR 1926 Subpart E |
| | U.S. OSHA | Fall protection Written program | OSHA: 29 CFR 1926 Subpart M |
| | U.S. OSHA | Confined space Written program | OSHA: 29 CFR 1926 Subpart AA |
| | U.S. OSHA | General Duty Clause | OSHA: SEC. 5. Duties |
| | U.S. The White House (WH) | Executive Order (EO) | WH: EO 14014, 2021 |
| | U.S. Small Business Administration (SBA) | Paycheck Protection Program, part of the Coronavirus Aid, Relief, and Economic Security Act, and the Paycheck Protection Program and Health Care Enhancement Act | SBA: Coronavirus Relief Options |
| Mitigation and Prevention Strategies to combat impacts of COVID-19 pandemic | U.S. CDC | Social distancing - To practice social or physical distancing, stay at least 6 feet (about 2 arm lengths) from other people who are not from your household in both indoor and outdoor spaces | CDC: Social Distancing |


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| Education Topic | Organization | Item | Resources |
|---|---|---|---|
| | U.S. CDC | Use of face masks -Wearing cloth face coverings in public settings where other social distancing measures are difficult to maintain, especially in areas where there is significant community-based transmission of COVID-19. | CDC: Use Masks to Slow the Spread of COVID-19 |
| | U.S. CDC | Personal cleanliness and sanitization - Everyday Steps, Steps When Someone is Sick, and Considerations for Employers | CDC: Cleaning and Disinfecting Your Facility |
| | U.S. CDC | Ventilation in buildings - SARS-CoV-2 viral particles spread between people more readily indoors than outdoors. When outdoors, the concentration of viral particles rapidly reduces with the wind, even a very light wind. When indoors, ventilation mitigation strategies help to offset the absence of natural wind and reduce the concentration of viral particles in the indoor air. | CDC: Ventilation in Buildings |
| | U.S. OSHA | Devising mitigation measures in construction projects | OSHA: COVID-19 Guidance for Construction Workers |
| | U.S. OSHA | Implementing the Hierarchy of Controls to Reduce COVID-19 Risk in Construction | OSHA: Construction Work |
| | Construction Industry Safety Coalition (CISC) | Devising mitigation measures in construction projects | CISC: Recommendations: COVID-19 Exposure Prevention, Preparedness, and Response Plan for Construction |
| | Association of General Contractors (AGC) | Devising mitigation measures in construction projects | AGC: Coronavirus (COVID-19) |
| | CPWR – The Center for Construction Research and Training | Contact tracing in construction | CPWR-NIOSH COVID-19 Series |
| | CPWR – The Center for Construction Research and Training | COVID-19 Vaccine Resources for Construction | CPWR: COVID-19 Vaccine Resources for Construction |
| | CDC- National Institute for Occupational Safety and Health (NIOSH) | Mental Health in the Construction Industry | NIOSH: Under the Hard Hat |


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| Education Topic | Organization | Item | Resources |
|---|---|---|---|
| | MT Copeland | Working safely during COVID-19 in construction (includes mental health) | MT Copeland: COVID-19 Safety |
| Smart Digital Technologies | European Commission (EC) | Rapid/fast detection, Pre-screening and prevention | EC: Digital health technologies |
| | World Health Organization (WHO) | Digital technology for COVID-19 response | WHO: Digital Health Technical Advisory Group |
| | CDC - NIOSH | Digital technology for COVID-19 response | NIOSH The National Personal Protective Technology Laboratory (NPPTL) |
| Coping, Wellbeing and work-related quality of life | CDC - NIOSH | "Policies, programs, and practices that integrate protection from work-related safety and health hazards with promotion of injury and illness-prevention efforts to advance worker well-being" | NIOSH: Total Worker Health Program |

The construction industry, particularly small construction businesses, should also familiarize themselves with federal, state, and local programs that assist employers and employees, as eligibility may change. For example, the Families First Coronavirus Response Act (FFCRA), enacted March 18, 2020, required eligible public employers and some private employers with less than 500 employees to provide employee paid sick leave or expanded family and medical leave for COVID-19 related reasons. However, the act expired December 31, 2020 and no longer requires employers to provide such leave, yet the Consolidated Appropriations Act, effective December 27, 2020 continued employer tax credits for paid sick leave until March 31, 2021. Additional provisions exist per Federal law, such as the Paycheck Protection Program, part of the Coronavirus Aid, Relief, and Economic Security Act (2020), and the Paycheck Protection Program and Health Care Enhancement Act (2020) providing assistance to small businesses as well. Implementation is through the U.S. Small Business Administration (www.sba.gov). Additionally, it is important that the construction industry, both employers and employees, educate themselves on key, COVID-19 mitigation and prevention measures to ensure a workplace that is healthy and that can sustain operations. Table 1 provides a variety of resources on COVID-19 contact tracing, vaccines, smart digital technologies, and wellbeing resources utilizing U.S. NIOSH's Total Worker Health® approach (n.d.), "*that integrates protection from work-related safety and health hazards with promotion of injury and illness-prevention efforts to advance worker well-being*". The Total Worker Health® approach is particularly relevant today, given the high level of stress and anxiety felt in the industry, particularly among vulnerable workers.

## 6. Conclusion

The COVID-19 pandemic is a seminal event in U.S. history, not only in terms of impact on U.S. business sectors like the construction industry, but also as a stark reminder of the gaps in the U.S. pandemic response system concerning the risks faced by vulnerable populations during a disaster event. The pandemic has highlighted the all too frequent impact on worker mental health, as this issue is often forgotten or relegated to a "backseat" of importance during a disaster event. It is important for employers to validate employees concerns and fears regarding the COVID-19 pandemic, and provide readily available resources such as EAPs (Employee Assistance Programs) or information on mental health community resources. Additionally, this is a tricky yet important concern in professions traditionally dominated by men, where "keeping a stiff upper lip", "sucking it up", etc. are the cultural norm, and mental health is deemphasized. Though events like the COVID-19 pandemic affect all people during an event, this could be a more difficult time for women and racial/ethnic minorities to voice their concerns about job safety if they appear "weak" to their supervisor or coworkers. Mental health issues typically take place in tandem with substance and alcohol abuse; therefore, it is important for employers to hold toolbox talks on mental health and handling the stress, fear, and anxiety all people are dealing with to some degree. For example, talks could include finding work-life balance and activities outside of the workplace (fitness, family, faith, friends, etc.) for support.

Additionally, some countries have restricted construction industry activities during the pandemic (Al Amri & Marey-Perez, 2020; Esa et al., 2020), but this has not been common practice in the U.S. construction industry. It has varied across


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states in terms of when constructions workers are deemed "essential" and thereby continue business operations. Furthermore, lack of understanding among policymakers in terms of what makes some work "essential", and others not (Storr et al., 2021) confuses both the workforce and public. Regardless, construction work cannot take place remotely. It takes place onsite, often in multiple locations and in close proximity to other workers who may be infected. Moreover, as the SARS-CoV-2 virus continues to spread aggressively across the United States, it will likely continue to be a chronic disease concern for some time (Del Rio, Collins, & Malani, 2020). Therefore, employers must take the steps to create a safe work environment and empower workers with the knowledge to protect themselves, their coworkers and families. This includes staying up-to-date on current best practices for reducing COVID-19 risk and developing a comprehensive workplace safety plan to mitigate risk. The construction workplace, as well as work in general, is rapidly changing amid new and emerging risks to safety, a healthy workforce, and business sustainability. In the World Economic Forum's recent report of the top 10 global risks in terms of potential impact (2019), spread of infectious disease is a significant concern in terms of fatalities and economic disruption (Asgary et al., 2020). Therefore, workplace planning must take this and other safety, health and wellbeing issues into consideration for today's construction workforce, particularly for vulnerable workers at most risk for illness and death.

One should note here that the scope of both our findings and recommendations are limited in that the SARS-CoV-2 virus is constantly changing, including our understanding of viral transmission. Additionally, practical evidence in terms of COVID-19 "literacy" and risk perception from a construction industry perspective is limited. Future studies should better examine how construction workers, particularly those within vulnerable groups, perceive COVID-19 risks and preparedness planning within the profession, as well as the necessary steps to reduce the impact of risk factors for disease in the construction industry.

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