

Trusted Sources: How Some US Employers Used Government Information during the COVID-19 Pandemic

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Running Head Title: Employer Trust in Government COVID-19 Guidance

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ABSTRACT

Objective: Assess employers' use of information from government sources during the COVID-19 pandemic.

Methods: Virtual interviews with employers from 28 US companies in 9 National Occupational Research Agenda (NORA) sectors. Transcribed interviews were thematically coded and analyzed using MaxQDA24.

Results: All but 3 companies relied on CDC as their primary source for policy decisions and workforce communications, supplementing this with information from state and local health agencies, OSHA, trade and professional associations. Half of respondents asked additional experts to interpret guidance for their industry, and all but a few modified available materials to share with their workforce. NORA sectors were not effective for audience segmentation. Perception of worksite transmission was loosely aligned with preference for and confidence in information sources.

Conclusion: Employers want industry-tailored information during a public health emergency; providing that remains a challenge.

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Keywords: COVID-19, employers, workforce, mitigation strategies, trust, health communication, health belief model

Learning Outcomes:

Upon completion of reading this article carefully, readers will be able to:

- Evaluate a method for comparing employers' *perceptions* of risk of worksite exposure to COVID-19.
- Identify what employers most wanted in information coming from government sources pertaining to COVID-19.
- Compare factors affecting trust in government information sources for employers in contrast to what has been reported for the public at large.

INTRODUCTION

While there are numerous epidemiological studies of workers, their risks, and protective behaviors during the SARS-CoV-2 (COVID-19) pandemic, there is little discussion about how employers interpreted and applied government-issued health communication resources to keep their workers safe.¹⁻⁴ This gap contrasts with extensive discussion of the *public's* response to government communication regarding COVID-19 and adoption of promoted measures such as masking, quarantine, and vaccination.⁵⁻⁷ Understanding how employers used government information pertaining to the pandemic will help us prepare for a future emergency. Employer dissemination of information is also important because more than half of adults living in the United States (US) are employed,⁸ and therefore, worksites are a critical filter for how the public receives emergency health information. This paper begins to fill this gap by discussing communication strategies and sources used by employers to share information for managing COVID-19 with the workforce.

The National Institute for Occupational Safety and Health (NIOSH) within the Centers for Disease Control and Prevention (CDC) addressed a myriad of health and safety issues specific to work environments and conditions during the COVID-19 pandemic.⁹ As part of their response, NIOSH produced guidance for multiple industries and occupational groups. It also collaborated with professional organizations such as the National Safety Council (NSC), the American Industrial Hygiene Association (AIHA), as well as university training and research workgroups to disseminate industry-specific guidance. However, the job was daunting and one question that arose early in the pandemic was whether it was possible for CDC/NIOSH to tailor COVID-19 messaging for specific industry audiences as the risks of transmission differed by work settings. In the present study, this general question generated specific research questions focused on: (1) employers' perception of risk and uptake of COVID-19 information, (2) audience segmentation to strategically

tailor communication approaches that are feasible and accessible to worker populations, and (3) confidence in and the applicability of information produced and disseminated to employers.

Perception of risk

The perception of risk of acquiring an illness (perceived susceptibility), perceptions of its severity, along with the perceived benefits and barriers to implementing protective behaviors are constructs from the Health Belief Model (HBM).^{10,11} In systematic reviews of the public's response to COVID-19 messaging, HBM constructs were associated with vaccination uptake¹² and other preventive behaviors (e.g. vaccination, masking, distancing).¹³ There was also enormous interest in examining how the perceived risk of acquiring COVID-19 related to mental health outcomes at the population level,¹⁴ as well as how it functioned as an additional workplace stressor.¹⁵ Keeping with our communication framework, we wanted to assess if perceived risk of worksite transmission of COVID-19 and related HBM constructs were evident in what employers told us about government-issued communications.

Audience segmentation

Perception of transmission risk may be considered a factor in “psychographic audience segmentation,” one of several approaches for dividing a large, heterogeneous population into smaller, more homogenous groups of people for the purpose of marketing products or communicating more effectively.¹⁶ Audience segmentation in public health often begins with demographic data, such as age, gender, race, and ethnicity; socioeconomic differences including education and income levels; behaviors such as tobacco use or healthcare seeking; and geography and setting.¹⁷ In commercial marketing, consumer wants and needs are identified to define viable market segments. More extensive segmentation strategies use multiple questions in surveys or collect even thousands of data points from marketing sources (shopping data, website and social

media analytics) to build profiles to characterize groups. Using audience segmentation at any level allows health communicators to customize or tailor messaging (through) “a combination of content, source, graphics, channel, etc....(so that) the audience receives (a message that) reflects individual characteristics.”¹⁸ Psychographic segmentation has emerged as a more effective strategy than demographics alone as the “worldviews, values, and mindsets that define psychographic segments can be incorporated into message framing and content to increase persuasion.”¹⁹

During the COVID-19 pandemic, the U.S. Department of Health and Human Services (DHHS) produced and disseminated communications that were strategically designed to appeal to different segments of the public defined by geography, demography, behaviors (e.g., vaccine uptake) and psychographic motivations. Materials were created with relevant communities (both locally and nationally) and tested to influence adoption of vaccination, masking, and social distancing.^{20,21} However, was such strategic co-creation and tailoring feasible for worker populations? Thousands of industry types exist in North America. With a goal of finding effective and efficient worksite audience groupings to communicate about an infectious disease outbreak, we explored the National Occupational Research Agenda (NORA) 10 sector scheme²² as a potential framework for audience segmentation. NORA sectors could incorporate settings or environmental factors together with behaviors associated with risks of worksite exposure.

Trust and confidence in government information

There has been considerable discussion of the public’s “loss of trust” in the CDC and related HHS agencies, as measured through surveys conducted during and after the pandemic.^{23,24} In a longitudinal assessment of 806 MTurk respondents Latkin et al documented “high trust for CDC” at 81.3% of the sample in March 2020 and 63.7% in July 2020.²³ Reviewing six nationally representative polls conducted in 2020 and 2021, Findling et al. found that self-reported

“Democrats were generally trusting of recommendations made by key public health institutions, whereas Republicans generally were not.” The gaps between parties were more than 20% for most agencies and across surveys; for example, in a 2021 poll, 76% of Democrats reported trust in the CDC compared to 27% of Republican respondents.²⁵ In a 2023 probability based survey, SteelFisher et al found 37% of the public sampled reported a great deal of trust in health information coming from the CDC and 24% having a great deal of trust in information from state public health departments.²⁶ These levels are nearly identical to those obtained through a 2022 survey of 4,208 US adults (through probability-based panels).²³ The primary reported reason for lower trust in all public agencies was “political influence on their recommendations and policies,” reported by 70, 72 and 74% of those who had lower trust in local and state public health, followed by CDC. Similarly, there was concern among 60% of survey takers with less trust in the CDC that it was influenced by the private sector; this was less of a concern for state and local agencies.²³ We set out to see if employers followed a similar trajectory of trust loss as well as factors associated with their opinion, although we did not ask about political party affiliation.

Finally, we were interested in the applicability of information produced and disseminated to employers. In what ways did employers use information resources? Did they revise materials or use them as is? This is a pragmatic question, and we sought pragmatic answers. Therefore, the objectives of this study were to assess how employers perceived risk of workplace COVID-19 transmission, the extent to which they trusted and used government information sources, and how they adapted this information to guide worksite communication and safety practices.

METHODS

We conducted individual virtual interviews with company representatives between October 1st, 2022, and January 31st, 2023. The first 9 authors participated in the interview process. Respondents

were 18 years of age or older, held a senior/managerial position in, or owned, a US-based company, and were able to communicate in English.

Recruitment Procedures, Participants, and Human Subjects Determination

Participants were recruited through established individual research team contacts with local companies in their US geographic region or through a flyer disseminated to NIOSH Centers (Total Worker Health, Education and Research, and Agricultural) and partners (e.g., National Safety Council and the American Industrial Hygiene Association). (See Appendix A-Recruitment Flyers, <http://links.lww.com/JOM/C439>). The University of South Florida Institutional Review Board reviewed the study protocol 004453 and determined it was “not human subjects research” on June 9, 2022. Authors at other universities submitted the USF protocol and determination letter and received their institution’s determination to participate in the study.

Study Participants

Company characteristics

In the 4 months devoted to the study, the authors completed 30 interviews from 28 unique organizations. This represents a convenience sample of the hundreds of companies sent recruitment materials through our academic and professional association networks. The employers selected individuals to participate in the interview and all but seven held titles including the terms “medical,” “occupational health,” “environmental health,” and/or “safety.” All but one interviewee (the company’s “wellness coordinator”) held a senior managerial or executive position. We did not collect personal information from the company representatives such as age, gender, race, political party affiliation. Most respondents represented larger companies, including multinational corporations. **Table 1** lists respondents by their data code name, company headquarters, industry,

NORA sector, and number of employees. **Table 2** shows company participants categorized by the NORA classification.

Interviews

The research team conducted open-ended, semi-structured interviews using a topic guide (See Appendix A). These recordings used the audio and transcription features of on-line platforms (e.g., Zoom, Teams, or Google), which were then cleaned and de-identified by the interviewer before transmitting to the first author and student assistants (TD, JZ) for qualitative data coding and organization. Most interviews ran thirty to forty minutes in length.

Study Measures

Risk perception assessment

At the outset of the interview, we asked interviewees to look at **Figure 1** and to provide a rough estimate of the percentage of their workforce that primarily worked in each of the exposure risk categories. It was our intention to have the proportions across the categories total to 100%. The risk perception categories were modeled after an analysis done by Deloitte,²⁷ which, in turn, was based on Bureau of Labor Statistics Occupational Employment Statistics from 2019. While similar to the SARS-CoV-2 Occupational Exposure Matrix (SOEM),^{28,29} we included healthcare and working from home categories using intuitive descriptions to get at *perceived* risk.

As we learned, this question was challenging due to extreme heterogeneity within companies. For further analysis, we constructed a weighted risk assessment score from the mean score of the percentage of the company's workforce estimated in each category (1-5) divided by 5 categories: $(\text{Cat } 5\% * 5 + \text{Cat } 4\% * 4 + \text{Cat } 3\% * 3 + \text{Cat } 2\% * 2 + \text{Cat } 1\% * 1) / 5$. A score of 100 indicates the respondent's perception that everyone in the company was at the highest perceived exposure risk level; a score of 0 would mean that no one was perceived to be at any exposure risk while working.

It's important to note that *perception* of risk is not equivalent to “Job Exposure Matrices” (JEM), such as used by OSHA³⁰ and subsequently by the Council for State and Territorial Epidemiologists (CSTE), and others.^{28,29,31} While the JEM might have influenced perceptions of risk, no respondent mentioned them in the course of our interviews.

Qualitative Data Analysis

De-identified transcripts were uploaded into *MaxQDA 2022*,³² a computer-assisted qualitative data analysis software (QDAS) program. MaxQDA, NVivo,³³ and Atlas.ti³⁴ are considered the top QDAS programs for academic research,³⁵ with MaxQDA incorporating statistical features useful for mixed methods. Where technologically feasible and affordable, QDAS has largely replaced hand coding of qualitative material due to its efficiency. In our case, coding consisted of close reading of all transcripts and then digitally “highlighting” passages of text according to concepts important to the study. The concepts, or “codes,” are defined by the user and maintained as “memos.” Together the codes and memos build up the coding system—alternatively a predefined codebook may be used. Where appropriate, qualitative codes were transformed into variables that were used to structure the data for additional analysis. QDA software records all user interactions chronologically, maintains the exact locus in the data set for all coded text passages, and allows for visualization, categorization, and at least in the case of *MaxQDA*, quantification and statistical analysis of codes when transformed into variables. These features support transparent and reproducible work.

Data Coding: Under the guidance of the first author, TD coded the first 13 transcripts and JZ coded the next 15. The first author checked and is ultimately responsible for all coding. We used a classic thematic coding approach in which we first captured responses to questions in the topic guide (which may have occurred randomly, or at multiple points in the discussion).³⁶ Under these broad

headings we further coded responses with new concepts suggested by the data, which we then collapsed into broader themes. This is a “grounded theory” method that allows for generating new hypotheses about the data.³⁷ To check the thoroughness of coding, the AI assisted ‘auto-coding’ feature of *MaxQDA*, which uses the code’s memo to identify passages in transcripts that are appropriate for that code, was used to check if all possible instances of a code had been captured. Only a few additional text segments were found in this manner after visually checking through and discarding “false positives.”

Analysis: Once the corpus of transcripts was coded, we applied a ‘framework method’ to allow all research team members to participate in data analysis.³⁸ The “Code Comparison” and “Smart Coding” features of *MaxQDA2022* were used to create matrices of quotations for each theme organized by the variables “sector” (construction, healthcare, other) and “risk score”. This presentation of responses made it easier to see if patterns emerged based on the study’s segmentation constructs. Team members interpreted the information and isolated the most pertinent quotations for publication.

RESULTS

Perceptions of risk of exposure

Referring to Figure 1, respondents described highly mixed conditions at all worksites apart from healthcare, which estimated 90-100% of their workers were in the highest risk category. Others estimated a percentage of their workforce in nearly every category, which varied within and between industries, somewhat dependent on specific occupations. **Figure 2** shows the weighted COVID-19 worksite exposure risk estimate, in ascending order, identified by respondent code name.

Revised Perception of Risk Categories:

From observational review of the data, we created three risk perception categories: Low (n=9) Weighted risk 0-50%; Medium (n=14) Weighted risk 51-79%; and High (n=5) Weighted risk 80-100%. The group with the highest weighted risk perception score includes four companies providing health care as well as one in food services, with the preponderance of their time close to the public. The medium risk perception score includes 14 companies where a good proportion of their workers needed to share airspace with the public and interact closely with other workers, while others were able to work outdoors or elsewhere. The lower risk perception scores were aggregated for 9 companies in “construction” (with more exterior work; no time spent in healthcare facilities), “manufacturing” (chiefly biotech), “services” (higher education, training), and “wholesale.” Six employers described being able to send most of their employees home to work at the outset of the pandemic. This eliminated the possibility of exposure to COVID-19 at work in their view.

Segmentation by occupational groups or NORA sectors

There was clear variation in how industry representatives conceptualized the burden of COVID-19, their industry’s role in the pandemic, and the details of their experience through the pandemic. Each industry presented a unique set of challenges requiring their interpretation and adaptation of guidance going out to the public at large. Both “Construction” and “Healthcare” represent unique NORA sectors, and our qualitative sample was adequate to see some trends within each of these groups which we describe in several sections below. However, other NORA sectors were internally diverse. For example, both “Transportation, Warehousing, and Utilities (TWU)” and “Service” include multiple industries and occupations in their sector, and while we see some cross-cutting themes (e.g., representatives from T, W, and U described offering “essential services”), there were

also striking differences related to co-worker interactions versus interacting closely with the public. Based on even our limited sample, we can reject the hypothesis that NORA sectors containing multiple industries behave as unified communication audience segments.

Trusted Sources of Information

Respondents reported using information from the CDC, World Health Organization (WHO), professional and trade associations, state and local governments, universities, recognized experts, published literature, and what was gleaned from the public to guide decision making. CDC was mentioned as the primary or in the top two sources by 25 (out of 28) respondents. Several employers emphasized their legal obligation to follow OSHA, their state OSHA regulations, and regulations from their local health departments. Several respondents described checking information from different sources with industry peers, professional associations, independent experts, and other organizations and using this consultative process to determine their policies. They also benchmarked their communication approaches with these same sources. This helped them identify effective strategies and learn from the experiences of others.

Twelve respondents identified their local and state health departments as a trusted source of information, (three preferentially to CDC) including representatives from healthcare and food services (highest perceived risk category), as well as construction, utility, and non-profit training (mid and lowest perceived risk categories). One individual noted that their preparedness plan template came from their state health department, and that a liaison from the state health department did site visits to help with planning and decisions about controls. Another mentioned that members of the health department, along with city officials, participated in monthly meetings and that organizational leadership attended these meetings. An individual from the transportation sector commented that some guidance from their state health department and CDC came to them

through the governor's office. A respondent from the construction sector mentioned that his governor held a daily conference call and that he received information from these calls on which he based decisions.

Three respondents stated that when it came to information regarding COVID, they were guided to some degree by the public and their customers. One of the interviewees that represented an institution of higher education remarked that the public was a stakeholder of the institution and as such their voice held some weight. The university in question collected public input through town halls, emails, and other means of communication. Within the construction sector, one interviewee said, *"We left [our masking and social distancing policy] up to our clients. You tell us what you want us to do. We really don't know what we're supposed to do right now... We left a lot of it up to our customer."* (Construction)

Preferred Source by weighted risk category

We found that respondents in the three weighted risk categories of high, medium and low responded to this question somewhat differently. **Table 3** provides illustrative quotations supporting preferred sources and trust levels related to weighted risk scores. Those in the high-risk group were more likely to use CDC or a local health department source, which they adopted 'as is', due to the rapidity with which information changed. Those in the medium range were more likely to use one or two primary sources, including CDC, and modify them for their needs. Those in the lower range tended to use non-CDC sources first (e.g., state or jurisdictional, professional or trade associations), sometimes commenting that they realized the CDC was the original source for the information.

The choice of information was closely aligned with the respondent's 'trust' in the source. We asked specifically about whether their trust in the CDC had changed over the course of the

pandemic. Again, we found some variation based on the respondent's perception of overall risk: The healthcare organizations in the highest risk group were accustomed to CDC as a credible source of information and expressed having considerable trust in the agency at the time of the interview. Those in the medium range had mixed opinions creating different trajectories of trust: Some who were previously familiar with CDC began fearing the agency was bowing to political pressures and 'watering down' their guidance; alternatively, there were also some companies less familiar with CDC prior to the pandemic who gained an appreciation for their guidance. Those in the lower risk category tended to also be in highly technical and scientific fields. They were initially reliant on CDC and WHO, but saw their local authorities maintain more stringent guidelines, for example for days of quarantine, after CDC had reduced the number. Some interpreted this as CDC acquiescing to political pressure, while others accepted that the situation had changed but they still were required to follow state or local authorities. As mentioned above, those in the third category of risk perception were less likely to use CDC sources for their primary references to begin with, preferring those from trade and professional associations, which may have tailored what CDC originally provided for industry needs.

Products

Purpose of communications

Participants described the primary ways they communicated with their workforce. In descending order, these are: Communication and enforcement of policy; issuing messages from 'experts'; issuing messages from organizational leadership; conducting meetings and training; and communicating with the public.

Policy communication: The weight and strength of organizational policy varied between organizations and often depended on the policy. For instance, words like mandate, mandatory, and

enforcement tended to be associated with policies regarding vaccinations, wearing masks, and following social distancing protocols. Significant messages were often released under the president or CEO's name or sent directly from leadership email accounts. Additionally, the leadership teams for many of these organizations were engaged in messaging through weekly meetings, situational updates, and briefings.

Messaging from experts

Several respondents mentioned that when they shared information with employees they made it clear that it was coming directly from experts. In most cases they meant the CDC, but it could have been published journal articles or independent experts who were recognized by their staff. One interviewee noted, *"We wanted a consistent, reliable source to base and justify our decision-making on that we could point back to our employees and to our stakeholders to say – Hey, we are relying upon subject matter experts."* (Wholesale)

Communicating with the Public

Healthcare and educational institutions in particular shared materials with the public. For example, *"We posted a lot of materials within the facility but the thing that we reiterated with employees and patients was that you know this guidance is current, constantly reviewed by CDC. And they're routinely updated, and you know it's being evaluated, research is being done. And, you know it's just an evolving circle....trust is a big thing..."* (Healthcare)

Applications

The use of printed material was nearly ubiquitous among those interviewed. Printed materials included posters, signage, and handouts. The signage included information about occupancy limits for certain rooms, markers that indicated six feet for social distancing, and reminders about wearing masks, washing hands properly, and maintaining safe distances. Some signage was very

specific, such as how to use a certain type of temperature sensor as part of a safe re-entry program. Handouts ranged from infographics printed straight from the CDC or local health department websites to scientific publications converted into plain language for a non-scientific reader.

Half of the participants mentioned using electronic means to convey information to their employees. One respondent noted that people in their headquarters seemed to be most responsive to email, so nearly all their health information and updates about COVID were pushed through email, while other people were more responsive to internal chat apps such as Yammer. Many had websites or apps that provided dashboard-like data, questions and answers, training videos, infographics, and policy updates. At least two organizations used the background image on their desktops or the welcome screen to show a revolving set of images that conveyed information related to COVID. Two organizations mentioned that company computer monitors were programmed to flash health communication messages to their employees at regular intervals.

Likes and Modifications

Respondents appreciated CDC materials for their 24-hour accessibility, clear language, and effective infographics. For example, *“They did a nice job of conveying a message through a very simple image. It was very clear what the intent(ion) of the image was, even without reading any of the texts that went with it. So, I liked that. I used those in some of our signage and, some of the site wide communication.”* (Utility) Modifications were made for multiple reasons: Many respondents developed their own communication materials in-house, using guidance from authoritative sources as a starting point. This allowed them to have more control over the messaging and ensure it aligned with their organizational needs and branding. While using the information from authoritative sources, the respondents often tailored and customized the materials to make them more relevant and understandable for their specific industries, workforces, and local contexts. This

included adjusting the language, formatting, and visuals to better suit their needs. As some described, the ‘shorter the better’ and the more complex information was simplified or reduced to a graphic and short statement.

Employers expressed three primary sources of frustration with available information: (1) Guidance did not account for industry specific circumstances, (2) Guidance varied among federal, state and local levels, and (3) Guidance from the CDC changed quickly and therefore was not always consistent across CDC subsites and pages. **Supplemental Table 1**, <http://links.lww.com/JOM/C440> (Supplementary files) presents examples of participant statements in line with these topics.

DISCUSSION

This pioneering study explores the communication needs and responses of corporate America during what was, for most, their first experience with an infectious disease outbreak of both domestic and global proportions. Our study of mostly larger employers showed them to represent *critical health communication infrastructure* that could be utilized as a public health partner in the future. We found that the employer representatives we interviewed generally sought out health information, interpreted it, tailored it for their workers, and disseminated it in a repeating cycle. Because more than half of the US population is employed, employers are a ready-made constellation for rapidly disseminating information through the ‘tailoring engine’ of the employer to the families and communities of the workforce. While there are certainly some employers that have not been perceived to prioritize their workers’ best interests,³⁸⁻⁴⁰ we did not encounter them in our study, which is addressed in limitations. The employers included in this study felt they had done an excellent job keeping their workers safe during the pandemic. This quote sums up the attitude:

“There was a point where we recognized that our team members were far safer within our four walls than they were outside our four walls from a pandemic perspective... we were practicing very strong social distancing, using face coverings, reinforcing hand washing and disinfection... We realized that for eight hours a day we were doing everything we could to help our team members out, and then for 16 hours they were going and having beers with their buddies in the garage, which then made our four walls much less safe.” (Wholesale)

From a health communication perspective, employers appear to respond differently to government issued information than what has been reported for the public.⁴¹⁻⁴⁵ For example, not one of our respondents mentioned the news media or political leaders as a primary source of information about the pandemic. Several mentioned the WHO, (those with a global footprint), and 25 out of 28 named the CDC as their primary source of information. Employers vetted information using both internal and external mechanisms. As frustrated as they were with the rapid changes in guidance, most claimed to have not lost any trust in CDC; several said they had an even greater appreciation of the work that was done. This seems to be opposite of the public’s reaction.⁴⁶ Employers were concerned that the CDC appeared to lessen restrictions on quarantine in response to political pressure without providing a detailed explanation of their thinking. Reading between the lines, employers felt they could be trusted to understand the nuances and the details, and they basically were not included in the discussion. While this study was conducted through our affiliation with NIOSH, respondents said very little about this CDC institute directly. This may be explained by NIOSH’s low profile in general, or possibly the fact that during the pandemic, CDC centralized its communication response, consistent with the National Incident Management System (United States Department of Homeland Security, 2024)⁴⁷ and as developed by CDC for public health emergencies (Reynolds & W. SEEGER, 2005; Seeger et al., 2018).^{48,49} All

information posted on the CDC website was reviewed and cleared by a “Response Team” and was designed to be applicable to all settings. While the need for clear and consistent messaging is indisputable, NIOSH (along with other CDC Centers) lost a valuable opportunity to reinforce and possibly expand its brand recognition among companies more accustomed to OSHA regulations than NIOSH guidance.

Our question concerning logical grouping of industries for audience segmentation remains unanswered. When it comes to risk of infectious disease transmission, heterogeneity within companies is the rule rather than the exception. This preliminary analysis of the small sample demonstrated that apart from healthcare, there was little alignment between an industry’s ‘NORA sector’ classification (e.g., Construction), and the perception of acquiring COVID-19 at work, as both the Construction sector and “Transportation/Warehousing/Utilities” were present in two of three risk perception categories. About half of the respondents would have liked information that was more tailored to their geography, industry, occupation, or other needs, as well as having information produced in multiple languages. We are not alone in finding this⁵⁰. As mentioned in the introduction, in addition to its own web postings with guidance for specific work settings and occupations, CDC/NIOSH collaborated with partners—most extensively the American Industrial Hygiene Association (AIHA), the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE), the American Society of Safety Professionals (ASSP), and the American Society for Health Care Engineering (ASHE)—to develop and disseminate industry-specific infection control, ventilation, and PPE guidance during the pandemic. (Several specific work settings are included in a recently updated resource put out by the Integrated Bioscience and Built Environment Consortium (IBEC) and AIHA.)⁵¹ The perception that CDC/NIOSH did not tailor information to these industries underlines the

difficulty in disseminating information from a centralized point without an organized network of “nodes” to amplify and reinforce the messaging. It also reflects the lack of co-branding these resources by NIOSH, whether intentional or unintentional. This problem is in the past; at the present time the companies themselves have amassed experience in what seemed most effective to them in managing an infectious disease outbreak. NIOSH could potentially expand its partnerships and bring companies on board now in the same manner that CDC works with state and local health departments through the National Public Health Information Coalition (NPHIC.org) and other communication networks. Core information packets and customization guidelines could be set up for different industries along with language and other tailoring suggestions.

From a health communication theoretical perspective, we could not directly apply the “Health Belief Model” (HBM) to the worksite.¹⁰ While ‘perceived severity’ of COVID-19 was universally recognized, ‘perceived susceptibility’ ‘efficacy of interventions’ and ‘benefits’ to implementing mitigation measures varied across both occupations and the exposure risks within one organization. There is a need for an ‘industrial sized and nuanced’ version of HBM to guide segmentation of audiences using risk perception, which we will explore in a larger sample.

Limitations and Strengths

This was a qualitative study with a convenience sample, and there is likely to have been selection bias of those who agreed to interviews. This is a study of mostly larger companies that came through the pandemic with relatively limited loss of life. They were proud of their achievements and stepped forward for interviews. We did not hear from others with different experiences. Except for mining, and agriculture/forestry/fishing we had at least one respondent from each sector in NORA, but construction dominated. And perhaps our study’s respondents were in occupations

requiring a high degree of technical acumen. However, they responded very similarly to those in previous studies conducted earlier in the pandemic.⁵² We did not ask respondents to speak about the gender, racial, or ethnic makeup of the workforce, nor to identify themselves by gender, race or ethnicity. It is known that racial and ethnic minorities were overrepresented in many occupations associated with higher risk of exposure.^{53,54} In addition, at the population level, minority communities were disproportionately affected by COVID-19 and HHS affiliated entities strove to create materials tailored to diverse linguistic and cultural needs.⁵³ While participants commented on the company's responsibilities to the community at large, we did not ask them to comment on how demographic factors may have contributed to COVID-19 rates in their company or community. This is an additional limitation of the study.

Conclusion

This qualitative study suggests that employers represent a network of trusted “communication nodes” that have a higher level of health and science literacy than the public at large. It is recommended that a systematic way of diffusing information from CDC/NIOSH through occupational sectors is tested soon, outside of an emergency. This would improve health literacy in the workplace, leading to increased worker safety during an emergency. We could also see the cascade effects of workers influencing and augmenting community health literacy, leading to a higher level of scientific literacy in the country.

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Figure Legends

Figure 1. Employee interaction categories used to assess perceived risk of COVID-19 exposure.

Categories reflect increasing levels of contact with the public or coworkers, from frequent in-person interaction to the ability to work remotely.

Figure 2. Weighted COVID-19 perceived workplace exposure risk scores for 28 participating companies, ordered from lowest to highest.

ACCEPTED

Table 1. Interview Respondents by Code Name, Headquarters, Industry, NORA Sector and Number of Employees

Interview Code Name ¹	Headquarters	Industry	NORA Sector	Number of Employees
S-GS-NY	New York	Training Nonprofit	Services	12
C-KM-OH	Ohio	Construction	Construction	17
C-KM-MI	Michigan	Construction (Electrical)	Construction	50
C-CB-NC	North Carolina	Construction	Construction	70
FS-GS-NY	New York	Food Service	Services	95
CI-AD-TX	Texas	Construction (Insurance)	Construction	100
M-KM-CA	California	Biotech	Manufacturing	200
H-CP-FL	Florida	Healthcare	Healthcare	300
C-AD-MS	Missouri	Construction	Construction	500
PU-JZ-MI	Michigan	Public Utility	TWU ²	750
M-CP-CA	California	Biotech	Manufacturing	800
O-TH-CA	California	Oil Refining	Oil Gas	950
CE-AD-MS	Missouri	Construction (Electrical)	Construction	1000
TWU-CP-FL	Florida	Transportation	TWU ²	1000
C-AD-MS2	Missouri	Construction	Construction	1300
C-TH-GA	Georgia	Construction	Construction	1450
H-CB-TX	Texas	Healthcare	Healthcare	1600
CEN-AD-TN	Tennessee	Construction (Environmental)	Construction	2000
C-GS-NY	New York	Construction	Construction	6000
H-CB-US	US	Healthcare	Healthcare	6000
HE-TD-MD	Maryland	Higher Education (HE)	Services	7000
HE-TH-PA	Pennsylvania	Higher Education	Services	15,000
HE-TH-CA	California	Higher Education	Services	20,000
TWU-CP-IL	Illinois	Wholesale	Wholesale/Retail	22,000
M-KM-CA2	California	Biotech	Manufacturing	24,000

PS-AD-MN	Minnesota	Security	Public Safety	25,500
S-GS-NY	New York	Healthcare	Healthcare	70,000
TWU-CP-WA	Washington	Warehousing	TWU ²	250,000

¹Nomenclature: Sector-Interviewer-State – Identifies companies in Figure 2

²NORA sector TWU=Transportation, warehousing, utilities

ACCEPTED

Table 2. Number of Participants by Company's classification in the National Occupational Research Agenda (NORA)

NORA Sector	n	%
Agriculture, Forestry & Fishing	0	0
Construction	10	35.0
Healthcare & Social Assistance	4	14.3
Manufacturing (including Biotech)	3	10.7
Mining	0	0
Oil & Gas Extraction	1	3.6
Public Safety	1	3.6
Services (Higher Education, Food, Industrial Training)	5	17.9
Transportation, Warehousing & Utilities	3	10.7
Wholesale & Retail Trade	1	3.6
Total Company participants	28	100

Table 3 – Illustrative quotations about Primary Information Source and Change in Trust of CDC by three weighted risk perception categories			
Weighted Risk Perception Score Group	High	Medium	Low
Primary information sources.	<i>“To the extent that I had any say in decision making, the sources would be the published literature, both industrial hygiene and the kind of descriptive epidemiology that was coming out...and of course to some degree the public health agencies, both locally and nationally.” (Healthcare)</i> <i>“We don’t create posters, we get the posters from the state, federal agencies, and we will move forward from there. there’s very little time...I mean for us to be able to have the leisurely time to be able to produce posters ourselves.” (Food Services)</i>	<i>“...whether that was OSHA information, CDC information, as long as it came from a trusted source on the subject that we were referencing...we would be very specific to the date....” (Construction)</i> <i>“...we typically would refer to CDC for guidance in this case...Yeah, mostly our communication with employees would be about company policy and how it was compliant with CDC and the County.” (Oil refining)</i> <i>“...so, we pulled down some of their posters, reprinted those, laminated them, slapped them up throughout our facilities...mostly CDC stuff and (state) department of health.” (Public Safety)</i> <i>“I would go look for sites specific to maybe the water industry, right... and honestly, some of my professional organizations... they put out lots of information during that time, as well. So I would always just make sure that they were roughly the agencies that I knew my staff was comfortable with, even though they were comfortable with those agencies I was making sure that the you know the reference material was also legitimate and valid. Because, just because John Smith said it was okay. Well, where does John Smith work? Oh, he works for the CDC. Okay, I think he’s okay... so just making sure that you know we’re getting stuff from reputable sources, even with the reputable sources of AWA. But if you’re not getting your sources from somebody legitimate, then I’m not gonna trust that source either.” (Public Utility)</i> <i>“We took that (CDC) information, plus whatever was coming from, like</i>	<i>“We posted all kinds of posters on the buckways, the elevators, the Jonny on the spots...we posted a lot of stuff from the AGC (Association of General Contractors of America).” (Construction)</i> <i>“AIHA, (American Industrial Hygiene Association) ...we recognize them as a great source of information.” (Construction).</i> <i>If I am citing somebody, whether it’s NIOSH or really at this point, it’s kind of a habit... I just don’t single source anybody. And I think as an organization, we try not to single source anybody. So if NIOSH recommends something, I’m going to see if someone else recommends something and then you know and then yes. And if I only see something in one place, then I might mention it, but, it’s not going to be the focus of my guidance. (Services)</i> <i>“We used some information from OSHA, but more for internal management decision making. We also benchmarked other corporations within our professional network to see what their policies were and what materials they had produced for guiding themselves through the pandemic.... we looked to even some of our network partners in other industries.” (Construction)</i> <i>We did use, I mean, I thought the CDC did a mostly good job of putting print materials and resource materials out there for use. There’s a couple of other organizations, SHRM had some resources.</i> <i>The National Safety Council had some resources that we would pull from, but primarily, if we were looking for graphics or print materials, a lot of that was CDC, and again, some of that the reasoning behind why we</i>

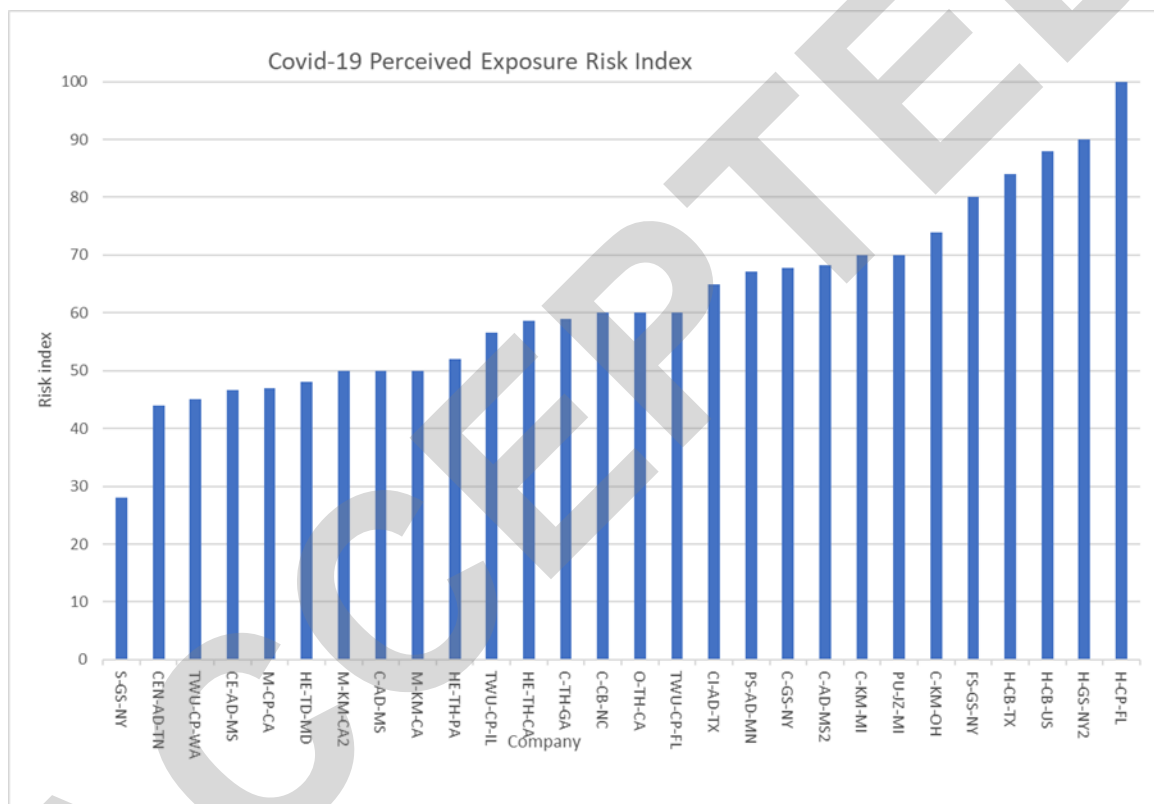
		CalOSHA emergency temporary standards, and we made all of our own communication. We didn't do a blanket copy of the CDC or the CDPH. Because here in California, like Cal should kind of go above that.... And that was very challenging, because requirements for quarantine isolation, from CDPH for a while were different than CalOSHA so having to try to communicate that to employees...So yeah, we made all of our own communications materials for our employees.” (Manufacturing)	chose them over most others is because we had said from the beginning we may not always like it, but the CDC will be our source of truth. And so we tried to hold true to that for as long as we could (Wholesale)
Change in trust for CDC or NIOSH?	{trust for CDC} “I would say it's probably about the same if not, maybe a little bit stronger. I mean, we're all faced with a challenge at that point for being exposed to something that we never really encountered, and all trying to figure out how to do the best...to keep everybody healthy and safe....so the thing that I saw was...they stayed on top of it. There were a lot of uncertainties, but we learned together, and we adapted to these changes and came out better because of it.” (Healthcare) “I think my belief in those agencies [is] stronger, except I think that there is not enough communication between those entities and our industry....” (Food Service)	“I used to think that we were the most prepared in the world. Um! They were ready, willing, and uh, following the science, I now believe these are political organizations, and I cannot trust them.” (Higher Education) It actually increased, it actually increased because of the, you know, even though you know these websites and government sites, you know, you you've heard of. But you know, going through Covid, it really forced you to have to take a deep dive into them, and then it helped you realize how much information, even outside of even outside of just infectious diseases. (Transportation) So you know, prior to this, I'm not sure that we had a lot of direct need to really go to CDC and look at specifics. You know everything.. that all of our policies are based on OSHA and what they had adopted through NIOSH and CDC. Right so, what's been written in their regulations. So, you know I'm not sure how to answer that question. You know we really didn't lean on CDC guidance prior to this because (we) followed OSHA regs. But you know, I think you know, from start to finish. You know everybody trusted	“I think earlier in the pandemic we relied pretty heavily on CDC and NIOSH, World Health Organization. We have quite a robust industrial hygiene program here and so ...we're very familiar with NIOSH and CDC and WHO recommendations. I think for us it's not so much erosion of trust, but it's questioning of some of the things that were communicated and when. ...When they made changes in isolation or quarantine time periods, for example, sometimes we felt it didn't come with enough explanation of why it was shortened. (Biotech) “We tried to line up as much as we could to WHO and the CDC...but after being burned a couple of times, we lagged behind them...we would do the most stringent...whenever they rolled things back, we're like 'wait. We're gonna move a little slower on roll back just in case,' because nothing hits...your credibility worse than rolling something back and then, two weeks later, reimplementing it.” (Warehousing) “...I understand things were very fluid, but I think there was just so much confusion on even their part that they didn't know what was really going on. ...as a result of lightening up their guidelines...towards the end I got to where I didn't really trust their information and I lobbied

		<i>what CDC was putting out there, and they were adjusting as they needed to adjust the recommendations.</i> Construction <i>I will say personally, I would say it's stronger. I felt the information was very good. I don't think I could say that that was my company's response. I would say that the response from the company would be perhaps somewhat unchanged, if not less confident.</i> Construction <i>"...if we were looking for graphics or print materials, a lot of that was CDC, and again, some of that the reasoning behind why we chose them over most others is because we had said from the beginning we may not always like it, but the CDC will be our source of truth. And so, we tried to hold true to that for as long as we could.</i> (Wholesale)	<i>not to use CDC anymore. [relied only on more stringent county guidelines.]"</i> (Construction) <i>"I think they did an admirable job considering the circumstances...I think the challenge for them and everybody else is these new platforms where disinformation comes out. It gets so hard to combat that...[trust in CDC] I would say it's slightly higher..it didn't go down.</i> (Higher Education)
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Figure 1. Employee interaction categories used to assess perceived risk of COVID-19 exposure. Categories reflect increasing levels of contact with the public or coworkers, from frequent in-person interaction to the ability to work remotely.

Risk Perception Category	Employee interaction with public or other workers	
5		Must touch/interact in the same close airspace as the public most of the day
4		Must share airspace with the public but not physically touch them
3		Must interact closely with other workers (even if only during transportation to worksite) - (no public interaction)
2		Able to have distance from other workers (individual office or work outside all day) - (no public interaction)
1		Able to work from home/off site

Figure 2. Weighted COVID-19 perceived workplace exposure risk scores for 28 participating companies, ordered from lowest to highest.



Graphical abstract

A systematic method to diffuse information from the CDC/NIOSH through occupational sectors could improve community health literacy.

Employers represent a network of trusted “communication nodes” that have a higher level of health and science literacy than the public at large.



During the COVID-19 pandemic, employer representatives sought out health information, tailored it for their workers, and disseminated it.



Is there a cascade effect of well-informed workers improving community health literacy?



Trusted Sources: How Some US Employers Used Government Information During the COVID-19 Pandemic

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