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EXPLORING PERCEPTIONS of U.S. Healthcare & Public Safety Workers at the Onset of the COVID-19 Pandemic

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There is a gap in research associated with emerging infectious diseases and the role that individual perceptions have on attitudes and health-protective behaviors. NIOSH researchers sought to understand healthcare and emergency medical services (EMS) workers' perceived risks toward SARS-CoV-2 and what factors may significantly influence subsequent health-protective behaviors. Between March and May 2020, 122 healthcare and EMS workers completed an assessment on a mobile safety application provided by their workplace. The results inform organizational practices regarding COVID-19 information sharing. First, it is important that all employees have access to information about respiratory protection as well as organizational resources such as their updated respiratory protection plans that may influence health-protective behaviors at work. Second, messaging for employees with individualistic attitudes may significantly differ and more research should be done to determine whether science-based consensus messages are the most effective risk communication strategy.

Introduction

SARS-CoV-2 and the disease it causes, COVID-19, may put some frontline workers who are employed in healthcare and first responder settings at risk of infection (CDC, 2020a; The Lancet, 2020; Maguire et al., 2020). Although an unknown proportion of these cases may be community-acquired, as of Jan. 13, 2022, the CDC (2020b) had confirmed 852,460 COVID-19 cases among healthcare personnel and 3,385 deaths. Also, prehospital care such as ambulatory calls that require response from firefighters and EMS has increased in population-dense locations. In areas within New York, NY, for example, the number of incident calls received have almost doubled, with dispatchers taking more than 7,000 calls per day (Pilgrim et al., 2020; Watkins, 2020). Further, in more rural or suburban areas such as Springfield, MO, emergency calls increased up to 10% in 2021 (Van Schoik, 2022), continuing to put these workers at risk of exposure to SARS-CoV-2. Along with the inconsistencies in the availability of PPE for healthcare and EMS personnel early in

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the COVID-19 pandemic, these workers have experienced significant uncertainty and stress (Kamerow, 2020; WHO, 2020).

To date, research involving a small sample of the public found that behaviors associated with mitigating COVID-19 were significantly higher for those who felt they were at a greater risk of contracting the virus (de Bruin & Bennett, 2020). Another study revealed that U.S. adults severely underestimate their perceived risk of first, contracting COVID-19 and second, dying from the virus (Niepel et al., 2020). Niepel et al. also found that those who had a lower perceived risk of contracting SARS-CoV-2 implemented fewer behaviors to reduce transmission such as avoiding shaking hands or crowded spaces. The implications of such results would take on a different context in healthcare and first responder settings, where interaction and contact with individuals who are already sick are more likely.

Risk perceptions have been shown to directly shape health-protective behaviors during pandemics (Bish & Michie, 2010), although there is a gap in such research associated with emerging infectious diseases (de Zwart et al., 2009). Specifically, studies have not focused on perceptions of an emergent infectious disease as it unfolded over a period of months, making it difficult to determine elements of a persuasive prevention program (Pakpour & Griffiths, 2020). To that end, in this study, researchers used a short survey to assess respondents' perceived risk toward COVID-19, perceived effectiveness of PPE and health-protective behaviors at the onset of the COVID-19 pandemic. Health-protective behaviors are defined as "any behavior performed by a person, regardless of his or her perceived health status, in order to protect, promote or maintain his or her health, whether or not such behavior is objectively effective" (Harris & Guten, 1979, p. 18). The results inform effective communication and management practices across industries that could be incorporated into organizational interventions to support how workers perceive and communicate about emergent risks on the job.

Methods

At the onset of the pandemic, NIOSH was able to leverage an existing memorandum of understanding with an administrator of a mobile safety and health application that was active from October 2019 to August 2020. Under the scope of the memorandum of understanding, NIOSH researchers were responsible for creating and uploading valid and reliable safety and health content into its own free-to-access portal that companies could then acquire and adapt for their workforce. Employers that subscribed to this application managed daily safety and health content, such as assessments and training materials, to facilitate quick and effective workplace communication. NIOSH used its free-to-access portal to create and upload a survey assessment to understand perceived risks toward SARS-CoV-2, barriers to protecting themselves and, if needed, cues to action to initiate health-protective behaviors. NIOSH researchers used the health belief model (HBM) to guide the development of the closed-ended questions. The HBM helps to explain why people may not participate in targeted health behaviors and why they may not adhere to specific healthcare recommendations or readily available treatments (Champion & Skinner, 2008; Janz & Becker, 1984; Rosenstock, 1974).

Items that were closed-ended used a six-point Likert scale: 1 (strongly disagree) represented sentiments toward lower risk, severity, confidence and importance in the topics being solicited, whereas 6 (strongly agree) indicated feelings of higher risk, severity, confidence and importance. Several questions were also open-ended, asking participants to discuss personal health-protective behaviors at work and outside of work to mitigate their chances of contracting SARS-CoV-2 as well as changes made by their organization to protect employees. See Table 1 (p. 18) for the HBM tenets, brief definitions and excerpts of questions that were included in the assessment.

Data Collection

These questions were posted on NIOSH's free-to-access portal on March 13, 2020, where subscribing customers were able to copy and make these questions available to their employees. One example of such a company was the National Accreditation Alliance of Medical Transport Application (NAAMTA), an organization that provides best practices for medical transport services. NAAMTA developed its own platform for subscribing customers in emergency response and transport, long-term care and hospital networks. Five of their subscribing companies took advantage of these questions, where individual employees had the option to open their phone application and respond during their daily work tasks at any point until May 1, 2020. NIOSH received blinded data from subscribed organizations that had already established a data use agreement to share deidentified data for research purposes.

Sample—In this time frame, 122 respondents (employees) in healthcare and public safety voluntarily completed the assessment as administered by their employer. Most of the respondents completed the mobile assessment in March when it was first posted ($n = 86$; 71.1%). The remainder ($n = 35$, 28.9%) completed the assessment when it was reposted at the end of April. Tables 2 and 3 show the COVID-19 testing that respondents experienced and the testing of their coworkers during the two primary time periods in participation. Regarding age, 30.3% respondents were 18 to 30 years old, 21.8% were 31 to 40, 29.4% were 41 to 50, 12.6% were 51 to 60, and 5.9% were over 60. On average, respondents noted working within 6 ft of others for 69.9% of their job, with the median being 58.0% and the mode being 50.0% of the time. Of the 122 individuals, eight did not provide an open-ended description of their job. For the remaining 114, five primary work groups emerged:

1. 24.6% ($n = 28$) held positions in a customer service department, which included interaction during scheduling, insurance and billing
2. 24.6% ($n = 28$) held positions in healthcare or public safety management, indicating they were office, area or regional managers/chiefs
3. 12.3% ($n = 14$) indicated they were nurses, certified nurse assistants or physicians employed at a hospital
4. 29.8% ($n = 34$) were part of an EMS team and indicated transporting patients in a variety of apparatus
5. 8.8% ($n = 10$) indicated being in a different healthcare service role such as home healthcare and environmental health

Results & Discussion

Data were cleaned and assessed for normal distribution using the Shapiro-Wilk test of normality. For the independent variables of interest, the Shapiro-Wilk was $p > 0.05$, indicating normal distribution of the data (Pallant, 2020). Additionally, the Levene's test for homogeneity among the five work groups was not significant ($p > 0.05$), indicating that the variances among the five work groups were approximately equal.

Perceived Risk Toward SARS-CoV-2

Regarding perceived risks toward SARS-CoV-2, a one-way ANOVA showed no significant difference among the five work groups at the $p < 0.05$ level: $F(4, 106) = 0.392$, $p = 0.814$. All work groups felt somewhat susceptible to COVID-19: healthcare administration ($n = 27$, $M = 3.72$, $SD = 1.18$); management ($n = 28$, $M = 4.05$, $SD = 0.96$); frontline healthcare positions ($n = 14$; $M = 3.89$, $SD = 0.88$); EMS personnel ($n = 33$, $M = 3.94$; $SD = 1.04$); and other healthcare service roles ($n = 9$, $M = 3.78$; $SD = 1.12$). Although work groups may have varying reasons that influenced their perceptions, risk susceptibility across the sample was neutral. Therefore, tailored COVID-19 materials for workers in various healthcare and public safety settings may not significantly influence perceptions and subsequent health-protective behaviors.

Although the results did not show differences among work groups, they did reveal age as a significant factor in the perceived susceptibility of COVID-19. Specifically, a one-way between-groups ANOVA showed that perceived susceptibility to contracting SARS-CoV-2 increased with age, at the $p < 0.05$ level: $F(4, 114) = 2.35$, $p = 0.058$. Generally, as age increased so did perceived susceptibility to contracting SARS-CoV-2: 18 to 30 years old ($n = 36$, $M = 3.64$, $SD = 1.42$); 31 to 40 years old ($n = 26$, $M = 3.96$, $SD = 1.00$); 41 to 50 years old ($n = 35$; $M = 4.43$, $SD = 1.10$); 51 to 60 years old ($n = 15$, $M = 4.33$; $SD = 1.18$); and 60 or more years old ($n = 7$, $M = 4.57$; $SD = 1.72$). However, post-hoc comparisons did not indicate statistically significant differences among the groups.

Additionally, a one-way between-groups ANOVA explored the impact of age on feelings or self-efficacy of being able to protect oneself from getting the virus that causes COVID-19. This was also statistically significant at the $p < 0.05$ level: $F(4, 76) = 2.691$, $p = 0.038$. Table 4 shows the post hoc results, indicating that those who were 31 to 40 felt they could protect themselves from getting COVID-19 more than those who were 18 to 30 or 41 to 50.

Confidence in PPE Efficacy

A one-way between-groups ANOVA explored the relationship between work group and confidence in PPE protection against COVID-19. There was a statistically significant difference at the $p < 0.05$ level: $F(4, 69) = 2.66$, $p = 0.04$. Post-hoc comparisons using Tukey's HSD test indicated that the mean score for field healthcare workers ($M = 4.77$, $SD = 0.927$) and the mean score for management ($M = 3.54$, $SD = 0.660$) were statistically significantly different from each other. That is, frontline healthcare workers such as nurses and physicians were significantly more confident that their PPE would protect them from the virus that causes COVID-19 than those respondents who were in management. Previous

research has demonstrated the effectiveness of PPE in protecting workers while caring for COVID-19-positive patients whether in a hospital setting or during patient transport (e.g., Bartoszko et al., 2020; Cook, 2020).

This finding is thought-provoking in that those who routinely wore PPE as a part of their job prior to the COVID-19 pandemic (e.g., physicians, nurses) had significantly higher levels of confidence in PPE protecting them from COVID-19 than those in management who may have had less experience routinely using PPE to protect themselves at work. Based on these results, the authors can speculate that individuals in frontline healthcare roles likely received and retained valuable PPE training and have experienced the protective efficacy of PPE in other routine or emergency situations.

To the authors' knowledge, this is the first study that assessed differences in perceived effectiveness of PPE between organizational levels in healthcare and sheds light on perceptual differences that may have existed across the country at the onset of the pandemic. Specifically, the results show that those employees who lacked experience in routinely using PPE had less trust in its protection, which we can extrapolate to others who lacked the same PPE experiences prior to the pandemic. For example, those occupations besides healthcare and emergency response who were routinely wearing PPE as a part of their job roles (e.g., construction, mining) may have been more amenable to wearing respiratory protection on the job versus other occupations, such as customer service roles in retail, hospitality and tourism.

This finding is important because potential negative outcomes of low confidence in company policies, such as those around PPE, include low morale, productivity and absenteeism. For these reasons, it is important for every level of management to understand PPE form, function and use. Additionally, it may be useful to involve the entire workforce in aspects of the company safety culture and respiratory protection resources so that all employees understand and perceive a strong commitment to safety (Dejoy et al., 1995; Gershon, Karkashian et al., 2000; Gershon, Vlahov et al., 1995).

Cues to Action to Prompt Health-Protective Behaviors

Finally, respondents could answer open-ended items about the processes or practices executed by employers during the pandemic. Respondents were asked to state what should continue as a routine part of safety and health management after the pandemic. These responses were content analyzed and grouped into themes or codes to help identify patterns in the data around 1. individual's health-protective behaviors during the pandemic; and 2. actions taken by their employer (Boyatzis, 1998; Patton, 2002). Cues to action in combination with perceived benefits and barriers are among the strongest predictors of initiating health-protective behaviors (Carpenter, 2010). Consequently, it is worth highlighting the open-ended data that mentioned supportive organizational practices employed during the pandemic.

The open-ended data revealed respondents' support toward changes in communication and risk management protocols as viable cues to action. Respondents indicated that organizational communication was a relevant cue to action and that effective communication

strategies have been underutilized in routine scenarios. Specifically, a trend in the qualitative data illustrated that communication and information being shared was welcome and should occur not only in a crisis capacity but also in a routine capacity so that informed decisions could be made daily. Additionally, there was a trend in qualitative feedback among respondents across all organizational levels—from those who check in patients to those who operate an emergency response apparatus—that communication, for the first time, was holistic and equally distributed to every level of their organization.

In response to the increase in communication quality and quantity, respondents noted being more situationally aware of how suggested disinfection and decontamination practices and processes were relevant to their own health-protective behaviors at work. For any type of persuasive communication strategy to be effective, all key individuals within an organization must comply, which makes understanding the attitudes of individual workers critical to prevention efforts (Fisher, 1991). Additionally, research has shown that transparent communication at work during the COVID-19 pandemic can support employees' safety and health behaviors (Kim et al., 2020). The current results align with these findings, indicating that transparent communication provides confidence in the protective actions taken by organizations to protect employees. Considering these results, it may be useful for organizations to conduct an internal analysis of communication strategies initiated during the COVID-19 pandemic and determine which of these can remain a principal part of their safety and health management plan and, consequently, a strong cue to action for their workers in the future.

Summary

These results were able to apply constructs from a well-validated behavioral theory, the HBM, to reveal response strategies that may resonate with individual workers, regardless of occupation, during an emergency. Specifically, results offer useful information and provide retrospective lessons learned for the future regarding organizational communication during times of increased ambiguity. Factors including age, confidence in PPE and individual health-protective behaviors accounted for significant relationships identified in the data. Other research has found that individual characteristics were more predictive of attitudes and behaviors related to the COVID-19 pandemic and, to a lesser extent, social amplification about the virus (Dryhurst et al., 2020). Importantly, the results from the current sample of respondents show the need to engage management in messaging around PPE and that administrative control knowledge, attitudes and skills are critical to help increase the effectiveness of emergency response plans. Future research should also seek to better understand workers' perceptions toward PPE since this belief has predicted eventual respiratory protective behaviors (e.g., Robertson et al., 2018).

Results also show the role of consistent communication practices as a reliable cue to action for employees. Consequently, organizations can consider improving workplace interventions that focus on fostering communication and promoting organizational safety culture. Previous empirical research has identified the promotion of sociability and interpersonal relationships to increase employee resilience when employee-held attitudes are heterogeneous (Welbourne et al., 2015). Thus, it may behoove management to communicate with workers about their

perceptions and individual behaviors immediately during such emergencies. If deemed necessary, management can address or mitigate knowledge and attitudes as needed to prevent at-risk scenarios through additional communication, training, performance feedback, and social approval or disapproval from coworkers or management (Moore et al., 2005).

However, communication cannot serve as the only impetus for individual health-protective behaviors and compliance at work. To illustrate, respondents indicated in qualitative feedback that there were inconsistencies in promoting or enforcing COVID-19 response plans. Even if working close to someone is an expected, unavoidable part of one's job, there was a theme identified in the responses that a difference in perceptions among coworkers caused tension at work and, without consistent monitoring from management, there was a lack of buy-in to the newly disseminated procedures. Thus, consistent implementation and role modeling on behalf of management remain critical for employee buy-in to new procedures and directives. This finding underscores the importance of organizational management during the COVID-19 pandemic, specifically, their confidence in PPE and other protective strategies in preventing infection.

Limitations

This study utilized a sample of employees in various healthcare and public safety occupations to collect perceptions in real time at the onset of the COVID-19 pandemic. Although these data may assist in improving future emergency response efforts, they are not without limitations. First, the sample size is small and in no way can be generalized to other healthcare and public safety employees nor other occupations. The small sample size also hindered more sophisticated analyses to further study specific interaction effects that may have revealed additional insights. Also, the data are self-reported and subject to social desirability bias particularly because those who completed the survey were likely engaged in the pandemic response to some degree. Participants also tended to be younger, and this could be due to familiarity and comfort in using mobile phone apps, limiting responses from older employees. Future work with additional samples is needed to further validate the findings reported.

Conclusion

This article shows the value of organizations being able to assess and understand the individual perceptions of their employees during an emergency response. First, open-ended data show that it would benefit organizations to engage in frequent and consistent communication in the workplace. Results also show that employers should be aware of the needs of employees whose values may place coworkers at a greater risk. Specifically, messaging for employees with individualistic attitudes may significantly differ and more research should be done to determine whether science-based consensus messages are the most effective at persuading health-protective behaviors on the job. Relatedly, organizations, regardless of occupation, might consider temporary programs that provide additional support networks for employees to emphasize interconnection with others during times of ambiguity. To advance the results of this small-scale analysis, future research should consider the intersection of these lessons learned, devise strategies, and explore potential mitigation

strategies via interventions that employers can use to influence and maintain desired health-protective behaviors.

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Ethical Considerations

NIOSH did not support or conduct the data collection, was not engaged with study participants, and did not receive any personal identifiable information as part of this effort, 45 CFR Part 46—Protection of Human Subjects did not apply to this work; no review on behalf of NIOSH Institutional Review Board was necessary.

Biographies

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KEY TAKEAWAYS

- Results identified differences in occupational sectors and work groups regarding perceived risks toward contracting SARS-CoV-2, efficacy to mitigate exposure risks and confidence in the efficacy of PPE during the pandemic.
- Previous experience in using PPE by way of job occupation has a significant impact on workers' confidence in the ability of their PPE to protect them from exposure to SARS-CoV-2.
- Role modeling behaviors of management as well as their enforcement of safety and health plans, including the use of PPE, is necessary to garner employee-wide participation in health-protective behaviors.

TABLE 1
ASSESSMENT QUESTIONS EXCERPT

Excerpt of assessment questions correlated to an HBM tenet.

HBM tenet	Definition	Example assessment items
Perceived susceptibility and severity	The perceived belief or probability about getting a disease or condition (susceptibility) and, consequently, the belief about the seriousness of that condition (Rosenstock, 1974)	- I am not worried about COVID-19. - If I get COVID-19, I will make a full recovery.
Perceived benefits and barriers	Beliefs regarding the effectiveness of strategies designed to decrease vulnerability or reduce the threat of illness (Brown et al., 1991, p. 51)	- I am confident that PPE (e.g., masks, gowns, gloves) provided to me at work can protect me from COVID-19. - I can easily access the PPE that I need to care for COVID-19 patients. - My organization has been taking extra precautions to protect the workforce.
Self-efficacy	Belief or confidence in executing the desired health practices (Bandura, 1983)	- COVID-19 is impacting my daily decision-making in my personal life. - COVID-19 is impacting my daily decision-making at work.
Cues to action	Any internal or external factor that triggers action or behavior modification such as communication cues (e.g., health messages or interpersonal conversations; Mattson, 1999)	- What can your organization do that would make you feel better? - My coworkers are worried about COVID-19.
Personal characteristics	Factors such as age, gender, ethnicity or location that may influence individual perceptions (Rosenstock, 1974)	- What is your age? - How many people live in your household? - Which of the following best describes your work setting?

TABLE 2
PERSONAL COVID-19 EXPERIENCES

Personal COVID-19 experiences reported among the sample.

	Respondent tested for COVID-19			
Month	Yes, negative	Yes, positive	No	Total
March	0.0%	0.0%	71.7%	71.7%
May	2.5%	0.8%	25.0%	28.3%
Total	2.5%	0.8%	96.7%	100%

TABLE 3
COWORKER COVID-19 EXPERIENCES

Coworker COVID-19 experiences reported among the sample.

	Coworker tested for COVID-19			
Month	Yes, negative	Yes, positive	No	Total
March	1.9%	3.9%	63.4%	69.3%
May	13.9%	5.0%	11.9%	30.7%
Total	15.8%	8.9%	75.3%	100%

TABLE 4**COVID-19 PERCEIVED RISK SUSCEPTIBILITY BY AGE GROUP**

Age group	<i>n</i>	Can protect myself from getting COVID-19 ^a	
		Mean	<i>SD</i>
18 to 30	36	3.94 ^b	0.998
31 to 40	26	5.13 ^b	1.09
41 to 50	35	4.07 ^b	1.36
51 to 60	15	4.10	1.10
Over 60	7	4.17	1.17

^aHigher averages indicated greater perceptions of being able to protect oneself

^bStatistically significant post hoc comparisons using Tukey's HSD test