Reported exposures among in-person workers with SARS-CoV-2 infection in 6 states, September 2020–June 2021

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Abstract:

Background

Surveillance systems lack detailed occupational exposure information from workers with SARS-CoV-2 infection. The National Institute for Occupational Safety and Health partnered with six states to collect information from adults diagnosed with SARS-CoV-2 infection (either COVID-19 or asymptomatic infection) who worked in person (outside the home) in non-healthcare settings during the two weeks prior to illness onset.

Methods

The survey captured demographic, medical, occupational characteristics, and work- and non-work-related risk factors for SARS-CoV-2 infection. Reported close contact with a person known or suspected to have COVID-19 was categorized by setting as: exposure at work, exposure outside of work only, or no known exposure/didn't know if they had exposures. Frequencies and percentages of exposure types are compared by respondent characteristics and risk factors for SARS-CoV-2 infection.

Results

Of 1,111 qualified respondents, 19.4% reported exposure at work, 23.4% reported exposure outside of work only, and 57.2% reported no known exposure/didn't know if they had exposures. Workers in protective service occupations (48.8%) and public administration industries (35.6%) reported exposure at work most often. Over a third (33.7%) of respondents who experienced close contact with ≥10 coworkers per day and 28.8% of respondents who experienced close contact with ≥10 customers/clients per day reported exposures at work.

Conclusions

Exposure to SARS-CoV-2 at work was common among respondents. Examining differences in exposures among different groups of workers can help identify populations with the greatest need for prevention interventions. The benefits of recording employment characteristics as standard demographic information will remain relevant as new and reemerging public health issues occur.

Keywords: occupational exposure, COVID-19 surveillance, SARS-CoV-2 infection

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Introduction

SARS-CoV-2, the virus that causes Coronavirus Disease 2019 (COVID-19), has considerably impacted worker health and safety in the United States [1]. While numerous employers moved to virtual environments or temporarily closed at the beginning of the pandemic, many workers were required to continue to work in close contact with co-workers and the public [2].

SARS-CoV-2 has several characteristics, such as presymptomatic and asymptomatic spread [3], that facilitate workplace transmission. A study during the early phase of the COVID-19 pandemic in Colorado found that 47 of 99 (47%) case-patients with known infected contacts reported exposure in workplaces [4]. Seroprevalence studies show that workers with in-person, public facing jobs are more likely than those who do not work away from home to test positive for SARS-CoV-2 [5,6]. Public health reports regarding COVID-19 outbreaks in specific work settings have also highlighted the burden of COVID-19 among workers [7, 8].

Several epidemiologic studies have assessed occupational risks among healthcare personnel, but information available on occupational risks among non-healthcare workers is sparse [2,9,10,11,12]. US COVID-19 surveillance data were originally based on the standard COVID-19 Case Report Form, which collected limited occupational information [13]. The Bureau of Labor Statistics (BLS) Survey of Occupational Injuries and Illnesses (SOII) captures cases of COVID-19 that were attributed to work by employers, per Occupational Safety and Health Administration (OSHA) recordkeeping requirements. For 2020, the SOII estimated 390,000 cases of “other diseases due to viruses not elsewhere classified” (including COVID-19) resulting in days away from work in private industry [14]. Most of these cases (74%) occurred in the healthcare and social assistance industries. The SOII data should be interpreted with caution given its limitations, including incomplete representation of small businesses, potential for employer bias, and limited information about risk factors.

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A few states have published reports of COVID-19 incidence or mortality by industry and occupation [15,16,17,18,19]. Most of these states have not collected specific data about occupational exposures among workers with COVID-19. A Washington state study linked the occupations of workers with COVID-19 to general occupational exposure data from the Occupational Information Network (O*NET) and identified disease exposure and physical proximity at work as predictors of occupations common among workers with COVID-19, however the O*NET exposure data were collected prior to the COVID-19 pandemic and may not reflect work experiences during the pandemic [20].

To reduce gaps in our knowledge of occupational risk factors for SARS-CoV-2 infection (either COVID-19 or asymptomatic infection) among US workers, the National Institute for Occupational Safety and Health (NIOSH) partnered with six states to collect information from adults confirmed to have SARS-CoV-2 infection who worked outside the home in non-healthcare settings during the two weeks prior to illness onset. This study used data from the multi-state survey to identify known exposures to workers with SARS-CoV-2 infection by individual characteristics and potential risk factors. This study is unique because it includes data from multiple states and characterizes worker-reported SARS-CoV-2 exposures by both occupation and industry.

Methods

Study sample

California, Georgia, New Hampshire, North Carolina, Pennsylvania, and Wisconsin participated in this study. These states identified persons aged 18–64 years with SARS-CoV-2 infection confirmed by reverse transcription polymerase chain reaction (RT-PCR) test using state-level surveillance systems from September 2020–June 2021. Further eligibility criteria were assessed using a set of screening questions at the start of the survey. Study participants must have 1) worked outside the home during the two-

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week likely exposure period, defined as either 14 days before the date of symptom onset or if asymptomatic, the first positive test, and 2) not identified as healthcare personnel, where healthcare personnel were defined as "all paid and unpaid persons working in healthcare settings who have the potential for exposure to patients and/or to infectious materials."

Survey Content

The survey captured SARS-CoV-2 exposure settings; demographic, medical, and occupational characteristics; employer COVID-19 prevention policies and practices; and work- and non-work-related risk factors for SARS-CoV-2 exposure (See Appendix A for survey questions). State health department personnel conducted all survey calls and shared de-identified data with NIOSH for aggregation and analysis.* Only people who met the eligibility criteria were interviewed and proxy interviews with family were not used. Each state developed a sampling plan to account for state-specific data availability and needs (Appendix B). Standardized English and Spanish survey templates were available. Exposure(s) during the likely exposure period were asked for each reported job as: "During the 14-day period before you got sick (or had a positive test), did you have close contact with a person or persons at this job who you knew or thought had COVID-19?" Exposure(s) outside of work were asked as: "During the 14-day period before you got sick (or had a positive test), did you have close contact outside of the place where you worked with someone who you knew or thought had COVID-19?" Close contact was defined as 6 feet or closer for at least 15 minutes [21].

Demographic characteristics included age, sex assigned at birth, current gender, race, ethnicity, and education. Gender identity was identified via crosstabulation of sex assigned at birth and current gender as cisgender man, cisgender woman, transgender man, transgender woman, or none of these. Medical characteristics included COVID-19 symptoms and outcomes, underlying medical conditions, and health insurance coverage. Occupational characteristics included number of jobs, occupation (type of job),

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industry (type of business), number of hours worked per week, and work arrangement (e.g., permanent employee, contractor).

Occupation and industry were captured as narrative responses for each reported job and coded to standardized 2010 Census occupation codes (COCs) and 2012 Census industry codes (CICs) using the NIOSH Industry and Occupation Computerized Coding System (NIOCCS) [22]. COCs and CICs were grouped according to the National Health Interview Survey (NHIS) occupation and industry groupings [23]; NHIS groups with few survey respondents were collapsed into higher-level groupings for analyses. All analyses were conducted using the occupational characteristics and work-related risk factors reported for the primary job (job in which they work the most hours per week).

Respondents were asked about employer-implemented prevention measures to reduce workplace transmission of SARS-CoV-2 (e.g., social distancing, providing and enforcing masks, screening measures). The survey also included questions about potential risk factors for SARS-CoV-2 exposure inside and outside the workplace. Work-related risk factors included close contact with clients, customers, and coworkers during work. Non-work-related risk factors for SARS-CoV-2 infection included attendance at indoor and outdoor gatherings and travel during the likely exposure period.

Study Definitions and Statistical Methods

Reported exposures to persons known or suspected to have COVID-19 were classified by exposure setting among individual respondents as: 1) Exposure at work, meaning exposure to persons known or suspected to have COVID-19 inside the workplace (including those who also had known exposure outside the workplace); 2) Exposure outside of work only, meaning exposure only to persons known or suspected to have COVID-19 outside of work; and 3) No known exposure, meaning no exposure(s) to persons known or suspected to have COVID-19 or reporting not knowing if they had exposure(s) to

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persons with COVID-19. Frequencies and percentages of respondent demographic, medical, and occupational characteristics; occupation; industry; prevention practices; and risk factors for SARS-CoV-2 infection are compared across exposure settings. All analyses were conducted in R (version 4.0.2; The R Foundation).

Results

A total of 1,174 respondents participated in the survey from September 23, 2020–July 14, 2021 after excluding incomplete responses. This included 13 respondents who were interviewed in Spanish and 11 respondents who were interviewed in languages other than English or Spanish. We successively excluded respondents who were outside the ages of 18–64 years (N = 3), reported healthcare occupations or industries (N=22), and were missing responses to questions on known exposures at work and outside of work (N = 38). The final study sample included 1,111 non-healthcare workers diagnosed with SARS-CoV-2 infection. Demographic, medical, and occupational characteristics of the study sample are summarized in Table 1. Dates of symptom onset or positive test results ranged from September 23, 2020–June 21, 2021. The median age of respondents was 40 years (range 18–64), 52.4% identified as cisgender men, 55.4% identified as Non-Hispanic White, and 64.2% had more than a high school education. Most respondents (95.2%) reported having only one job, 87.0% worked as permanent employees in a standard work arrangement, and 77.9% worked full-time.

Most respondents (86.5%) had symptoms of COVID-19 that did not require hospitalization, 5.4% were hospitalized, and 8.0% were asymptomatic (Table 1). Overall, 40.1% of respondents reported one or more underlying condition—most commonly obesity (11.5%), diabetes mellitus (7.4%), or smoking (7.2%). Most respondents (84.2%) had health insurance coverage.

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Almost one fifth of respondents (19.4%) reported exposure to someone with COVID-19 at work, 23.4% reported exposure outside of work only, and 57.2% reported no known exposure (among whom 80.3% reported no exposures and 19.7% didn't know if they were exposed in one or both settings) (Table 1). The largest proportions of respondents reported exposure at work within the following populations: workers aged 25–44 years; workers who identified as neither cis- or transgender men or women; workers who identified as non-Hispanic multiple race; workers who had more than a high school education; and workers who were paid by a temporary agency or contractor (Table 1).

Among occupation groups, the largest proportions of respondents reported known workplace exposures in protective service (e.g., firefighting, law enforcement) and personal care and service (e.g., funeral service, personal appearance) occupations (48.8% and 30.8%, respectively) (Table 2). Among industry groups, the largest proportions of respondents reported known workplace exposures in public administration (e.g., justice, public order) and natural resources and utilities (e.g., agriculture, mining, utilities) industries (35.6% and 30.4%, respectively).

The most common employer COVID-19 prevention practices included providing hand sanitizer (89.3%), requiring employees to wear a face covering/mask (88.3%), and using enhanced cleaning/disinfection procedures (83.7%) (Table 3). Less than 1% of respondents reported that their employer did not implement any of the prevention strategies mentioned. The smallest proportions of respondents reported known workplace exposures in workplaces where employers changed or improved the ventilation system (15.6%), reassigned workers at increased risk for severe illness (16.4%), and put up physical barriers like plexiglass partitions or plastic curtains (16.6%). Employer prevention practices with the largest differences in reported exposures at work between respondents who reported the practice and those who did not included the following: requiring employees to wear face coverings/masks (18.2% and 28.5%, respectively) and implementing physical distancing (18.3% and 25.0%, respectively).

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Most respondents (87.5%) agreed or strongly agreed with the statement "Protecting employees from exposure to COVID-19 was a high priority with management where I worked"; 16.2% of respondents who agreed with this statement reported known exposures at work, compared with 41.6% of respondents who disagreed.

More than one third (33.7%) of respondents who experienced close contact with ≥10 coworkers per day and 28.8% of respondents who experienced close contact with ≥10 customers/clients per day reported exposures at work. Only 7.0% of respondents who did not experience close contact with any coworkers each day and 16.2% of respondents who did not experience close contact with any customers/clients each day reported exposures at work. Larger proportions of respondents who attended indoor and outdoor gatherings of >10 people during the exposure period reported only known exposures outside of work compared with respondents those who did not attend large gatherings (indoor: 29.0% and 21.4%, respectively and outdoor: 24.8% and 23.1%, respectively).

Discussion

Few studies have investigated specific risk factors for SARS-CoV-2 infection among those working in-person outside the home [5,6]. To the best of our knowledge, this is the first study to collect detailed information about occupational exposures and risk factors from US adults with SARS-CoV-2 infection employed in non-healthcare settings. Overall, almost one fifth of respondents in our survey reported known exposure to COVID-19 at work, almost one fourth reported known exposure outside of work only, and over half reported no known exposure to a person with COVID-19. Many respondents with no known exposures may have unknowingly had exposures at work, including exposures to people with asymptomatic SARS-CoV-2 infection. Knowledge of COVID-19 cases in a workplace may vary by occupation and other work-related characteristics. Presumably, workers may be less informed of COVID-

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19 among work contacts than among personal contacts. Many workers are in workplaces where they can be exposed by coworkers and customers or clients. Some research suggests that workers may be more likely to be exposed by coworkers when there is a lapse in precautions between coworkers over time [24]. While many employers notify employees when a coworker has tested positive for SARS-CoV-2, some employers do not and some workers may feel incentivized by employers to not report infection [25]. Additionally, employers do not usually know the health status of customers or clients. These conditions may have resulted in a conservative estimate of the proportion of workers with SARS-CoV-2 infection who were exposed at work. Considering that availability of SARS-CoV-2 testing was variable and that many persons with SARS-CoV-2 infection are asymptomatic, persons to whom workers were exposed may not have known their own status.

Respondents ages 25–44 years most frequently reported exposure at work, while respondents ages 18–24 years most frequently reported exposure outside of work. Younger workers may have taken fewer precautions in social situations due to lower perceived risk of COVID-19 severity and peer pressure [26]. The relatively high proportion of workers who were paid by temporary agencies or who worked as contractors who reported exposure at work is concerning. This group of workers is known to have fewer workplace protections than their permanently employed counterparts [27]. The relatively high proportions of workers who identified as neither cis- nor transgender men nor transgender women or who identified as non-Hispanic multiple race who reported exposure at work could signal that these groups also lack adequate workplace protections, but small subsamples within these populations make these results difficult to interpret. The Human Rights Campaign Foundation has highlighted the challenge of job-related risk among US LGBTQ population during the COVID-19 pandemic [28].

We found that workers in protective service and personal care and service occupations, as well as workers in public administration and natural resources and utilities industries, had higher reported proportions of known exposure at work. Many workers in these groups are required to work near

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coworkers and members of the public. These findings are consistent with prior analyses by occupation [29,30]. The worker characteristics of both occupation and industry are presented here; they represent type of job and type of business, respectively. These data are currently lacking from surveillance systems, and this is an actionable change that would improve our understanding of risks and help design prevention efforts. Further analyses are needed to examine specific worker populations.

Respondents who reported interacting with high volumes of coworkers and customers or clients more frequently reported known exposures at work than those with no close contact with coworkers and customers or clients. Jobs that require interacting with large volumes of people face-to-face might benefit from additional layered protective interventions, such as improved ventilation measures [31].

This study illustrates some of the challenges in identifying work-related SARS-CoV-2 infections among workers. Concurrent to when this study was performed, the Council of State and Territorial Epidemiologists (CSTE) Occupational Health Work Group developed an update to the standardized surveillance case definition for COVID-19 that addresses epidemiological classification of work-relatedness [32]. The CSTE classification is based on combinations of these factors: 1) work outside the home; 2) employment as a healthcare worker or work includes face-to face contact with the public; 3) being part of a cluster of COVID-19 illnesses among workers in a facility or having had contact with a co-worker, patient, resident, client, or customer classified as a confirmed or probable case; 4) no known contact with a confirmed or probable case outside the workplace. The present study incorporates some of these factors into the study definition of workplace exposure and provides support to the utility of the CSTE classification for use in surveillance.

Limitations

There are several limitations to this analysis. First, the study population was limited to workers diagnosed with SARS-CoV-2 infection who survived and no non-cases were surveyed for comparison.

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Second, less than half of the sample was aware of any close contact with persons with COVID-19 in any setting. The narrow definition of close contact used in the survey prevented some workers who thought they had contracted SARS-CoV-2 at work or who had been linked to a workplace cluster from being categorized as having a workplace exposure. We were unable to incorporate links to workplace clusters into our study definition of workplace exposure because links to clusters were not tracked by all participating states. Third, because of the diversity of participating states, there is inherent variation across their data. For example, testing methods (e.g., RT-PCR vs antigen tests) varied between states. We limited study eligibility to persons with SARS-CoV-2 infection confirmed by RT- PCR. Fourth, response rates and collection periods for the survey also varied among the states and not all states reported their final responses rates. Fifth, small numbers within some subgroups and convenience sampling methods preclude these data from being representative of the general population. Since this is a descriptive study with convenience sampling and not a probability-based sample, statistical testing was not performed. Sixth, risks associated with non-primary jobs were not captured in this analysis. Seventh, questions about COVID-19 vaccination status were not included in the survey, which was designed before COVID-19 vaccinations became available. Eighth, the occupational and community exposure data are self-reported and subject to potential social acceptability bias and recall bias. Finally, the study was conducted before the highly infectious delta variant emerged and when vaccination rates were low.

Conclusions

This study provides information on non-healthcare workers who contracted SARS-CoV-2, many of whom had in-person contact with coworkers and clients/customers and provided essential services. Elevated workplace exposure prevalence among some worker populations suggests that more workplace protections are needed. Further research and surveillance are needed to accurately describe patterns in SARS-CoV-2 exposure inside and outside of work both for those who have worked outside the home

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throughout the pandemic and those who have or will transition from remote work to in-person work. Such information would help identify US worker populations with the greatest need for prevention interventions. The benefits of recording employment characteristics (i.e., employment status, occupation, and industry) as standard demographic information for use in addressing social determinants of health will remain relevant as new and reemerging issues occur [33,34].

NOTES

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Footnotes:

*This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy.§

Publication Policy Disclaimer

The findings and conclusions in this article are those of the authors and do not necessarily represent the views or opinions of the Centers for Disease Control and Prevention, California Department of Public Health; Public Health Institute, Oakland, CA; Heluna Health, City of Industry, CA; Georgia Department of Public Health; New Hampshire Department of Health and Human Services; University of New Hampshire; North Carolina Department of Health and Human Services; Pennsylvania Department of Health; or Wisconsin Department of Health Services.

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Conflicts of Interest

NK reports participating in the CDC – Environmental Public Health Tracking Cooperative Agreement NUE1EH001357. KA reports funding from National Institute for Occupational Safety & Health (NIOSH) and participation in Cooperative Agreement 010910. They also report receiving funds from the Council for State and Territorial Epidemiologists (CSTE) for travel to attend the annual conference in June 2022. GD reports being employed by the North Carolina Department of Health and Human Services and their position and work were supported through funding by a cooperative grant agreement between NIOSH and NC DHHS: State Occupational Health and Safety Surveillance Program (U60) series. They also report being a paid full-time employee of CDC-NIOSH-WSD and performed manuscript peer review and methods consultation work. JW reports that their employment is supported by funding from the CDC Agreement 6 NU50CK000539. They also report receiving institutional funding from NIOSH. KG reports receiving institutional funding from NIOSH and an ELC grant through Cooperative Agreement 6 NU50CK000539. KG reports NIOSH Callback Survey Contract #75D30120P08814 and NIOSH NC Occupational Health and Surveillance Program Grant 2 U60OH010909-06-00. KKSM reports CDC grant Wisconsin Fundamental-Plus Occupational Health Surveillance Project Grant 6 U60OH010898-05-01. They also report two short term contracts 75D30121P10334 and 75D30121P11161 from the Worker's Compensation Program at CDC National Institute for Occupational Safety and Health. KJC reports receiving institutional funding for their institution, NIOSH. XV reports that their employment is supported by funding from the CDC through Cooperative Agreement 6 NU50CK000539. They also report being part of the Council of State and Territorial Epidemiologists Occupational Health Subcommittee Leadership Committee. SB, ARB, AL, HLC, GA, HF, HT, KE, LHM, MHS, RB, SL, and MRG have no conflicts to report.

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Table 1. Characteristics of survey respondents with SARS-CoV-2 infection who reported working outside the home in non-healthcare settings during the 14 days prior to symptom onset or diagnosis stratified by exposure status, 6 states[a], September 2020 to June 2021

Characteristic	N (% of sample[b])	No known exposure[c], N (%)	Exposure outside work only, N (%)	Exposure at work, N (%)
Total	1,111 (100.0)	636 (57.2)	260 (23.4)	215 (19.4)
Age group				
18-24 years	152 (13.8)	85 (55.9)	45 (29.6)	22 (14.5)
25-34 years	264 (24.0)	149 (56.4)	57 (21.6)	58 (22.0)
35-44 years	234 (21.3)	136 (58.1)	45 (19.2)	53 (22.6)
45-54 years	231 (21.0)	128 (55.4)	61 (26.4)	42 (18.2)
55-64 years	219 (19.9)	133 (60.7)	48 (21.9)	38 (17.4)
Gender identity[d]				
Cisgender man	573 (52.4)	316 (55.1)	140 (24.4)	117 (20.4)
Cisgender woman	449 (41.1)	253 (56.3)	111 (24.7)	85 (18.9)
Transgender man	27 (2.5)	24 (88.9)	1 (3.7)	2 (7.4)
Transgender woman	36 (3.3)	32 (88.9)	0 (0.0)	4 (11.1)
None of these	8 (0.7)	1 (12.5)	4 (50.0)	3 (37.5)
Race/Ethnicity				
Non-Hispanic White	607 (55.4)	334 (55.0)	150 (24.7)	123 (20.3)
Hispanic	263 (24.0)	148 (56.3)	64 (24.3)	51 (19.4)
Non-Hispanic Black	174 (15.9)	111 (63.8)	31 (17.8)	32 (18.4)
Non-Hispanic Asian	29 (2.6)	19 (65.5)	7 (24.1)	3 (10.3)
Non-Hispanic AIAN or NHOPI[e]	12 (1.1)	10 (83.3)	1 (8.3)	1 (8.3)
Non-Hispanic Multiple Races	11 (1.0)	5 (45.5)	3 (27.3)	3 (27.3)
Education				
Less than high school	73 (6.6)	47 (64.4)	15 (20.5)	11 (15.1)
High school or equivalent	320 (29.1)	195 (60.9)	77 (24.1)	48 (15.0)
Some college	383 (34.8)	212 (55.4)	82 (21.4)	89 (23.2)
Bachelor's degree or higher	323 (29.4)	174 (53.9)	83 (25.7)	66 (20.4)
Work more than one job				
No	1,055 (95.2)	601 (57.0)	247 (23.4)	207 (19.6)
Yes	53 (4.8)	32 (60.4)	13 (24.5)	8 (15.1)
Work full-time (35 hours/week) at primary job				
No	244 (22.1)	135 (55.3)	71 (29.1)	38 (15.6)
Yes	861 (77.9)	497 (57.7)	188 (21.8)	176 (20.4)
Work arrangement				
Self-employed business owner	80 (7.2)	46 (57.5)	22 (27.5)	12 (15.0)
Permanent employee	966 (87.0)	554 (57.3)	221 (22.9)	191 (19.8)
Paid by temporary agency or contractor	24 (2.2)	12 (50.0)	6 (25.0)	6 (25.0)
Independent contractor or freelancer	24 (2.2)	15 (62.5)	6 (25.0)	3 (12.5)
Other work arrangement	16 (1.4)	9 (56.2)	4 (25.0)	3 (18.8)
Health insurance coverage				

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No	172 (15.8)	99 (57.6)	47 (27.3)	26 (15.1)
Yes	920 (84.2)	524 (57.0)	211 (22.9)	185 (20.1)
SARS-CoV-2 outcomes				
No reported symptoms[f]	89 (8.0)	56 (62.9)	20 (22.5)	13 (14.6)
Symptomatic, not hospitalized	958 (86.5)	538 (56.2)	230 (24.0)	190 (19.8)
Hospitalized	60 (5.4)	40 (66.7)	8 (13.3)	12 (20.0)
Reported underlying medical condition(s)[g]				
No	641 (59.9)	369 (57.6)	157 (24.5)	115 (17.9)
Yes	430 (40.1)	244 (56.7)	97 (22.6)	89 (20.7)

[a]California, Georgia, New Hampshire, North Carolina, Pennsylvania, and Wisconsin

[b]Sample percentages are out of the total number of non-missing responses for each variable. Counts may not sum to the total.

[c]No known exposure includes individuals who reported no close contact with known or suspected COVID-19 cases and individuals who did not know if they had close contact with known or suspected COVID-19 cases. Close contact was defined as 6 feet or closer for at least 15 minutes.

[d]Gender identity was categorized by cross-tabulation of sex assigned at birth and current gender. Individuals whose current gender identity is the same as the sex they were assigned at birth were categorized as cisgender and individuals whose current gender identity differs from the sex they were assigned at birth were categorized as transgender. No respondent selected transgender as their current gender. Respondents who did not respond to either sex assigned at birth or current gender were excluded from frequencies and percentages by gender identity.

[e]American Indian or Alaskan Native (AIAN); Native Hawaiian or Other Pacific Islander (NHOPI).

[f]Symptoms queried included fever or chills, cough, shortness of breath or difficulty breathing, fatigue, muscle or body aches, headache, new loss of taste or smell, sore throat, congestion or runny nose, nausea or vomiting, diarrhea, and other symptoms.

[g]Underlying medical conditions queried included cancer, chronic kidney disease, chronic obstructive pulmonary disease, immunocompromised state from solid organ transplant, obesity, serious heart conditions, sickle cell disease, type 2 diabetes mellitus, pregnancy, current smoking status, and other chronic diseases.

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Table 2. Exposure settings by occupation and industry group for the primary job among survey respondents with SARS-CoV-2 infection who reported working outside the home in non-healthcare settings during the 14 days prior to symptom onset or diagnosis, 6 states[a], September 2020 to June 2021

Worker population	N (% of sample)[b]	No known exposure[c], N (%)	Exposure outside work only, N (%)	Exposure at work, N (%)
Total	1,111 (100.0)	636 (57.2)	260 (23.4)	215 (19.4)
Occupation group				
Building and grounds cleaning and maintenance	52 (4.7)	30 (57.7)	14 (26.9)	8 (15.4)
Business and financial operations	40 (3.6)	22 (55.0)	10 (25.0)	8 (20.0)
Computer, engineering, and science[d]	44 (4.0)	25 (56.8)	10 (22.7)	9 (20.5)
Education, training, and library	61 (5.5)	33 (54.1)	13 (21.3)	15 (24.6)
Food preparation and serving related	67 (6.0)	39 (58.2)	14 (20.9)	14 (20.9)
Installation, maintenance, and repair	44 (4.0)	28 (63.6)	10 (22.7)	6 (13.6)
Legal, community service, arts, and media[e]	30 (2.7)	14 (46.7)	12 (40.0)	4 (13.3)
Management	109 (9.8)	63 (57.8)	29 (26.6)	17 (15.6)
Natural resources and construction[f]	85 (7.7)	55 (64.7)	19 (22.4)	11 (12.9)
Office and administrative support	138 (12.4)	82 (59.4)	34 (24.6)	22 (15.9)
Personal care and service	39 (3.5)	17 (43.6)	10 (25.6)	12 (30.8)
Production	95 (8.6)	56 (58.9)	17 (17.9)	22 (23.2)
Protective service	41 (3.7)	15 (36.6)	6 (14.6)	20 (48.8)
Sales and related	125 (11.3)	68 (54.4)	37 (29.6)	20 (16.0)
Transportation and material moving	97 (8.7)	61 (62.9)	17 (17.5)	19 (19.6)
Military	13 (1.2)	9 (69.2)	2 (15.4)	2 (15.4)
Other/unknown	31 (2.8)	19 (61.3)	6 (19.4)	6 (19.4)
Industry group				
Accommodation, food, and entertainment[g]	134 (12.1)	74 (55.2)	35 (26.1)	25 (18.7)
Administrative, support, and waste services	39 (3.5)	16 (41.0)	15 (38.5)	8 (20.5)
Construction	112 (10.1)	74 (66.1)	25 (22.3)	13 (11.6)
Education and social assistance[h]	118 (10.6)	62 (52.5)	31 (26.3)	25 (21.2)
Information, finance, real estate, and professional services[i]	81 (7.3)	44 (54.3)	27 (33.3)	10 (12.3)
Manufacturing	165 (14.9)	95 (57.6)	34 (20.6)	36 (21.8)
Natural resources and utilities[j]	23 (2.1)	10 (43.5)	6 (26.1)	7 (30.4)
Other services (except public administration)	60 (5.4)	30 (50.0)	21 (35.0)	9 (15.0)
Public administration	59 (5.3)	31 (52.5)	7 (11.9)	21 (35.6)
Retail trade	143 (12.9)	85 (59.4)	32 (22.4)	26 (18.2)
Transportation and warehousing	92 (8.3)	60 (65.2)	14 (15.2)	18 (19.6)
Wholesale trade	43 (3.9)	24 (55.8)	8 (18.6)	11 (25.6)
Military	13 (1.2)	9 (69.2)	2 (15.4)	2 (15.4)
Other/unknown	29 (2.6)	22 (75.9)	3 (10.3)	4 (13.8)

[a]California, Georgia, New Hampshire, North Carolina, Pennsylvania, and Wisconsin

[b]Sample percentages are out of the total number of non-missing responses for each variable. Counts may not sum to the total.

[c]No known exposure includes individuals who reported no close contact with known or suspected COVID-19 cases and individuals who did not know if they had close contact with known or suspected COVID-19 cases. Close contact was defined as 6 feet or closer for at least 15 minutes.

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[d]Computer and mathematical, Architecture and engineering, and Life, physical, and social science occupation groups.
[e]Legal, Community and social services, and Arts, design, entertainment, sports, and media occupation groups.
[f]Farming, fishing, and forestry and Construction and extraction occupation groups.
[g]Arts, entertainment, and recreation and Accommodation and food services industry groups.
[h]Education services and Healthcare and social assistance industry groups.
[i]Information, Finance and insurance, Real estate, rental, and leasing, and Professional, scientific, and technical services industry groups.
[j]Agriculture, forestry, fishing, and hunting, Mining, and Utilities industry groups.

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Table 3. Exposure settings by employer COVID-19 prevention practices among survey respondents with SARS-CoV-2 infection who reported working outside the home in non-healthcare settings during the 14 days prior to symptom onset or diagnosis, 6 states[a], September 2020 to June 2021

Employer prevention practice[b]	N (% of sample)[c]	No known exposure[d], N (%)	Exposure outside work only, N (%)	Exposure at work, N (%)
Total	1,111 (100.0)	636 (57.2)	260 (23.4)	215 (19.4)
Implemented physical distancing (≥6 feet)				
No	200 (18.3)	113 (56.5)	37 (18.5)	50 (25.0)
Yes	895 (81.7)	517 (57.8)	214 (23.9)	164 (18.3)
Provided employees respirators, masks, or face coverings to prevent COVID-19				
No	250 (22.6)	155 (62.0)	50 (20.0)	45 (18.0)
Yes	856 (77.4)	478 (55.8)	208 (24.3)	170 (19.9)
Required employees to wear face coverings/masks				
No	130 (11.7)	68 (52.3)	25 (19.2)	37 (28.5)
Yes	977 (88.3)	566 (57.9)	233 (23.8)	178 (18.2)
Required customers/clients to wear face coverings/masks				
No	345 (32.9)	192 (55.7)	75 (21.7)	78 (22.6)
Yes	703 (67.1)	404 (57.5)	168 (23.9)	131 (18.6)
Screened employees				
No	393 (35.5)	210 (53.4)	95 (24.2)	88 (22.4)
Yes	713 (64.5)	423 (59.3)	163 (22.9)	127 (17.8)
Screened customers/clients				
No	735 (70.6)	416 (56.6)	163 (22.2)	156 (21.2)
Yes	306 (29.4)	176 (57.5)	78 (25.5)	52 (17.0)
Reassigned high risk workers				
No	858 (79.7)	503 (58.6)	182 (21.2)	173 (20.2)
Yes	219 (20.3)	114 (52.1)	69 (31.5)	36 (16.4)
Put up physical barriers				
No	621 (57.9)	358 (57.6)	129 (20.8)	134 (21.6)
Yes	452 (42.1)	258 (57.1)	119 (26.3)	75 (16.6)
Used enhanced cleaning procedures				
No	180 (16.3)	101 (56.1)	33 (18.3)	46 (25.6)
Yes	921 (83.7)	529 (57.4)	223 (24.2)	169 (18.3)
Provided training on COVID-19				
No	500 (45.3)	282 (56.4)	108 (21.6)	110 (22.0)
Yes	603 (54.7)	349 (57.9)	150 (24.9)	104 (17.2)
Limited the number of customers at once				
No	498 (48.1)	304 (61.0)	95 (19.1)	99 (19.9)
Yes	537 (51.9)	285 (53.1)	146 (27.2)	106 (19.7)
Provided hand sanitizer				
No	119 (10.7)	73 (61.3)	26 (21.8)	20 (16.8)
Yes	989 (89.3)	562 (56.8)	232 (23.5)	195 (19.7)
Posted signs about safe practices				
No	213 (19.5)	118 (55.4)	50 (23.5)	45 (21.1)
Yes	880 (80.5)	508 (57.7)	205 (23.3)	167 (19.0)
Changed/improved the ventilation system				

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No	855 (80.2)	498 (58.2)	184 (21.5)	173 (20.2)
Yes	211 (19.8)	116 (55.0)	62 (29.4)	33 (15.6)
None of these actions taken				
No	1,099 (99.2)	630 (57.3)	257 (23.4)	212 (19.3)
Yes	9 (0.8)	5 (55.6)	1 (11.1)	3 (33.3)

[a]California, Georgia, New Hampshire, North Carolina, Pennsylvania, and Wisconsin

[b]All employer-implemented prevention practices were examined for the primary job only and refer to the 14-days prior to symptom onset or COVID-19 diagnosis. See Appendix A for exact wording of prevention practices queried.

[c]Sample percentages are out of the total number of non-missing responses for each variable. Counts may not sum to the total.

[d]No known exposure includes individuals who reported no close contact with known or suspected COVID-19 cases and individuals who did not know if they had close contact with known or suspected COVID-19 cases. Close contact was defined as 6 feet or closer for at least 15 minutes.

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Table 4. Exposure settings by work- and non-work-related risk factors among survey respondents with SARS-CoV-2 infection who reported working outside the home in non-healthcare settings during the 14 days prior to symptom onset or diagnosis, 6 states[a], September 2020 to June 2021

COVID-19 risk factor[b]	N (% of sample)[c]	No known exposure[d], N (%)	Exposure outside work only, N (%)	Exposure at work, N (%)
Total	1,111 (100.0)	636 (57.2)	260 (23.4)	215 (19.4)
Close contact with coworkers per day				
0	313 (28.2)	194 (62.0)	97 (31.0)	22 (7.0)
1-9	630 (56.8)	354 (56.2)	139 (22.1)	137 (21.7)
10+	166 (15.0)	86 (51.8)	24 (14.5)	56 (33.7)
Close contact with customers/clients per day				
0	677 (61.0)	404 (59.7)	163 (24.1)	110 (16.2)
1-9	217 (19.6)	122 (56.2)	52 (24.0)	43 (19.8)
10+	215 (19.4)	108 (50.2)	45 (20.9)	62 (28.8)
Protecting employees from exposure to COVID-19 was a high priority[e]				
No	137 (12.5)	61 (44.5)	19 (13.9)	57 (41.6)
Yes	956 (87.5)	568 (59.4)	233 (24.4)	155 (16.2)
Attended an indoor gathering of >10 people				
No	844 (76.5)	473 (56.0)	181 (21.4)	190 (22.5)
Yes	259 (23.5)	159 (61.4)	75 (29.0)	25 (9.7)
Attended an outdoor gathering of >10 people				
No	971 (88.3)	549 (56.5)	224 (23.1)	198 (20.4)
Yes	129 (11.7)	81 (62.8)	32 (24.8)	16 (12.4)
Traveled away from home[f]				
No	922 (83.8)	518 (56.2)	213 (23.1)	191 (20.7)
Yes	178 (16.2)	112 (62.9)	44 (24.7)	22 (12.4)

[a]California, Georgia, New Hampshire, North Carolina, Pennsylvania, and Wisconsin

[b]All work-related risk factors were examined for the primary job only and refer to the 14-days prior to symptom onset or COVID-19 diagnosis. See Appendix A for exact wording of risk factors queried.

[c]Sample percentages are out of the total number of non-missing responses for each variable. Counts may not sum to the total.

[d]No known exposure includes individuals who reported no close contact with known or suspected COVID-19 cases and individuals who did not know if they had close contact with known or suspected COVID-19 cases. Close contact was defined as 6 feet or closer for at least 15 minutes.

[e]Agree or strongly agree with this statement.

[f]Defined as traveling to a different city/town, county, state, or country for reasons other than work or routine errands.

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