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THE SILENT KILLER ON OUR WATERWAYS

Carbon Monoxide Exposure Potential Associated With Recreational Watercraft

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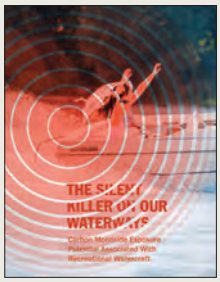

Exposure to elevated carbon monoxide (CO) concentrations can cause an array of health problems or even death. Of increasing concern are CO-related poisonings and fatalities associated with recreational watercraft. The article featured on this month's cover, "Carbon Monoxide Exposure Potential Associated With the Use of Recreational Watercraft," examined the significance of this public health hazard using a range of plausible exposures that were characterized by measuring instantaneous CO concentrations at 17 sampling locations on or near the stern of four recreational boats. Observed CO concentrations were highest in samples proximal to the engine exhaust manifold. Environmental health professionals should be aware of this hazard and examine controls that can reduce watercraft-related CO exposures to prevent injuries and fatalities.

See page 8.

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PRESIDENT'S MESSAGE

Roy Kroeger, REHS

Together We Can Do Much

I am humbled to serve as your president of the National Environmental Health Association (NEHA) for the coming year. I was introduced to NEHA at the 1995 Annual Educational Conference (AEC) & Exhibition held in Denver, Colorado. During that conference, I met environmental health professionals who have guided my career and served as mentors in the nearly three decades since. I have attended 16 different AECs since 1995, meeting many new friends along the way. I look forward to more AECs and meeting more friends.

My name is Roy Kroeger and I am currently the environmental health director for the Cheyenne-Laramie County Health Department in Cheyenne, Wyoming. Our county has a population of approximately 100,000 people and is located in southeast Wyoming, 100 miles north of Denver. Cheyenne has been our family home for nearly 28 years. Yes, I have worked for the same employer the whole time.

I graduated high school in Sterling, Colorado, and joined the U.S. Army right after. The military provided me the opportunity to attend college, see more of the world, and most of all, diversify who I am. After serving as a construction engineer in the U.S. Army, I enrolled at Colorado State University (CSU). Upon enrollment, I chose environmental chemistry as a major but quickly switched to environmental health after learning what it was all about. Dr. Ken Blehm was influential in my love for this profession as he has been for many environmental health students at CSU.

NEHA is leaving the station and picking up steam.

While at CSU, I started my journey participating in professional organizations. During my senior year, I joined professional societies to enhance my résumé. The Environmental Health Student Association and the Colorado Environmental Health Association (CEHA) were just the beginning. I joined NEHA a few months later while completing my internship at a local health department. Currently, I am working on my Master of Public Health at American Public University.

From the start of my career, professional associations have been a big part of my life and an opportunity to give back to the field of environmental health. Since college, I have remained a member of CEHA and joined the Wyoming Environmental Health Association (WEHA) within days of being hired by the Cheyenne-Laramie County Health Department. I have continued participation in both associations, including serving as the president of WEHA in 2001.

Active involvement with WEHA opened doors to do more with NEHA. I was appointed to the NEHA Board of Directors in 2007 to fill the vacated position of vice-president of Region 3. As the vice-president of Region 3, I represented Colorado, Montana, Utah, and Wyoming. Serving the region was both rewarding and challenging. The region has the fewest number of NEHA members, which allowed me the opportunity to build close relationships. The area in the region, however, is vast with limited air transportation. In Region 3, most travel was done by driving to meetings. Occasionally, I made a round trip on the same day to attend a different conference in the same week.

Being involved with NEHA has not been all give. This association has blessed me to become a part of so many different projects. Building a vast network in NEHA has provided me the opportunity to be part of the Environmental Health Accreditation Council. I have visited environmental health academic programs across the country and have met so many students who are our future. The Food and Drug Administration (FDA) Partnership for Food Protection has allowed me to be part of its governing council representing local food safety programs. NEHA asked me to serve on the Council to Improve Foodborne Outbreak Response, an organization funded mainly by the Centers for Disease Control and Prevention (CDC). The FDA National Curriculum Standards Retail Framework Workgroup has been another place I have given back to the profession while meeting incredible food safety professionals from across the country. One last opportunity I want to mention is being part of the U.S. Virgin Islands training and mentorship project funded by CDC. This project allowed me to work with peers to

help the U.S. Virgin Islands rebuild its environmental health programs following Hurricanes Irma and Maria.

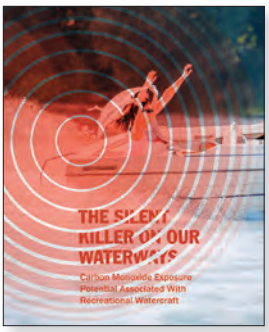
I mention these opportunities not to say I have done much, but to say there is much to do! We need every one of our members to do what they can to make this association better. Helen Keller said, "Alone we can do so little; together we can do so much." NEHA always has opportunities for professionals who want to be involved, and there is much more to do.

In a sense, NEHA is leaving the station and picking up steam. The new Registered Environmental Health Specialist/Registered Sanitarian (REHS/RS) exam will be released this fall. Increased efforts are being made to market the profession. NEHA continues to build bipartisan relationships with our national leadership in Washington, DC. The Environmental Health Workforce Act has been reintroduced in Congress. In May, NEHA received its most significant grant award ever to work with FDA to improve participation in the Voluntary National Retail Food Regulatory Program Standards and reduce foodborne illness. A considerable effort is also planned with rebranding and marketing this coming year. NEHA has an incredible staff, but they cannot get all this work done themselves. I have reached out to many members to solicit their help on our team, but we always need more.

Over the next year I hope to build on the work started by recent presidents who led NEHA to our highest number of members ever. Dr. Adam London is a great storyteller. NEHA needs to continue telling our story to our communities and policy makers to increase our profession's increased exposure. Vince Radke is a great communicator and scientist. NEHA needs to continue building relationships with our partners and stakeholders. Dr. Pricilla Oliver stressed the importance of an inclusive membership and profession. NEHA should strive to find the best people to fill every role in our organization and those who represent us. Lastly, Sandra Long has been a strong proponent of students. NEHA needs more student involvement in our committees, work groups, and other areas where a young perspective can benefit the environmental health profession.

While retaining these essential strategies, I will be working with NEHA staff and board members to improve our marketing efforts to promote both NEHA and the profession. Completing a strategic plan for the organization is another goal for the year ahead. I also hope to reach out to other environmental health fields such as sustainability, the built environment, climate change, and emergency preparedness to increase opportunities for these environmental health professionals through NEHA and to provide them with an organization they want to be part of. Through everyone working together, we can "take NEHA to the environmental health summit."

President@neha.org



Carbon Monoxide Exposure Potential Associated With the Use of Recreational Watercraft

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Abstract **Carbon monoxide (CO) is a colorless and odorless gas generated from incomplete combustion of hydrocarbon-based fuels. Exposure to elevated CO concentrations can cause an array of health problems or even death. Of increasing concern are CO-related poisonings and fatalities associated with recreational watercraft. From 2005–2018, there were 78 known deaths of people due to CO associated with the use of recreational watercraft in the U.S. The incidence, however, is likely higher due to many CO poisoning-related deaths being inaccurately attributed to drowning instead of CO poisoning.**

To examine the significance of this public health hazard, a range of plausible exposures were characterized by measuring instantaneous CO concentrations at 17 sampling locations on or near the stern of four recreational boats. Observed CO concentrations were highest in samples proximal to the engine exhaust manifold, with maximum concentrations for the four boats being 42,600 ppm, 2,550 ppm, 6,100 ppm, and 3,700 ppm, respectively. Continuous CO monitoring was performed at a fixed location near the passenger seat in the back of each boat. Comparing our monitoring results with thresholds set by the U.S. Environmental Protection Agency, National Institute for Occupational Safety and Health, and World Health Organization demonstrates that many CO concentrations exceed or nearly exceed established exposure thresholds. Thus, environmental health and public safety professionals must remain aware of this hazard and examine administrative and engineering controls that reduce watercraft-related CO exposures and prevent injuries and drowning related to CO.

Introduction

Carbon monoxide (CO) gas is generated from the incomplete combustion of hydrocarbon-based fuels. Due to its colorless and odorless nature, combined with its potential to produce lethal health outcomes, CO is often considered a "silent killer." CO inhalation toxicity is characterized by its enhanced affinity and binding strength to hemoglobin, which leads to hypoxia (Rose et al., 2017). CO affinity for hemoglobin is 210 times greater than oxygen and CO has an even greater affinity for myoglobin, which when bound to CO can lead to myocardial depression, low blood pressure, and irregular heartbeats (Barrett et al., 2009). Symptoms and outcomes of CO poisoning can include headache, irritability, fatigue, confusion, dizziness, vomiting, disorientation, seizures, angina, and death; increasing CO concentration, length of exposure, and ventilation rates exacerbate these conditions (Blumenthal, 2001; Ramos et al., 2016).

CO-related poisonings and fatalities associated with exposure to recreational watercraft emissions occur every year in the U.S. In 2017, more than 142 million people in the U.S. (36% of the population) participated in recreational boating (National Marine Manufacturers Association [NMMA], 2017), which represents an increase from 67.5 million people in 2000 and 87.3 million in 2014 (NMMA, 2015). From 2002–2011, the number of CO-related deaths associated with recreational boating in the U.S. averaged 6.7 per year, with cabin motorboats accounting for 53.7% of these deaths (LaSala et al., 2015). From 2005–2018, there were 167 CO-related accidents, 324 CO-related injuries, and 78 CO-related deaths reported to the U.S. Coast Guard and entered into the Boating Accident Report Database (U.S. Coast Guard, 2018, 2021).

These data account for CO-related exposures associated with auxiliary boat equipment, boat exhaust from other vessels, and exhaust of the vessel on which persons were either aboard or in close proximity at the time of the accident (U.S. Coast Guard, 2018). Overall, the incidence of CO-related accidents is likely underreported among drowning victims. Thus, physiologic testing for CO exposure needs to be requested by a

TABLE **1**

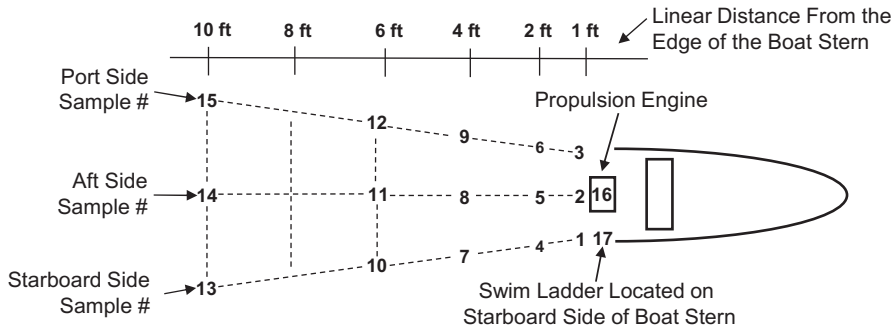
Boat Characteristics and Carbon Monoxide Monitoring Locations

Characteristic	Boat 1	Boat 2	Boat 3	Boat 4
Model and type	Bayliner, 1850 Caprice	Weldcraft, fishing	Ski Supreme, V Pro Sky	Four Winns Funship 234
Engine model	120 HP Force Outboard	Outboard Evinrude V6	Mercruiser 5.7L	Mercruiser 6.2L MX
Engine year	1999	1983	2001	2002
Site elevation	3,100 ft above MSL	2,470 ft above MSL	4,212 ft above MSL	3,100 ft above MSL
Study location	Spring Shores Marina	Private residence	Private residence	Spring Shores Marina
Water body	Lucky Peak Reservoir	Snake River	Snake River	Lucky Peak Reservoir
City and state	Boise, Idaho	Hammett, Idaho	Rupert, Idaho	Boise, Idaho

*MSL = mean sea level.

FIGURE **1**

Sampling Locations Used for Each Study Boat to Measure Carbon Monoxide



medical examiner when watercraft exhaust inhalation is expected (Armstrong & Erskine, 2018).

With regard to potential CO exposure, National Institute for Occupational Safety and Health (NIOSH) research shows that concentrations present in engine and generator exhaust emitted from houseboats often exceeded NIOSH's immediately-dangerous-to-life-or-health (IDLH) value of 1,200 ppm, a threshold that when exceeded limits one's ability to self-escape from the exposure environment (Hall et al., 2014). Research conducted by government organizations, such as NIOSH, provides a foundation for the characterization of CO emissions from recreational watercraft. Much of this research pertains to CO exposure associated with houseboats as well as the effectiveness of newly developed CO emission control features.

Significant contributors to deaths occurring outside the cabin area of recreational vessels are associated with teak surfing, sitting on the swim platform, or swimming behind an idling boat. Teak surfing is a practice now banned in many U.S. states and discouraged by the U.S. Coast Guard. This activity involves a person hanging onto the swim platform (often made of teak wood) and letting go at a time that allows them to ride (surf) the wake created by the moving boat. Teak surfing enhances the potential for greater exposure to CO because CO accumulates in the displacement wave gap created by the boat's wake. Even when the boat is moving, elevated CO exposures to those inside the vessel can exist via the "station wagon effect," an atmospheric condition created when air is displaced as a boat travels forward, creating a pocket of low pressure behind the boat that pulls exhaust gases into the boat (Garcia et al., 2006).

U.S. Coast Guard data confirm that CO poisonings and deaths continue to occur every year on U.S. waterways. Given recreational boating popularity in the U.S., studies investigating adverse CO exposure risks on and adjacent to recreational boats remain important to the safety and health of the recreating public. Thus, to better characterize CO exposures associated with the operation of non-houseboat style watercraft (e.g., ski boats, bass boats, etc.), this article describes the results of our study, which showed the dynamic nature of CO concentrations in ambient air and the potential for adverse exposure when measured at various locations on and adjacent to operating a recreational watercraft.

Methods

We performed CO monitoring on and adjacent to four boats using portable CO analyzers (Monoxor II & Monoxor II H). These handheld analyzers were used to record instantaneous CO concentrations. Due to the dynamic nature of CO in ambient air, CO was instantaneously monitored at 17 fixed locations for 10-s intervals and the maximum concentration over that interval was recorded. Continuous CO levels were monitored on the back passenger seat of each boat using an indoor air quality monitor (Q-Trak). Using a 1-s logging interval, the Q-Trak provided continuous results throughout the data collection period.

Wind direction was evaluated using a wind vane (Vortex Visual Vane) that logged and digitally recorded wind speed. For boats 1 and 4, atmospheric temperature and pressure were extrapolated to the sampling site using data collected at the National Oceanic and Atmospheric Administration weather station located at Lucky Peak Dam, Idaho. Due to the absence of an adjacent weather station at

study locations for boats 2 and 3, the Q-Trak monitor was used to obtain sampling site temperature and relative humidity.

CO monitoring methodologies were similar for all four boats, with the only differences being geographical location. Differences in the age, style, engine type, location, and elevation of the four boats assessed are noted in Table 1 and represent a cross-section of day-use boats on many U.S. waterways. For each boat, the wind vane and indoor air quality monitor were mounted on the back passenger seat, which is most proximal to the boat's engine.

To record CO concentrations at distances proximal and behind the boat's stern, CO analyzers were used to acquire maximum concentrations at 17 fixed locations using a researcher-operated, 7-ft Outcast pontoon boat. Monitoring distances ranged from directly behind the boat's engine to as far as 10 ft beyond the stern (Figure 1). To enable data collection at consistent distances, each monitoring location was measured using a graduated PVC pipe demarcated in 1-ft intervals. In addition to the distance-specific results obtained at engine idle, CO concentrations were recorded while the boat was in motion at engine speeds that mimicked recreational activities such as teak surfing and platform dragging.

Results

Environmental Conditions

Atmospheric data provided in Table 2 illustrate the stable, clear, sunny, and relatively warm or hot conditions observed during the three monitoring events. Wind speeds were light (<5 mph) at three of the four study locations and relative humidity variations were minor and decreasing throughout each of the four sampling periods.

Carbon Monoxide Monitoring Results at Engine Idle

Instantaneous CO results at engine idle (Table 3) show large variations at or near the engine exhaust port (locations 16 and 17). Specifically, boat 1 had CO levels ranging from 2–42,600 ppm, boat 2 had readings ranging from 45–2,550 ppm, boat 3 had readings ranging from 2–6,100 ppm, and boat 4 had readings ranging from 6–3,700 ppm. For all boats, CO concentration maximums occurred proximal to the engine.

TABLE **2**

Summary of Weather Conditions Specific to the Observation Period for Each Study Boat and Location

	Boat 1	Boat 2	Boat 3	Boat 4
Sample date	7/28/2011	8/7/2011	8/14/2011	8/21/2011
Time and duration of study	12:40–1:15 p.m.	10:16–11:03 a.m.	9:52–10:40 a.m.	8:20–11:42 a.m.
Temperature range (°F)	92–94	85–90	90–95	70–85
Relative humidity (%)	18–19	30–38	20–28	25–42
Average wind speed (mph)	1–2	1–3	0–1	8–15
Maximum wind speed (mph)	3	5	3	20

TABLE **3**

Carbon Monoxide (CO) Concentrations for the Study Boats by Sample Location and Distance

Sample Site	Distance (ft)	Carbon Monoxide Concentration (ppm)			
		Boat 1	Boat 2	Boat 3	Boat 4
1	1	270	600	35	**3,700**
2	1	320	600	**6,100**	190
3	1	80	63	**1,390**	620
4	2	800	292	27	**1,800**
5	2	500	**1,200**	1,030	**1,475**
6	2	200	24	1,030	100
7	4	90	218	20	1,100
8	4	270	270	450	6
9	4	410	45	580	8
10	6	100	–	4	42
11	6	45	–	5	30
12	6	60	–	8	14
13	10	7	350	2	75
14	10	5	120	3	80
15	10	2	24	3	10
16	0	**42,600***	**2,550***	103**	700**
17	<1	1,050	**1,850**	**5,000*****	540**

Note. Bolded numbers indicated CO concentrations at or above the National Institute for Occupational Safety and Health immediately-dangerous-to-life-or-health threshold (>1,200 ppm).
*Sample collected directly in front of outboard engine exhaust port.
**Sample collected directly behind swim platform at level of head height when holding onto platform.
***Sample collected directly behind the swim platform at platform level.

Distribution analyses of instantaneous CO results using the Shapiro–Wilk test demonstrated that data were not normally distributed and thus, all data were log-transformed. Overall, *t*-test analyses showed no difference in the average of $\log_{10}$ CO levels between the

FIGURE **2**

Scatterplot Demonstrating the Negative Relationship Between Carbon Monoxide (CO) Concentration and Distance From the Stern of Each Study Boat

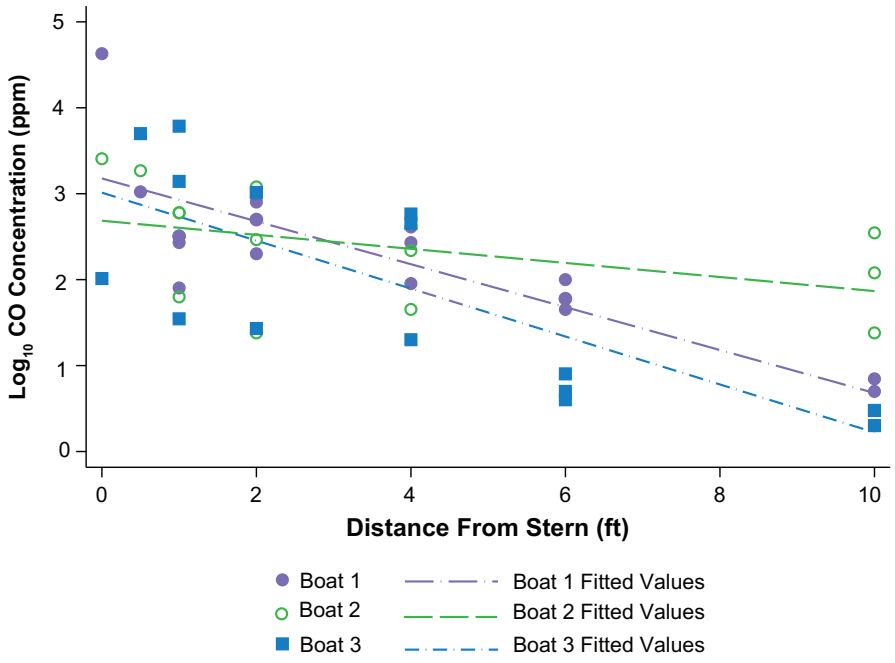


TABLE **4**

Carbon Monoxide (CO) Concentrations Measured During Simulated Recreational Activities

Activity	Boat #	Speed (mph)	CO Concentration (ppm)
Platform dragging (5 ft from stern)	1	2	160
	2	2	90
	3	5	55
	3	7	150
	3	10	75
	4	5	390
Platform dragging (10 ft from stern)	1	2	140
	2	2	50
Teak (wake) surfing	3	10	155
	3	10	520
	4	10	700
	4	10	540
	4	10	250
	4	10	448

four boats. For all boats, there was a significant negative correlation between CO concentrations and distance from the boat stern (Figure 2). Spearman's ρ was -.81, -.61, -.83, and -.56 for boats 1, 2, 3, and 4, respectively.

Carbon Monoxide Results for Each Boat in Motion

CO concentrations acquired for each boat in motion were monitored under conditions mimicking platform dragging and teak surfing. The observed CO concentrations mimicking platform dragging at varying speeds and at distances of 5- and 10-ft behind moving boats ranged from 50–390 ppm (Table 4). Table 4 shows CO concentrations ranging from 155–700 ppm when using boats 3 and 4 to simulate teak surfing at speeds of 5, 7, and 10 mph.

We performed continuous CO monitoring over the duration of the sampling period at the rear seat location of boats 2 and 3. Figure 3 shows 60-s peak concentrations of 302 ppm and 1,000 ppm for boats 2 and 3, respectively. Additionally, Table 5 provides 15-, 30-, and 60-min time-weighted average (TWA) CO concentrations computed from the logged data. Acquired 15-min TWA concentrations for boats 2 and 3 were 56 ppm and 13 ppm, respectively. The 30-min averages for boats 2 and 3 were lower at 38 ppm and 7 ppm, respectively. The 60-min average CO levels were lowest at 25 ppm and 4 ppm for boats 2 and 3, respectively.

Discussion

The four study boats, with variable engines, usage hours per engine, and exhaust systems, provided an opportunity to investigate a range of CO exposure scenarios. Additionally, for each boat, we examined the potential for near-engine exhaust concentrations to exceed health-relevant standards. The results of this study suggest CO exposures can occur at concentrations that encroach upon and exceed exposure thresholds established by government and nongovernmental organizations.

Comparing Results to Occupational Standards

Upon reviewing boat-related CO poisoning case reports (National Institute for Occupational Safety and Health, 2006), it is apparent to us that CO poisoning happens to persons of all ages; however, children and adolescents could be at increased risk for CO-related accidents. The World Health Organization

(WHO, 1999) has always considered children a high-risk group for CO poisoning. Children presumably have higher received and inhaled doses due to differences in their respiratory rates and body mass.

For working adults, NIOSH designates occupational exposures to CO concentrations that are at or above 1,200 ppm to be immediately-dangerous-to-life-or-health (IDLH). Thus, given their enhanced risk, children would theoretically need a level more protective than 1,200 ppm. For all four boats, our study showed that persons using the swim ladder or hanging from the stern or swim platform could be exposed to CO levels that exceeded the IDLH level (Table 3). For boat 2, even at a distance of 2 ft beyond the stern, CO concentrations were observed at or above 1,200 ppm. These results corroborate findings from Hall et al. (2014), who observed CO levels above the NIOSH IDLH concentration proximal to houseboat exhaust.

The Q-Trak continuous sampling for boats 2 and 3 mounted on a passenger seat nearest the stern showed peaks ranging from 300–1,000 ppm (Figures 3 and 4). On boat 3, the boat started and stopped several times, mimicking typical recreational skiing or surfing, where a boat starts and stops numerous times to collect fallen recreationalists. The air current during this time was dragged into the back of the boat and concentration spikes reached upwards of 300 ppm inside the boat. Although these levels when averaged over 8 hr might not result in exceedances of 8-hr TWA limit values for working adults in occupational environments, it is plausible that the TWA could be exceeded depending on the different watercraft involved, variations in engine performance, and activity use patterns on the water. The 8-hr TWA values from NIOSH, American Conference of Governmental Industrial Hygienists (ACGIH), and Occupational Safety and Health Administration are 35, 25, and 50 ppm, respectively (ACGIH, 2013; Air Contaminants, 1997; NIOSH, 2007). Boat 3 had 15-min, 30-min, and 60-min values of 55, 38, and 25 ppm, respectively. Boat 3, if used for skiing all day theoretically could have exceeded the 8-hr TWA values.

Comparing Results to Indoor and Ambient Air Guidelines

In comparison to WHO indoor air guidelines, our results suggest that under conditions that closely mimic skiing activities (after 10:45 a.m. in boat 3, Figure 3), the potential for passengers to be exposed to levels exceeding WHO established standards is plausible. The WHO guidelines indicate persons should not be exposed to levels exceeding 87 ppm for 15 min, 52 ppm for 30 min, 26 ppm for 60 min, and 9 ppm for 8 hr. The 60-min result observed inside boat 3 was 25 ppm, which was just below the 60-min level of 26 ppm set by WHO.

It should be noted that a full 60 min of skiing was not simulated, and only 20 min were recorded by the Q-Trak. The 60-min average obtained from the Q-Trak included approximately 40 min of idling time. If the study occurred for a period of time only focusing on the boat in operation for skiing, wakeboarding, etc., it is apparent over 60 min that boat 3 would likely have exceeded one or more WHO guidelines. Furthermore, it is plausible that over 60 min, the passenger seat of boat 3 could have experienced an exceedance of the U.S. Environmental Protection Agency (U.S. EPA, 2021a) ambient air quality standard of 35 ppm for a 60-min average.

TABLE **5**

Maximum Time Weighted Average of Carbon Monoxide (CO) Concentrations Measured During the Sampling Period

Time (min)	CO Concentration (ppm)	
	Boat 2	Boat 3
15	56	13
30	38	7
60	25	4

Comparing Results to Acute Exposure Guideline Levels

U.S. EPA identifies CO as an extremely hazardous substance. For assisting communities with planning for potentially harmful emergency exposures to extremely hazardous substances, the National Research Council (2010) developed acute exposure guideline levels (AEGLs). The two AEGL values applicable to life safety (AEGL-2 and AEGL-3) are applicable to the general population, which includes susceptible individuals. AEGL-2 is the concentration that could result in irreversible or other serious long-lasting health effects, or impair the ability to escape. AEGL-3 is the level that could result in life-threatening adverse health effects or death. Values for AEGL-2 and AEGL-3 exist for exposures ranging from 10 min to 8 hr.

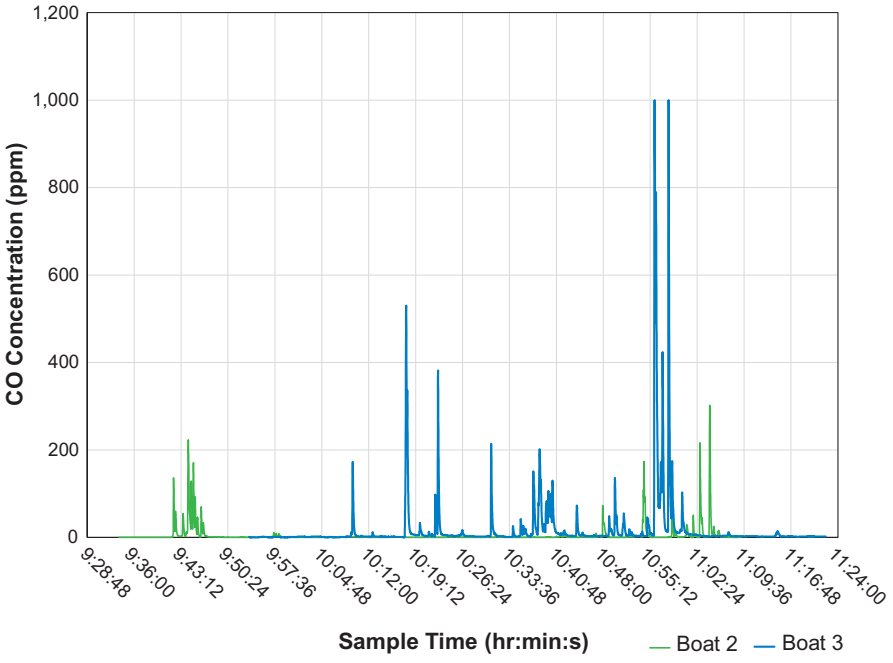
AEGL-2 indicates that 10 min of 420 ppm or 30 min of 150 ppm exposure would be disabling and could result in an inability to escape. AEGL-3 indicates that 10 min of exposure at 1,700 ppm could be lethal. The AEGL values were developed by the National Research Council (2010) as "emergency exposure limits for exposures at high levels but of short duration, usually less than 1 hour, and only once in a lifetime for the general population, which includes infants (from birth to 3 years of age), children, the elderly, and persons with diseases, such as asthma or heart disease."

The CO concentrations observed for the teak surfing scenario for boats 3 and 4 (Table 4) would exceed AEGL-2 if 10 min of sustained teak surfing occurred. Individuals who are exposed might be unable to escape, which could result in injury or drowning if the person is not wearing a face-up personal flotation device. Sustained platform dragging with a distance of 5 ft could also exceed AEGL-2 (Table 4).

Overall, the variability observed here in CO concentrations likely pertains to engine type, engine performance, and wind variability. A larger study of more engine types would likely demonstrate more health-favorable as well as more concerning measures of CO. The TWA values used in this study are inclusive of the time periods with idle operation of the watercraft. The TWA values would be higher for sustained activities involving operation of the watercraft at speeds used for skiing, wakeboarding, etc. The engines and watercraft involved in our study were all operational with no known defects. Improper fuel mixtures, engine malfunctions, exhaust system damage,

FIGURE **3**

Maximum Carbon Monoxide (CO) Concentrations Measured at the Rear Seat of Study Boats 2 and 3



Note. This time-series plot is inclusive of CO concentrations obtained at idle and moving speeds during 60-s measurement periods.

and other factors could create conditions that would be of greater concern for public health than the results observed in our study.

Health Implications and Recommendations

Recreational watercraft continue to be linked to preventable CO-related injuries and deaths (U.S. Coast Guard, 2018, 2021). Since 1995, there has been clear documentation in the medical literature of this danger (Silvers & Hampson, 1995). In this study, the CO observations show opportunities for exposed persons to experience loss of consciousness, neurologic damage, physical injury, and accidental death. Furthermore, even passengers in open-air watercraft can be exposed to CO levels that are detrimental to health. Also of concern would be pregnant passengers, as increasing CO exposure has been linked to adverse impacts on fetal growth and birth-related health outcomes (Liu et al., 2007; Stieb et al., 2012)

It is presumed many recreational boaters remain unaware of CO dangers present on and around boats. Along with existing private and government efforts, increasing awareness through state-mandated boating education courses could further reduce CO-related accidents. Signage, decals, and greater use of regulations regarding the dangers of teak surfing—as well as emphasizing the unique concept of the "death zone" could be considered as intervention opportunities. Interventions aimed at reducing CO-related injuries and mortality could fit into the National Association of State Boating Law Administrators (NASBLA) public health advocacy work related to the *National Recreational Boating Safety Program 2017–2021 Strategic Plan* that emphasizes a public health approach for increasing safer recreational boating practices (NASBLA, 2016; U.S. Coast Guard, 2016).

For houseboats, NIOSH recommended a variety of engineering controls such as exhaust stacks (Dunn et al., 2001). Research demonstrates that well-designed stacks can reduce houseboat CO concentrations by 90% (Dunn et al., 2003). Continued efforts at engineering controls for reducing CO emissions would improve boater safety. Newer engines (post-2010) should have lower emissions due to regulations pertaining to marine spark-ignition engines established by U.S. EPA (2021b); however, older engines will continue to remain on the water. In the absence of engineering controls and as a precautionary measure, people of all ages should avoid danger areas and always wear a life vest, as drowning events from CO-related loss of consciousness are plausible.

For legislation, several states including California, Nevada, Oregon, Pennsylvania, and Washington prohibit teak surfing, while some jurisdictions consider it reckless or careless operation of a vessel. In addition, several states including California, Minnesota, and Washington require decals, CO monitors, or both to warn boaters of the dangers of CO; however, the laws vary regarding vessel types and whether the vessel has any enclosed spaces. Few states mandate CO-related decals to be placed on watercraft, which can be an affordable intervention. Lastly, NASBLA (2019) reports that an overwhelming majority of U.S. states and territories require some form of boater education, which affords an opportunity to educate boaters on CO dangers. Many states already include CO-related education; however, education should not be limited to cabin-only vessels.

Conclusion

Recreational boater exposure to CO, on both idling and operational watercraft, has the potential to encroach and often exceed government exposure thresholds. Our study results validate the potential for poisonings and fatalities that have been documented by the U.S. Coast Guard. We anticipate that these findings will promote awareness of this health hazard among environmental health practitioners. Results from this study can promote continued progress in enhancing education as well as administrative and engineering controls for minimizing dangerous and potentially fatal CO exposures.

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JEH QUIZ

FEATURED ARTICLE QUIZ #1

Carbon Monoxide Exposure Potential Associated With the Use of Recreational Watercraft

Available to those with an active National Environmental Health Association (NEHA) membership, the *JEH* Quiz is offered six times per calendar year and is an easily accessible way to earn continuing education (CE) contact hours toward maintaining a NEHA credential. Each quiz is worth 1.0 CE.

Completing quizzes is now based on the honor system and should be self-reported by the credential holder. Quizzes published only during your current credential cycle are eligible for CE credit. Please keep a copy of each completed quiz for your records. CE credit will post to your account within three business days.

Paper or electronic quiz submissions will no longer be collected by NEHA staff.

INSTRUCTIONS TO SELF-REPORT A *JEH* QUIZ FOR CE CREDIT

1. Read the featured article and select the correct answer to each *JEH* Quiz question.
2. Log in to your MyNEHA account at https://neha.users.membersuite.com/home.
3. Click on Credentials located at the top of the page.
4. Select Report CEs from the drop-down menu.
5. Enter the date you finished the quiz in the Date Attended field.
6. Enter 1.0 in the Length of Course in Hours field.
7. In the Description field, enter the activity as "*JEH* Quiz #, Month Year" (e.g., *JEH* Quiz 1, July/August 2021).
8. Click the Create button.

JEH Quiz #5 Answers

March 2021

1. a	4. c	7. b	10. c
2. b	5. d	8. a	11. b
3. c	6. d	9. b	12. a

→ Quiz effective date: July 1, 2021 | Quiz deadline: October 1, 2021

1. Carbon monoxide (CO) is a colorless and odorless gas generated from incomplete combustion of hydrocarbon-based fuels.
   a. True.
   b. False.
2. CO affinity for hemoglobin is __ times greater than oxygen.
   a. 50
   b. 110
   c. 210
   d. 250
3. In 2017, more than __ million people in the U.S. participated in recreational boating.
   a. 92
   b. 142
   c. 192
   d. 242
4. From 2002–2011, the number of CO-related deaths associated with recreational boating in the U.S. averaged __ per year.
   a. 3.7
   b. 4.7
   c. 5.7
   d. 6.7
5. From 2005–2018, there were __ CO-related accidents, __ CO-related injuries, and __ CO-related deaths reported to the U.S. Coast Guard.
   a. 167; 324; 78
   b. 78; 324; 167
   c. 342; 167; 78
   d. 167; 78; 324
6. National Institute for Occupational Safety and Health (NIOSH) research shows that concentrations present in engine and generator exhaust emitted from houseboats often exceeded NIOSH's immediately-dangerous-to-life-or-health (IDLH) value of
   a. 1,000 ppm.
   b. 1,100 ppm.
   c. 1,200 ppm.
   d. 1,300 ppm.
7. The authors performed CO monitoring on and adjacent to __ boats using portable CO analyzers.
   a. two
   b. three
   c. four
   d. five
8. For all boats, CO concentration maximums occurred proximal to the engine.
   a. True.
   b. False.
9. CO concentrations ranged from __ when using boats 3 and 4 to simulate teak surfing at speeds of 5, 7, and 10 mph.
   a. 56–302 ppm
   b. 155–700 ppm
   c. 155–1,000 ppm
   d 300–1,000 ppm
10. For all boats, this study showed that persons using the swim ladder or hanging from the stern or swim platform could be exposed to CO levels that __ the IDLH level.
    a. exceed
    b. do not exceed
11. The CO concentrations observed for the teak surfing scenario for boats 3 and 4 would exceed the acute exposure guideline level (AEGL)-2 if __ of sustained teak surfing occurred.
    a. 5 min
    b. 10 min
    c. 15 min
    d. 20 min
12. The following could be considered as intervention opportunities to reduce CO-related accidents related to recreational watercraft use:
    a. signage.
    b. decals.
    c. regulations.
    d. all the above.
    e. none of the above.

A Rapid-Response Survey of Essential Workers in Midwestern Meatpacking Plants: Perspectives on COVID-19 Response in the Workplace

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Abstract **The meatpacking industry has faced significant challenges in maintaining a safe and healthy working environment for its employees during the COVID-19 pandemic, which has resulted in worker illness and death, temporary closures of facilities, reductions in production capacity, and consequences throughout the supply chain. We sought to explore the concerns and perceptions of COVID-19 among meatpacking workers in the Midwestern part of the U.S. We conducted an online survey of meatpacking workers in Nebraska, Iowa, Kansas, and Missouri between May 7 and 25, 2020. A total of 585 workers participated (*M* = 41.3 years, *SD* = 10.3). More than 72% of workers believed that they were at "high risk" for contracting COVID-19, but less than one half had been tested (42%). Most workers (83%) reported that their employer had instituted some safety measures, but less than one half reported physical distancing on the line (39%), slowing down the line (34%), additional paid time off (28%), or restructuring of shifts (20%). Enforceable standards are needed in the meatpacking industry to reduce COVID-19 transmission. Culturally and linguistically tailored education, paid sick leave, and restructuring of work can reduce the risks of COVID-19 transmission. Transparency on workplace transmission rates is essential to developing strategies to mitigate occupational risks and foster worker trust.**

Introduction

The meat processing (meatpacking) industry has faced significant challenges in maintaining a safe and healthy working environment for its employees. The culture within these plants prioritizes production (Ramos et al., 2021) and the industry consistently has higher rates of occupational injuries and illnesses than other industries. In 2018, animal slaughter and processing (North American Industry Classification System code 3116) had a rate of 4.3 recordable cases of nonfatal occupational injuries and illnesses per 100 workers compared with the combined average for all industries of 3.1 recordable cases per 100 workers (U.S. Bureau of Labor Statistics, 2018). Occupational injuries and illnesses might be underreported within the industry for various reasons such as fear of retaliation, being reported to immigration authorities, or losing one's job given that much of workforce is comprised of immigrants and people from racial and ethnic minority backgrounds (Fagan & Hodgson, 2017; Leibler & Perry, 2017; McConnell, 2019).

Due to safety concerns, the Occupational Safety and Health Administration (OSHA) initiated a regional emphasis program to address safety and health issues in high-hazard workplaces such as meat processing facilities and has maintained a local emphasis program in Nebraska (OSHA, 2019a, 2019b) that is designed to address hazards through enforcement (OSHA, n.d.). Numerous reports spanning multiple decades have documented cases of poor working conditions, human rights abuses, and exploitation of vulnerable worker populations (e.g., immigrants, racial and ethnic minorities) within the meatpacking industry (Jain, 2016; McConnell, 2019; Nebraska Appleseed, 2009).

During the coronavirus disease 2019 (COVID-19) pandemic, the U.S. Department of Homeland Security (2020) deemed the meatpacking industry "essential critical infrastructure." By default, the declaration positioned all meatpacking workers as "essential workers." Meatpacking plant workers are particularly at risk for COVID-19 due to the significant number of workers per shift, the proximity of workers on processing lines, the prolonged duration of contact among workers, and the enclosed nature of these facilities (Centers for Disease Control and Prevention, 2021). The declaration of meatpacking workers as essential was not accompanied by any enforceable federal worker protection standards and the implementation of infection prevention and control measures to ensure the health and safety of these workers has been inconsistent.

Over the course of the pandemic, many meatpacking workers have been required to work without or with inconsistent supplies of personal protective equipment and had no effective right to refuse dangerous assignments despite working in difficult and demanding conditions (McNicholas & Poydock, 2020). In other essential industries—from hospitals to grocery stores—additional worker protections generally were put into place as harm reduction measures and out of fairness to workers who took on greater than usual risks (Lowe et al., 2020).

Hundreds of outbreaks of COVID-19 occurred in meatpacking facilities across the U.S., and in many cases, these work-related outbreaks spurred large-scale outbreaks in communities that surrounded these facilities, with the plants becoming vectors for community transmission (Taylor et al., 2020). High absenteeism due to isolated and quarantined workers led to temporary plant closures and reductions in production capacity that resulted in large economic losses throughout the meat supply chain, from agricultural producers to the processing facilities. Although there is no national comprehensive data on the impact of COVID-19 within the meatpacking industry, as of May 13, 2021, the Food & Environment Reporting Network has tracked at least 58,727 cases of COVID-19 and 293 deaths among meatpacking workers (Douglas, 2020). These numbers likely are a vast underrepresentation of the actual impact of COVID-19 among meat processing workers given the challenges with access to data and reporting of cases by the industry. In Nebraska as of March 19, 2021, 7,237 positive cases, 255 hospitalizations, and 27 deaths have been reported among meatpacking workers (Bahr, 2021).

On April 26, 2020, the Centers for Disease Control and Prevention (CDC) and OSHA released infection prevention and control guidance for workers and employers at meat and poultry facilities. The guidance included recommendations on active screening, distancing on the processing line, placing physical barriers, wearing face masks, and educating workers—however, this guidance came too late. Many of the plants had already experienced large outbreaks and struggled to fully implement the guidance. On May 19, 2020, OSHA released a memo outlining that COVID-19 could be a recordable occupational illness if the case 1) was confirmed, 2) was deemed work-related as defined by 29 C.F.R. § 1904.5, and 3) met one or more of the criteria from 29 C.F.R. § 1904.7 (OSHA, 2020).

The impacts of COVID-19 on meat processing workers and the industry more generally have been highly publicized and reported on in the media; however, the worker perspective regarding the COVID-19 pandemic and the interventions that were put into place by an industry with a history of poor working conditions has not been studied. Therefore, we sought to explore the concerns and perceptions of COVID-19 among meatpacking workers in the Midwestern part of the U.S. Specifically, we sought to understand the worker perspective of how plant leadership had responded to COVID-19 including the 1) types of protective strategies that were implemented in the plants, 2) information that was provided to workers about the virus and its transmission, and 3) specific actions workers wanted their employers to take to prevent the spread of COVID-19.

Methods

Participants

To participate in this study, a person needed to be employed by a meatpacking plant at the time of the survey and be at least the legal age of majority in the state where they lived (i.e., age 18 for most states but age 19 for Nebraska).

Procedures

In early April 2020, our team hosted a series of virtual meetings with community organization partners across Nebraska to discuss COVID-19 outbreaks in meatpacking facilities. During these meetings, it became clear that there needed to be a mechanism to hear directly from workers about their experiences. A 40-question survey was created based in part on the University of Nebraska Medical Center's *COVID-19 Meat Processing Facility Playbook*, which was developed by teams with expertise in infectious disease, health security, public health, and health disparities (Herstein et al., 2020).

Given the time-sensitive nature of this study, the survey questions were reviewed for comprehension by individuals who had significant experience with meatpacking workers. Study data were collected and managed using Research Electronic Data Capture (REDCap), a secure, web-based application designed to support data capture collection. This online mechanism was chosen due to the institutional restrictions on research-related physical contact during the COVID-19 pandemic.

The survey was available online in English, Spanish, and French between May 7 and 25, 2020. Completing the survey took approximately 15 min. All questions were voluntary and participants could choose to skip any questions that made them uncomfortable. The study was anonymous and no personally identifiable information was collected. Participants were recruited through advertisements on Facebook and through community organization partners, Spanish-language and bilingual (English-Spanish) media outlets (e.g., Telemundo Nebraska, Mundo Latino, Radio Lobo, and El Perico newspaper), and word-of-mouth. Participants did not receive any compensation for completing the survey. The study was approved by the institutional review board at the University of Nebraska Medical Center.

Measures

The following measures were collected through the survey:

- **Perceived risk of personally contracting COVID-19:** Participants were asked, "How much at risk do you feel you are for getting the coronavirus (COVID-19)?" Survey response options included: at high risk, somewhat at risk, a little at risk, or not at all at risk.
- **Testing and experience with COVID-19:** Participants were asked if they had

been tested for COVID-19, what barriers they experienced related to testing, and whether they or a household member had tested positive.

- **Employer actions in response to COVID-19:** Participants were asked how their employer had responded to COVID-19. A list of actions with the following options was provided: slowed down the line speed, increased distance between workers, increased the number of shifts and reduced the number of people per shift, installed plastic barriers between workers, made everyone wear masks at all times, rescheduled breaks and lunches to reduce the number of workers who are together at one time, paid bonuses to those who came to work every day they were scheduled for a specific time period, increased hourly wages, posted signage in multiple languages throughout the plant to inform workers about COVID-19, ensured temperature checks for everyone entering the plant, provided workers with additional paid time off, conducted more frequent cleaning and sanitation of facilities, and other. If a participant chose "other," there was an opportunity to describe what they had experienced. Participants could respond yes, no, or not sure to each action. Employer actions in response to COVID-19 were dichotomized into yes and no for analysis. Additionally, we asked participants an open-ended question, "What do you want your employer or supervisor to do to keep workers safe during this outbreak?"
- **Information provided by the employer:** Participants were asked whether they had received any information on COVID-19 from their employer, what type of information had been provided, and what type of information would be helpful (open-ended question).
- **Demographics:** Participants were asked a series of demographic questions including gender, age, race, country of origin, English proficiency, education, household size, length of time working in the meatpacking industry, and whether they had health insurance, a regular healthcare provider, or any chronic health conditions. They were also asked about their work, including their position within the plant. Positions were collapsed into four broad categories including 1) kill (harvest) floor, 2) processing, 3) packaging, and 4) all others. Finally, participants were asked to provide the city and state of their employer, which was collapsed into Nebraska and surrounding states (Iowa, Kansas, and Missouri).

Analysis

We used descriptive statistics including frequencies, means, and standard deviations to examine the study variables of interest. We then used chi-square tests to identify significant associations between employer actions in response to COVID-19, work categories (i.e., kill floor, processing, packaging, and all others), and plant location (i.e., Nebraska or surrounding states). Data were analyzed using SPSS version 25. Two members of the research team used thematic analysis techniques to code and categorize survey participant responses to open-ended questions.

Results

A total of 585 workers from Nebraska, Iowa, Kansas, and Missouri participated in the study (M = 41.3 years, SD = 10.3). More than 75% of participants worked in Nebraska. Almost one half of participants were immigrants from Mexico (49%) and 54% had limited English proficiency. On average, participants had been working in meatpacking for 7 years. They represented various positions within the plant such as kill floor, deboning, packaging, meat grading, quality assurance, cleaning crew, maintenance, human resources, and the health office. Demographic characteristics of study participants are presented in Table 1.

Nearly three fourths (n = 419, 72%) of workers believed that they were at "high risk" for contracting COVID-19, but only 42% had been tested at the time of the survey. When asked about barriers to testing, 45% of participants responded that they were not sick so there was no need to be tested. Participants also noted other barriers such as being unsure about the location of testing sites (9%), being unsure what to do if they tested positive (9%), and the cost of testing (8%).

Most workers reported that their employer had instituted temperature screening for anyone entering the facility (88%), made everyone wear a face mask while in the facility (83%), and posted signage in multiple languages throughout the facility about COVID-19 (79%). Less than one half of participants reported physical distancing on the line (39%), slowing down the line (34%), additional paid time off (28%), or restructuring of shifts (20%) (Figure 1).

There were significant differences among participants by work categories and reporting how their employer had responded to the pandemic. Those who worked on the kill floor were significantly less likely to report the installation of physical barriers, posting of signage in multiple languages, and restructuring of breaks or lunches; however, they were significantly more likely to report restructuring of shifts. Those who worked in packaging were significantly more likely to report that everyone had to wear a mask. Workers in the category "all others" were significantly more likely to report additional paid time off. Table 2 highlights the significant associations between employer actions in response to COVID-19 and work category. Workers in Nebraska were significantly less likely to report that the production line had slowed down compared with workers in other states: 34% in Nebraska compared with 46% elsewhere.

Most workers (71%) had received some information related to COVID-19 from their employer (e.g., general information about the virus, control strategies, COVID-19 workplace practices). About one half of workers reported that they had received information about COVID-19 symptoms (51%), safety precautions (51%), and handwashing guidelines (50%). Workers wanted information at the appropriate language and literacy level on topics such as what to do if they or a coworker tests positive, the return to work process, and community spread of the virus. Although 83% of workers reported that their employer was ensuring the use of face masks in the plant, only 45% indicated that they had received information on how to wear and care for a mask properly.

Workers consistently reported that companies and supervisors emphasized production. One worker noted, "They don't care about their workers, they only care about the money. Each person's life for them is just another cow." Workers described actions that they wanted their employers to take to prevent the spread of COVID-19 within the facility. Table 3 presents main themes based on comments from 328 workers.

Discussion

Literature published to date has focused on epidemiologic data related to the number of

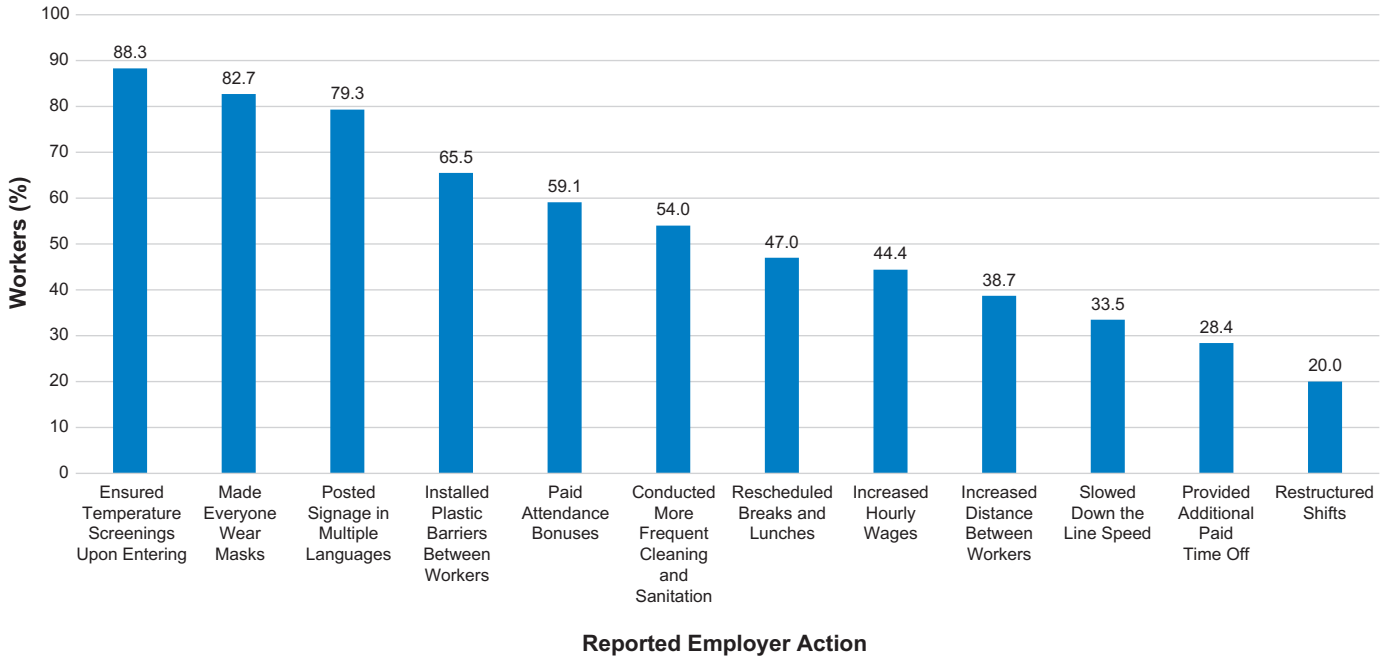
TABLE **1**

Demographic Characteristics of Study Participants

Characteristic	Total (*N* = 585)		Nebraska (*n* = 443)		Surrounding States (*n* = 142)	
	# (%)	*M* (*SD*)	# (%)	*M* (*SD*)	# (%)	*M* (*SD*)
Gender (*n* = 441)						
Male	185 (42.0)		145 (42.8)		40 (39.2)	
Female	254 (57.6)		192 (56.6)		62 (60.8)	
Nonbinary	2 (0.5)		2 (0.6)		0 (0)	
Age (years, *n* = 441)		41.3 (10.3)		40.7 (10.3)		43.4 (10.0)
Country of origin (*n* = 440)						
U.S.	46 (10.5)		35 (10.3)		11 (10.9)	
Mexico	216 (49.1)		162 (47.6)		56 (55.4)	
Cuba	62 (14.1)		46 (13.5)		16 (15.8)	
El Salvador	32 (7.3)		28 (8.2)		4 (4.0)	
Guatemala	37 (8.4)		32 (9.4)		5 (5.0)	
Other	47 (10.7)		37 (10.9)		9 (8.9)	
Race/ethnicity (*n* = 451)						
White	44 (9.8)		34 (9.8)		10 (9.5)	
African American/Black	11 (2.4)		11(3.2)		0 (0)	
Asian	9 (2.0)		8 (2.3)		1 (1.0)	
Hispanic/Latino	380 (84.3)		287 (82.9)		93 (88.6)	
Other	7 (1.6)		6 (1.7)		1 (1.0)	
Education (*n* = 394)						
≤Eighth grade	101 (25.6)		82 (27.2)		19 (20.4)	
Some high school	71 (82.0)		60 (19.9)		11 (11.8)	
High school graduate/GED	143 (36.3)		104 (34.6)		39 (41.9)	
Some college or technical training	79 (20.1)		55 (18.3)		24 (25.8)	
Limited English proficiency (*n* = 441)	236 (53.5)		183 (53.8)		53 (52.5)	
Number of people in household (*n* = 429)		4.1 (1.8)		4.2 (1.8)		3.8 (1.5)
Self-rated health (*n* = 454)						
Excellent, very good, or good	339 (74.7)		259 (74.9)		80 (74.1)	
Fair or poor	115 (25.3)		87 (25.1)		28 (25.9)	
Have health insurance (*n* = 453)	410 (90.5)		309 (89.6)		101 (93.5)	
Have regular healthcare provider (*n* = 453)	290 (64.0)		227 (65.6)		63 (58.9)	
Have a chronic condition (*n* = 434)	130 (30.0)		105 (32.0)		25 (23.6)	
Plant tenure (years, *n* = 457)		7.8 (7.6)		7.7 (7.6)		8.1 (7.5)
Work tasks (*n* = 585)						
Kill (harvest) floor	114 (19.5)		80 (18.1)		34 (23.9)	
Processing	128 (21.9)		103 (23.3)		25 (17.6)	
Packaging	140 (23.9)		110 (24.8)		30 (21.1)	
All others	203 (34.7)		150 (33.9)		53 (37.3)	

FIGURE **1**

Employer Actions in Response to COVID-19 as Reported by Workers



large outbreaks and positive COVID-19 cases in the meatpacking industry, as well as commentaries about protecting essential workers (Dyal et al., 2020; Herstein et al., 2021; Middleton et al., 2020; Ramos et al., 2020; Waltenburg et al., 2020). To our knowledge, this study is the first to explore perceptions and concerns related to COVID-19 directly with meatpacking plant workers. We found that most participants felt they were at high risk for contracting COVID-19, and many wanted the plant to close temporarily. Most also reported that their employers had implemented a temperature screening upon entry to the plant as well as a universal mask policy. Other effective measures to reduce the spread of COVID-19 in the plant, however, were far less frequently reported including physical distancing on the line and in common areas, provision of paid sick leave, slowing down the line, and restructuring shifts to reduce the number of workers on the line and in the plant at one time.

Workers on the kill floor were significantly less likely to have reported specific protective measures, except for restructuring shifts. Workers in other positions not on the line (e.g., administrative or supervisory roles) were significantly more likely to report that there was a specific paid time off policy for COVID-19. Workers gave concrete feedback on the types of actions that they felt their employers should take to protect their health and safety, such as more transparent communication on the number of positive cases within the facility and how they were being addressed.

A worker's risk for COVID-19 can be impacted by their specific position within the plant. Although meatpacking facilities have been characterized as environments with high transmission risk due to a) the high density of workers, b) prolonged close contact between workers, and c) shared common areas (Durand-Moreau et al., 2020), specific positions can bear more of the risk due to challenges in instituting infection prevention and control strategies. The unique responsibilities of those on the kill floor require greater movement; therefore, there is more opportunity for physical distancing but less opportunity for physical barriers than what is feasible on pace-set production lines where workers remain stationary throughout their shift except for lunch and breaks. Additionally, these production environments (i.e., processing and packaging; collectively, fabrication) are kept cold for food safety purposes—a more favorable environment for coronavirus than the higher-temperature kill floor—and often involve supervisors and coworkers amplifying their voices to be heard over the sound of the production line, which can further the spread of both droplet and aerosol virus particles (Rubenstein et al., 2020).

Regardless of position in the plant, shift changes, lunch, and breaks can present some of the greatest risks for transmission of COVID-19 in these facilities: high concentrations of workers compacted in small spaces where physical distancing is challenging if not impossible, masks cannot be worn while workers eat near each other, and there is high potential for increased interactions in hallways and locker rooms as workers move between workstations and common areas. Workers in clerical or administrative roles could be in a better position to circumvent these risks, especially if they have the option to work remotely or isolate during lunch in smaller offices or conference rooms.

Active screening protocols and a universal face mask policy should supplement other

TABLE **2**

Significant Associations Between Worker Perceptions of Employer Actions in Response to COVID-19 Based on Work Category Compared With All Other Work Categories

Employer Action	Kill Floor (*n* = 114)			Processing (*n* = 128)			Packaging (*n* = 140)			All Other Tasks (*n* = 203)		
	% Within Work Category	% of All Other Work Categories	*p*-Value	% Within Work Category	% of All Other Work Categories	*p*-Value	% Within Work Category	% of All Other Work Categories	*p*-Value	% Within Work Category	% of All Other Work Categories	*p*-Value
Temperature screening upon entry	90.3	92.9	.398	95.1	91.7	.247	91.6	92.7	.700	92.5	92.4	.956
Universal mask policy	81.4	86.2	.234	86.4	85.0	.713	91.6*	83.2	.025	82.2	86.8	.175
Posted signage in multiple languages	76.7**	88.2	.005	86.5	85.8	.860	88.0	85.2	.442	89.4	84.2	.130
Installed barriers between workers	54.5***	73.2	.001	76.3	67.9	.109	72.3	68.7	.468	72.0	68.4	.432
Paid attendance bonus	72.0	68.8	.573	69.9	69.3	.912	59.5**	73.0	.008	75.4	66.3	.057
More frequent cleaning and sanitation	56.9	68.6	.058	64.8	67.0	.702	68.0	66.0	.715	71.6	63.9	.122
Rescheduled breaks and lunches to reduce contact	38.3*	51.9	.019	48.5	49.3	.889	50.4	48.7	.747	55.3	46.2	.067
Increased hourly wages	52.8	47.2	.345	42.9	49.9	.220	41.1	50.7	.076	54.7	45.2	.057
Increased distance between workers	32.3	43.4	.051	38.2	42.0	.496	43.7	40.3	.515	46.7	38.5	.096
Slowed the line speed	44.6	35.0	.089	28.9	39.0	.075	28.4*	40.0	.027	44.1*	33.6	.033
Provided additional paid time off	40.3	39.6	.914	31.6	42.1	.096	32.6	42.1	.111	50.0**	34.3	.005
Restructured shifts to reduce contact	31.9**	19.3	.010	20.7	22.2	.746	16.7	23.7	.117	20.5	22.6	.630

*$p < .05$.
**$p \leq .01$.
***$p \leq .001$.

types of administrative or engineering controls, not replace them. Physical barriers, adequate ventilation, and restricted access are strategies that do not depend on worker adherence or employer enforcement of policies. Strict, enhanced environmental cleaning and disinfection procedures can limit potential fomite transmission of the virus, particularly when focusing on high-touch surfaces (e.g., railings, doorknobs) that are handled by hundreds of workers in one shift. A universal mask policy is effective (Herstein et al., 2021); however, masks must be worn properly and consistently. As detailed in this survey, many workers had not received information related to proper mask use and care. Education and strategies to disseminate information must be part of a facility's COVID-19 communication strategy. Such planning must consider the diversity of the workforce, including literacy levels and the multiple languages often spoken in a single facility. Effective communication strategies, developing trust and empathy, and educating workers on the disease and specific workplace policies are important for mitigating transmission risks in these facilities (Reynolds & Quinn, 2008).

Paid sick leave is another important tool to enable workers who are ill or potentially infected to isolate or quarantine. Lack of paid sick leave during the pandemic has harmed not only workers but also threatened the health and well-being of coworkers, worker families, and communities. It also can also adversely affect the production capacity and financial security of the plant. Without paid sick leave, sick workers might feel compelled to work through illness, creating infection control risks for the rest of the workforce. Likewise, instilling monetary rewards tied to attendance such as "responsibility bonuses"

TABLE **3**

Themes, Number of Comments, and Sample Quotes From Workers About What They Wanted Their Employer to Do to Reduce the Transmission of COVID-19 in the Plant

Theme	# of Related Comments	Worker Quotes
Active screening and monitoring of worker symptoms	32	• "Do not allow people who are sick to continue working." • "Perform the test on everyone to be sure people are not sick."
Distancing on the line and throughout the plant	84	• "On the line the employees are still glued to each other. At the gam table [referring to a specific workstation] in the slaughter, they are side by side with no way to put space in the middle and many are getting sick." • "Do not allow crowds in lockers, cafeteria, or bathrooms."
Education on COVID-19	7	• "Education is key—[we need] not just posters. We need an educator to come and speak to all people in all languages and stress the importance of handwashing, wearing a mask, and social distancing. The workers do not understand at all. Trust me I know." • "We have many cultures, many which do not understand the seriousness of the situation."
Face masks	49	• "Give new masks every day or whenever an employee needs it." • "Provide masks because they only give one mask a day and they become wet and you are not able to work that way." • "Demand all employees to use masks correctly."
Humane treatment	17	• "To be more humane and to put themselves in the place of those of us who are working." • "Value their workers that are putting themselves in danger so that the plant can meet its orders."
Line speed	32	• "I would want them to lower the speed of the lines so that people do not get together because at each line there are 3 or 4 people missing, but the production is the same." • "Slow down the work lines because they don't care if they are missing people on the lines—they run the line as if all the people who should be at each job were there."
Restructure work	17	• "That we wouldn't work as many hours so that both shifts don't gather at the same time." • "Reduce the hours of work to reduce contact with other employees." • "That they reduce the personnel and the production because it is impossible to keep the required distance. And as for production, they try to get the same amount, with a much smaller number of employees."
Return to work policies	17	• "We want a general cleaning and for everyone to be tested before returning to work to ensure that everyone is healthy."
Sick leave policies to promote sick workers staying home	16	• "If people are sick to stay home and for them not to call them to return to work." • "That they let us go home without running the risk of losing our job due to the threat of infection, which is our greatest fear." • "Remind all the employees that if they feel sick that they can stay home without retaliation."
Temporary plant closure	61	• "To close for a few days to stop the spread of infections." • "Suspend work and that they give [us] days [off] while the problem is solved at least until we know who is infected and who is not." • "That it [production] stops! So that they can do a deep cleaning and disinfect the air because the virus is in the air…and that it [the company] sends everyone to get tested." • "It would be good to stay closed until everyone has been tested and can return safely to work."
Transparency regarding positive COVID-19 cases in the plant	11	• "Notify us when a coworker is positive so that we can take better precautions." • "They should be honest about how many positive cases do we have around there because that is our right, to keep us safe."

can impel people to come to work even when sick (Yearby & Mohapatra, 2020). Offering paid sick leave to essential workers who take on additional risks during a pandemic is an ethical imperative (Lowe et al., 2020; Ramos et al., 2020).

Although changes to polices at meatpacking plants to provide sick leave were reported in the media (Taylor, 2020; Telford, 2020), they were not commonly reported directly by the workers as evidenced by our study. We found that those who were classified as "all others" were significantly more likely to report these types of policies than those directly on the production line, which could indicate communication gaps between those in more administrative, oversight, and supervisory roles compared with those on the pro-

duction line. Without knowledge of these policies, line workers are less likely to use sick leave. Lack of knowledge of paid sick leave policies among line workers could be an indication of the industry's emphasis on production and supervisors' focus on maintaining an adequate workforce to meet production goals.

Paid sick leave policies enable workers to stay home without having to decide between a paycheck or potentially exposing others to COVID-19. Unfortunately, as early as June 2020, large meat processing corporations announced that they were reverting to regular attendance policies and no longer offering paid sick leave (Jett, 2020). This decision was detrimental and premature as COVID-19 transmission in many areas of the U.S. continued to increase through summer and fall 2020. Although media and public attention on the meatpacking industry has wavered, the industry and its workers remain vulnerable to COVID-19 outbreaks (Douglas, 2021), particularly given some of the recent evidence related to lower levels of vaccine confidence among immigrant and racial and ethnic minority communities, which comprise a large proportion of the meatpacking workforce (Khubchandani et al., 2021; Viswanath et al., 2021). Policies that promote sick workers isolating or seeking care over coming to work are the most effective strategy for preventing COVID-19 from entering the facility; however, meatpacking employers could also consider adding on-site vaccination clinics to a more comprehensive strategy to protect workers.

Our survey also found that workers reported a major barrier to testing was not feeling sick so workers felt there was no need to be tested. This finding signifies that workers within meatpacking plants might be uninformed about asymptomatic or presymptomatic transmission of COVID-19. Hence, additional education and randomized workplace testing strategies could be useful.

COVID-19 has become a workplace hazard (Carlsten et al., 2021; Faghri et al., 2021). Workers have the right to be informed about hazards in the work environment and to be trained about hazards and safety practices in a language that they can understand (OSHA, 2017). Our data highlight the continued need for worker education and training regarding COVID-19. Occupational health and safety programs within meatpacking plants should implement additional strategies to educate workers on COVID-19 risks beyond solely posting signage. Such strategies should consider culture, language, and literacy of the workforce. The COVID-19 pandemic could be an opportunity to develop a peer health leader network or peer health coaches who could not only educate workers on COVID-19 in a culturally and linguistically appropriate manner but also address other health and safety issues as part of a greater workplace wellness or Total Worker Health approach (Hudson et al., 2019; Ramos et al., in press; Rowland et al., in press).

Our study benefited from a large sample size. The quick response to the survey indicated the importance of this topic among workers. There are, however, limitations to note. First, we used a cross-sectional design and thus our survey represents only a snapshot in time within one region of the U.S. Second, information was sought directly from meatpacking plant workers. Surveys were conducted online and were available in only three languages: English, Spanish, and French. This design likely limited potential participation of workers due to challenges with language, internet access, technology literacy skills, and trust. Most participants self-identified as Hispanic/Latino, reflecting the strong outreach to Spanish-speaking communities; however, people from many other parts of the world also are employed in meatpacking facilities. Therefore, our sample might not be representative of the diversity of workers across the industry. Finally, our study assessed worker perspectives and cannot distinguish between the need for better communication about existing policies, the absence of such policies, adherence by leadership and management to policies, or implementation of CDC guidance.

Conclusion

Undisputedly, meatpacking workers are a vulnerable essential workforce, and as such, they require protection from infectious diseases such as COVID-19. Despite the significant risk for COVID-19 infection, barriers to testing and control measures were reported by workers. Although a few recommended preventive measures such as signage and masks have been widely implemented, actions likely to impact productivity such as paid sick leave, slowing the speed of the production line, and physically distancing line workers have not been widely adopted.

COVID-19 is a workplace hazard and worker safety within the food and agriculture system should be a high priority. Essential workers need strong enforceable policies, not merely recommendations or guidance, to protect them from COVID-19 transmission at work. National leadership is necessary to establish and enforce COVID-19 safety standards, especially for high-risk essential workers. COVID-19 has been and continues to be a public health emergency. As such, it is vital to have data on workplace-associated cases and workplace safety practices. Fostering worker safety and confidence requires transparency in communicating the number of cases and contact tracing processes. Culturally and linguistically tailored education, paid sick leave, and restructuring of work are needed to reduce the risks of COVID-19 transmission in meatpacking facilities, particularly given the structural vulnerability of the workforce. Future research is needed to determine the effectiveness of specific employer actions including engineering and administrative controls on transmission rates, as well as to explore the long-term health, economic, and social consequences of COVID-19 among meatpacking workers, their families, and their communities.

COVID-19 has highlighted many serious health and safety challenges faced by essential workers. As a society, we must reflect on this experience and understand the synergistic effects of structural and occupational conditions on the well-being of workers. Lessons learned from this pandemic will hopefully transfer into better preparedness for future pandemics and help to foster a more equitable and just society.

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and disparities associated with COVID-19 as well as to improve overall health and safety conditions in the meatpacking industry.

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Acceptability of Household Practices to Prevent Boils in Rural Alaska

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Abstract **Boils are a major health problem affecting rural Alaska Native communities. Boils result from transmission of *Staphylococcus aureus* from steam bath surfaces, infected skin, and household environments. To assess the acceptability of practices to prevent boils within one community, we surveyed 57 households before and after distribution of supplies and educational materials. Before distribution, 64% of households cleaned steam baths with bleach (23/36), 72% used steam bath seat barriers (41/57), 74% did not share scrubbers (42/57), 35% added recommended bleach to laundry (20/57), and 30% used hand sanitizer (17/57). After distribution, 75% households used new scrubbers (43/57), 88% used new seat barriers (50/57), and 25% used new antiseptic skin cleanser (14/57). Additionally, after the intervention, more households used seat barriers in steam baths (from 72% to 86%, $p = .046$) and hand sanitizer (from 30% to 60%, $p < .001$). This study supports development of a household-based intervention as a potential strategy to prevent boils in Alaska Native communities.**

Introduction

Furunculosis (boils) and other skin abscesses are a major health problem affecting rural Alaska Native communities (Raczniak et al., 2016; Stevens et al., 2010). Boils are predominantly caused by infection with *Staphylococcus aureus* (Daum et al., 2017; Stevens et al., 2010; Talan et al., 2016). In the U.S., an increase in a strain of methicillin-resistant *S. aureus* (MRSA) led to an estimated 3-fold increase in skin and soft tissue infections (SSTI) (Qualls et al., 2012).

In Alaska, MRSA infections have led to several outbreaks of SSTI (Baggett et al., 2003; David et al., 2008; Landen, 1997; Landen et al., 2000) as well as an increase in hospitalizations (Castrodale, 2009; Raczniak et al., 2016). Approximately 10% of patients admitted with boils have invasive disease (Miller et al., 2015) and the recommended treatment of incision and drainage typically is painful (Singer et al., 1999). Infections can be stigmatizing (Mozzillo et al., 2010) and result in transmission to others (Cluzet et al., 2015; Larsson et al., 2011; Lee et al., 2018). Among respondents to a survey that assessed knowledge, attitudes, and existing practices in four communities in rural Alaska, 84% reported having had a boil, 95% knew another person who had a boil, and 81% considered boils a problem for the community (Raczniak et al., 2016).

Preventing the spread of boils depends on interrupting the transmission of *S. aureus* in the community (Lee et al., 2018; Miller, 2012), which is challenging because asymptomatic colonization is estimated to contribute to the majority of transmission (Macal et al., 2014). *S. aureus* can persist on inanimate objects and materials (fomites) for weeks to months (Kramer et al., 2006) resulting in transmission via the environment (Fritz et al., 2014; Knox et al., 2012). Approximately one half of the staphylococcal transmission in communities is estimated to occur within households (Mork et al., 2020). In Alaska Native households, the risk of transmission can be elevated due to large household sizes (Fritz et al., 2014; Leman et al., 2004), prevalent colonization with *S. aureus* (Stevens et al., 2010), and by SSTI in other household members (Landen, 1997).

In communities without water piped into the home, the risk of SSTI is elevated (Hennessy et al., 2008; Thomas, Hickel, & Heavener, 2016; Thomas, Ritter, et al., 2016). Other sources of transmission likely are important. Steam baths (i.e., saunas) are used for personal hygiene and to socialize, but can be a potential source of infection. Previous investigations in Alaska found that MRSA biofilm was present on steam bath surfaces (Baggett et al., 2004). Steam bath use was associated with increased risk of SSTI (Landen, 1997). Other studies indicate that sharing personal items and towels or scrubbers can also be an important source of infection (Nerby et al., 2011; Oller & Mitchell, 2009), especially if there are any breaks in

TABLE **1**

Components of a Household-Based Intervention to Prevent Boils in a Remote Alaska Native Community, 2016

Household Practice	Rationale for Prevention	Component(s) of Household Kit
Cleaning steam bath with chlorine bleach on average at least once weekly	• Steam bath surfaces frequently contain *Staphylococcus aureus* • Steam bath use is associated with boils	Cleaning equipment, chlorine bleach, advice to use 2 capfuls of bleach per 1 gallon of water (for a final concentration of approximately 0.05% sodium hypochlorite)
Sitting on seat barrier while using steam bath	• Steam bath use is associated with boils • Sitting on a barrier is associated with a decreased risk of boils	Foam seat pads for all household members
Use of personal scrubber in steam bath (without sharing)	• Most transmission estimated to occur from the skin of persons colonized with *S. aureus* • Risk increased by skin abrasion or contaminated fabrics (e.g., clothing, towels)	New scrubber offered, one for each household member
Use of chlorhexidine body scrub in steam bath[a]	• Most transmission estimated to occur from skin of persons colonized with *S. aureus* • Chlorhexidine might decrease colonization	Chlorhexidine gluconate (6%) body scrub provided for each household as option for cleaning
Addition of ≥1 capful of chlorine bleach to household laundry	• Contaminated fabrics (e.g., clothing, towels) can result in transmission of *S. aureus* • Sterilization of laundry could be achieved with 1 capful of chlorine bleach[b]	Recommendation to add ≥1 capful of bleach to laundry wash loads
Use of hand sanitizer in the home	• Contaminated household surfaces and objects can lead to transmission of *S. aureus* • Boils are associated with a lack of water piped into the home • Evidence from healthcare settings indicates that handwashing can decrease transmission of *S. aureus*	Hand sanitizer (alcohol-free) provided for each household
Self-care of boil (e.g., covering wound, seeking medical care if was not improved within 2 days, or other indications[c])	• Having a boil is associated with an elevated risk of another household member having a boil • Early intervention and covering the wound decrease the opportunity for transmission	Boils management kit provided, which included dressings, antiseptic, and advice on when to seek medical attention[c]

[a]Cloths impregnated with 2% chlorhexidine gluconate included for possible use outside steam bath (e.g., for a person avoiding the steam bath because of a skin infection). See Supplement 2, Figure S1 at www.neha.org/jeh/supplemental.

[b]See Supplement 1 at www.neha.org/jeh/supplemental.

[c]For example, if an individual thinks the lesion needs to be drained, there is spreading erythema, or there is evidence of systemic infection such as fever.

the skin (Lee et al., 2018). Limited opportunity for laundry with hot water can increase the risk of transmission from contaminated clothing, bed linens, towels, and scrubbers (Honisch et al., 2014).

An effective strategy to prevent boils must first be acceptable to the local community. Before effectiveness can be assessed, practices need to be identified that can be adopted successfully. Raczniak et al. (2016) found that respondents in the four rural communities in Alaska demonstrated a high level of knowledge about the source of boils, several recommended practices were already in place, and there was strong motivation to adopt new approaches to prevent boils.

Our study objectives were to assess acceptability of several community-based practices that might be capable of preventing SSTI. We identified several practices with the potential to prevent staphylococcal transmission, promoted adoption of recommended practices within households, and assessed acceptability in the community using a household survey.

Methods

Study Setting

The study was conducted in a remote Alaska Native community of approximately 500 residents living in <100 households. Similar to many other communities in rural Alaska, there is no piped in-home water service; instead water is drawn from collection points (self-haul) and stored within households for use in sanitation, cooking, cleaning, washing, and in steam baths (Thomas, Hickel, & Heavener, 2016). Laundry is performed within households, often with reused water from previous wash loads (Raczniak et al., 2016). A community laundry facility that has piped water is also available, but there are fewer than five washing machines for the entire community. Many households have adjacent steam baths for congregation, personal hygiene, and social interaction that contain a wood-burning stove to provide heat and steam. The community is served by community health aides who are trained to treat boils and other conditions in the local clinic. The clinic is supported by a comprehensive regional health system that includes medical evacuation, if needed.

Development of Practices to Prevent Boils

We identified several practices from previous recommendations and published evidence that had the potential to prevent boils by preventing staphylococcal transmission in the community (Table 1):

- To decrease the risk of transmission from contaminated steam baths, we recommended cleaning surfaces at least weekly using a chlorine bleach (sodium hypochlo-

rite 8.4%) solution made with 2 capfuls (approximately 20 ml) of chlorine bleach in 1 gallon of water, which results in a final sodium hypochlorite concentration of approximately 0.05% (Medrano-Félix et al., 2011). We also recommended sitting on a barrier while using a steam bath; sitting on a towel has been associated with a reduced risk of boils (Landen et al., 2000).

- To prevent transmission from contaminated fabrics (e.g., clothing, towels), we recommended not sharing personal washcloths (i.e., scrubbers) due to staphylococcal transmission being associated with a high prevalence of *S. aureus* colonization (Baggett et al., 2004; Stevens et al., 2010), sharing towels (Fritz et al., 2014; Nguyen et al., 2005), and skin abrasions (Lee et al., 2018). Based on published evidence, we recommended adding bleach to household laundry (Fisher et al., 2008; Oller & Mitchell, 2009). Additional support for this action came from an experiment we conducted as part of our study. Using a small portable Danby washer and reused wash water to simulate local laundry practices, we found that adding one capful (approximately 10 ml) of chlorine bleach could prevent contamination of laundry with *S. aureus* from an inoculated cotton swatch (see Supplement 1 at www.neha.org/jeh/supplemental).
- To prevent transmission from colonized skin, we recommended use of 4% chlorhexidine gluconate as a temporary alternative to regular body lotion, because chlorhexidine use can lead to decolonization (Millar et al., 2015; Whitman et al., 2010). Based on evidence from healthcare settings (Stone et al., 2012), we also considered use of hand sanitizer to be of potential benefit because of the lack of piped water.
- For individuals who had a boil, we recommended following local clinical guidance on when to seek care as well as previous public health recommendations to cover an open wound (Raczniak et al., 2016).

TABLE **2**

Household Practices Before and After Distribution of Intervention Packs to Prevent Boils in a Remote Alaska Native Community, 2016

Household Practice	Before Intervention (*N* = 57) # (%)	After Intervention (*N* = 57) # (%)	*p*-Value[a]
Use of bleach to clean steam bath ≥1 time/week[b]	23 (64)	29 (81)	.083
Use of any seat barrier in steam bath	41 (72)	49 (86)	.046
Sharing of scrubbers for steam bath[c]	15 (26)	10 (18)	.197
Use of antiseptic scrub in the steam bath	–	14 (25)	–
Use of ≥1 capful of chlorine bleach in personal laundry	20 (35)[d]	24 (42)[d]	.285
Use of hand sanitizer	17 (30)	34 (60)	.001

[a]*p*-values were calculated using McNemar's test for paired data, including 44 households (77%) that tried a new foam seat pad provided in the intervention pack.
[b]Among the 36 households included in both surveys that had a steam bath.
[c]After the intervention, 55 households (86%) included members who used the new personal scrubber.
[d]Including 5 of 8 households without use of a high-temperature dryer before the intervention and 4 of 8 households without use of a high-temperature dryer after the intervention.

Design of a Household-Based Intervention

We designed interventions to promote recommended practices within each household across the community. A household-based approach was chosen because of the importance of staphylococcal transmission within households (Alam et al., 2015; Knox et al., 2015; Macal et al., 2014; Uhlemann et al., 2014), inclusion of household-level practices such as steam bath cleaning and laundry, and the opportunity to promote practices within households (Raczniak et al., 2016). To assess acceptability independently from limitations in household resources, we provided the supplies needed to support recommended practices (Table 1). We consulted with community members to identify preferred types of scrubbers and seat barriers. We provided an information card to inform participants about recommended practices (see Supplement 2, Figure S1 at www.neha.org/jeh/supplemental) in addition to product-specific guidelines.

Further explanation was provided in a short locally produced video. A community gathering was held to explain promoted practices and how to obtain household kits. One adult representative from each household was eligible to receive a household kit after receiving a summary of the recommendations, which included an explanation that the promoted practices were voluntary and that manufacturer recommendations should be followed. Household kits were distributed over a 2-week period.

Assessment of Acceptability

We used household-level surveys to assess acceptability of the practices before and 2 weeks after community-wide distribution by four measures: 1) report of existing practices before the intervention, 2) new practices adopted, 3) overall change in household practices, and 4) report of attitudes to promoted practices. A member of each household was interviewed using a standardized questionnaire 4 weeks before the intervention period and 2 weeks after the distribution period had ended. Interviews were attempted with an adult representative of each household in the community, excluding <10 households with piped water that were linked to the school.

After the survey was completed, responses were added to a secure database using double data entry. We performed descriptive analyses using SAS version 9.4 and compared proportions using McNemar's test for paired data. To compare the characteristics of households that completed only one survey or both surveys (before and after the intervention), we used the chi-squared test, or Fisher's exact test if expected counts were <5. We compared median values using the Wilcoxon rank-sum test and considered differences to be statistically significant at $p < .05$.

TABLE **3**

Reasons Given for Following or Not Following Practices That Can Prevent Boils in a Remote Alaska Native Community, 2016

Household Practice	Reason Given for Following Practice[a] (# of Responses)[b]	Reasons Given for Not Following Practice[a] (# of Responses)[b]
Cleaning steam bath with bleach	• Disinfect the steam bath (13) • Keep the steam bath clean (6) • Helps to prevent boils (4)	• Not enough time (2)
Use of a solid mat in steam bath[c]	• Hygienic (12) • Helps to prevent boils (4) • Habit (2)	• Unnecessary if floor cleaned (4) • Not used to it (2) • Unavailable (2)
Use of provided foam mat in steam bath	• Something new to try (31) • Comfortable or liked to use (2)	• Did not try yet (6) • Uncomfortable (2)
Use of new personal scrubbers	• Scrubber was new (18) • Replace old scrubber (17) • Try something new (2) • Well designed (2)	• Existing scrubber does not need replacing (3) • Did not find it (2)
Use of antiseptic skin cleanser	• Wanted to try it (4) • Skin hygiene (2)	• Unfamiliar with product (12) • Did not find or try it yet (9) • Unnecessary (7) • Concern regarding risk of skin reaction (3)
Adding chlorine bleach to laundry	• Disinfection of laundry (6)	• Discoloration of clothes (3)

[a]Responses were categorized by reason given and were included if one or more responses were given for a particular reason.
[b]Responses for following a practice were included only if the relevant promoted practice was also reported. Responses for not following a given practice were included only if that practice was not reported.
[c]Defined as the use of a mat made of wood, rubber, or plastic in the household steam bath.

Ethical Considerations

After requesting public health assistance from the community's tribal council, the study was reviewed and approved by the Alaska Area Institutional Review Board as public health practice and by the Yukon-Kuskokwim Health Corporation Human Subjects Committee. All participation in the project was voluntary, including uptake of the recommendations. Written consent was obtained from adults who collected household kits. Data were stored confidentially and securely according to the approvals granted and the use policy of the Centers for Disease Control and Prevention.

Results

Household Characteristics

During the distribution period, 91% of eligible households collected a household kit (80/88). Of the 57 households included in both the baseline and follow-up surveys, 55 (96%) had received a household kit. Overall characteristics were similar to 21 additional households that did not complete both surveys; however, households included in both surveys were more likely to have a steam bath, use a personal washer for laundry, and include members ages 5–65 years (see Supplement 2, Table S1 at www.neha.org/jeh/supplemental). The 57 households surveyed included 342 reported household members (median household size of 6, range 1–14). The median age of interviewees was 52 years (range 21–84 years) and 38 (67%) were female.

Steam Bath Practices at Baseline

Of the 57 households included in both surveys, 36 owned a steam bath (60%), of which 22 out of 36 (61%) shared the steam bath with other households and 23 out of 36 (64%) used chlorine bleach to clean steam bath surfaces at least once a week. Of 342 household members, 287 (84%) used the steam bath within 2 weeks and 166 (49%) used a seat barrier while using the steam bath. A seat barrier was used by 41 households (72%), including seat barriers made of wood, rubber, or plastic in 9 households (16%)—other reported materials included a towel or cardboard. A scrubber was used in 47 households (82%), including 15 in which scrubbers were shared among steam bath users (26%).

Laundry Practices at Baseline

Laundry was performed at least once per week of bedding in 23 households (40%), scrubbers or towels in 26 households (46%), and clothing in 30 households (52%). A household washer was available for 49 households (86%), including 18 with a Danby washer and 3 that used a washer in a different household. Among these households, 33 (67%) used water kept at room temperature for laundry, 41 (84%) reused water for multiple wash loads, and 33 (67%) did laundry without a rinse step. As an alternative to a household washer, 22 households (39%) used the community laundry facilities. Overall, chlorine bleach was added to at least some wash loads by 43 households (75%), and 20 households (35%) used ≥1 capful of bleach. A high-temperature dryer was used by 41 households (72%); only 10 of the 49 households that used a household washer (20%) did not report using a high-temperature dryer.

Other Practices at Baseline

Before distribution of household kits, 17 households (30%) reported already using hand sanitizer in the home, while 52 (91%) indicated they would use hand sanitizer if it were provided. Overall, 21 households (37%) included a person who had a boil within the past year. Among these 21 households, individuals with boils attended the local clinic in 18 households (86%), used clean dressings in 15 households (71%), and used antiseptic cream in 9 households (43%).

Adoption of New Practices

The follow-up survey reported that new foam seat barriers were used in 43 households (75%), by 30 survey participants (53%), and by 142 out of 295 household members (48%).

New scrubbers were used by 50 households (88%), by 35 survey participants (61%), and by 235 out of 327 household members (80%) who used the steam baths. New chlorhexidine antiseptic wash was used in 14 households (25%) included in the follow-up survey, including 5 survey participants (9%) and 47 out of 295 household members (16%) who used the steam baths in the previous 2 weeks.

Changes in Practice After Distribution of Household Kits

Changes in the proportions of households following recommended practices after distribution of household kits are summarized in Table 2. Among the 36 households that had a steam bath, we were not able to detect a statistically significant difference in the proportion of households cleaning at least once a week using bleach (64% [23/36] at baseline versus 81% [29/36] at follow-up; $p = .083$). There was a significant increase in the proportion of households reporting use of a seat barrier while using a steam bath (72% [$n = 41$] at baseline versus 86% [$n = 49$] at follow-up; $p = .046$). The proportion of households sharing scrubbers did not change significantly (26% [15/36] at baseline versus 18% [10/36] at follow-up; $p = .197$). At least 1 capful of chlorine bleach was added to laundry in 24 households after distribution (42% [$n = 24$]), although this finding did not reach statistical significance ($p = .285$).

Meanwhile, the proportion of households using hand sanitizer increased (30% [$n = 17$] at baseline versus 60% [$n = 34$] at follow-up; $p < .001$). When we compared all households (including those in baseline or follow-up surveys), there remained an increase in the use of any seat barrier in the steam bath and of hand sanitizer. Additionally, we found no difference in the use of bleach in laundry and no statistical difference in sharing of scrubbers or the use of bleach to clean steam baths (see Supplement 2, Table S2 at www.neha.org/jeh/supplemental).

Reasons Given for Household Practices

Interviewees gave a variety of reasons for following or not following different household practices (Table 3). Reasons for following recommended practices included responses such as "to kill germs" and could further be categorized as: hygiene and cleanliness, preventing boils, habit or tradition, desire to try something new, finding a new product comfortable, and recommendations from others. Reasons for not following recommended practices included examples such as "didn't try yet" and could also be grouped into several larger categories: lack of perceived benefit, no existing habit or unfamiliarity with product, inconvenience, and discomfort or concerns about the design.

Discussion

We found that there was acceptability for several practices that were recommended to prevent boils, which was demonstrated by reports of existing practices, uptake of new practices, and the attitudes of interviewees. Before distribution of household kits, the majority of households reported use of a seat barrier in steam baths, restricting scrubbers to personal use, and regular cleaning of the steam bath using chlorine bleach (for households that owned a steam bath). Furthermore, one in three households reported adding a recommended quantity of chlorine bleach to laundry; a similar proportion reported using hand sanitizer in the home. Among households that reported a boil within the past year, several households had used antiseptic, dressings, and attended the local clinic as part of medical management of the boil.

The majority of households surveyed adopted new practices, including use of new foam mats as seat barriers, new personal scrubbers, and hand sanitizer. Fewer households (25%) tried using the 2% chlorhexidine body scrub, but interviewees from several other households expressed an intention to use it. After distribution of household kits, there was an overall increase in the proportion of households following all of the recommended practices and all promoted practices were adopted by new households. We found a statistically significant increase only in the use of seat barriers and hand sanitizer, which could have reflected limitations in the overall number of households surveyed. Among eligible households, 65% participated in both surveys and our findings are likely to be representative of the overall community, although households participating in both surveys were more likely to own a steam bath and use a personal washer for laundry than households completing only one survey.

Attitudes of household members provided further evidence of the acceptability of recommended practices. Interviewees reported following practices to support hygiene efforts and to prevent boils, and expressed a willingness to try new practices. Following a previous study (Raczniak et al., 2016) that indicated a willingness to try new practices, our study also found that recommended practices were acceptable while they were being implemented. Interviewees, however, reported several perceived barriers to implementation such as unfamiliarity with new products, concern of possible side effects or adverse reactions, lack of understanding of the rationale, or simply not finding the time to try adopting a new practice. Addressing these barriers could improve acceptability of a future intervention strategy.

Although we found that recommended practices were acceptable in the community, future studies are needed to determine the potential impact of these practices on the incidence of boils. There is only partial evidence for effectiveness of some practices when used alone. More frequent cleaning of household surfaces with chlorine bleach has not been found to prevent staphylococcal contamination (Eells et al., 2014), possibly because of other sources of transmission (Fritz et al., 2014). The use of topical chlorhexidine in military recruits has been found to prevent nasal colonization (Millar et al., 2015) but not SSTI (Ellis et al., 2014). Evidence for the effect of hand hygiene has been limited mainly to the clinical setting (Stone et al., 2012).

There is stronger evidence for combining practices to prevent multiple sources of transmission. A decline in SSTI has been reported following several combination strategies including personal hygiene measures in military recruits (Morrison et al., 2013), hygiene and disinfection practices in a sports team (Romano et al., 2006), and a range of measures in a German village that included nasal mupirocin and chlorhexidine (Wiese-Posselt et al., 2007).

There is also some evidence for prevention of recurrent SSTI in the community, which can occur in 50% of patients within 6 months (Creech et al., 2015). An intervention that included hygiene education, nasal mupirocin, and chlorhexidine was more likely to prevent recurrent SSTI in children among households randomized for implementation by multiple household members rather than implementa-

tion only by the index case (Fritz et al., 2012). Clinical treatment guidelines recommend decolonization for recurrent SSTI (Stevens et al., 2014) and studies have demonstrated a benefit of initial treatment with adjunctive antibiotics, in addition to incision and drainage, for preventing recurrent infections (Daum et al., 2017; Gottlieb et al., 2019; Talan et al., 2016, 2018). Overall evidence, however, has been lacking for effective community-based interventions (Miller, 2012).

In our setting, a prevention strategy needs to take into account the healthcare and social context as well as specific sources of transmission such as steam baths. In communities without water piped into houses, household water use is approximately 1% of the U.S. average (Thomas, Hickel, & Heavener, 2016), the use of the steam baths has an important hygiene as well as social function (Landen et al., 2000), and reuse of water for laundry is part of managing a scarce water supply (Raczniak et al., 2016). Although improvements in water infrastructure are likely to lead to a decline in boils (Hennessy et al., 2008; Thomas, Hickel, & Heavener, 2016; Thomas, Ritter, et al., 2016), other interventions are also needed.

One challenge is stigmatization of individuals with boils within the community, which has been reported in other contexts (Mozzillo et al., 2010). Recommending prevention measures irrespective of whether a boil has been reported could limit the effect of stigmatization, whereas a focus on prevention of recurrent infections could prioritize households in which transmission is most likely to occur. These prevention measures could also provide the opportunity to integrate recommendations into clinical care. Eliminating transmission of *S. aureus* might not be feasible, but incremental gains in preventing transmission from different sources could lead to a future decline in SSTI.

Conclusion

To prevent skin abscesses resulting from the transmission of *S. aureus* in Alaska Native communities, strategies are needed to interrupt transmission from steam bath surfaces, the skin of community members who might be asymptomatically colonized, and household environments—including contaminated laundry. Several practices with the potential to prevent boils were already adopted by the community, such as regular cleaning of steam baths with bleach, use of a seat barrier in the steam bath, not sharing personal scrubbers, and adding bleach to household laundry. Households were willing to use new seat barriers, scrubbers, hand sanitizer, and chlorhexidine body wash; distribution of household kits led to an increased use of seat barriers in steam baths. Acceptability of practices could be enhanced by refining the design of key components, demonstrating use of unfamiliar products, and improving communication of the rationale. A household-based intervention to prevent boils could be widely adopted in affected communities.

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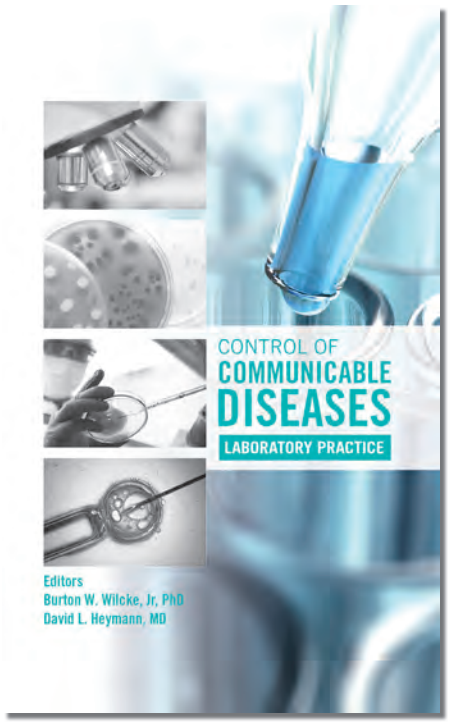

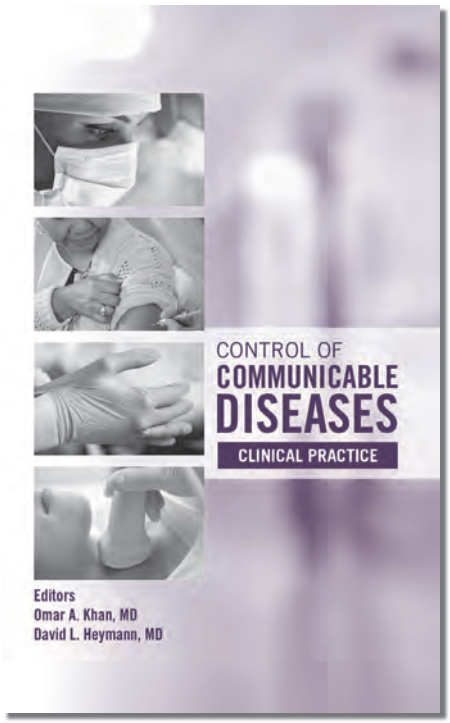

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Finding a New Normal: Helping Adolescents Cope After Natural Disasters

Editor's Note: The National Environmental Health Association (NEHA) strives to provide up-to-date and relevant information on environmental health and to build partnerships in the profession. In pursuit of these goals, NEHA features this column on environmental health services from the Centers for Disease Control and Prevention (CDC) in every issue of the *Journal*.

In these columns, authors from CDC's Water, Food, and Environmental Health Services Branch, as well as guest authors, will share insights and information about environmental health programs, trends, issues, and resources. The conclusions in these columns are those of the author(s) and do not necessarily represent the official position of CDC.

Sabrina Riera and Vivi Siegel are health communication specialists in CDC's National Center for Environmental Health, specializing in emergency and risk communication.

During summer 2017, the U.S. and its territories were struck by three major hurricanes—Harvey, Irma, and Maria—within the span of one month. The damage caused by these storms was devastating, leaving widespread flooding, power outages, and interruptions to everyday life for millions of people.

The mental health impact of these storms was severe. By late 2017 and early 2018, media outlets reported increased suicide rates and mental illness in Puerto Rico following Hurricane Maria (Acevedo, 2018; Campbell, 2018; Dickerson, 2017; Dickerson & Bourne, 2018; Jackson, 2018; Perez, 2018). Adolescents were not exempt from these mental health impacts. A 2018 survey of public school students in Puerto Rico administered 5–9 months after Hurricane Maria made landfall showed that 7.2% of children and adolescents in grades 3–12 reported symptoms of clinically significant post-traumatic stress disorder (Orengo-Aguayo et al., 2019).

Stress Following Natural Disasters Can Affect the Mental Health of Adolescents

Distress caused by natural disasters can cause emotional, mental, and physical problems. It can affect a person's ability to think clearly, making it harder for them to process information and, in turn, follow health and safety guidance (Centers for Disease Control and Prevention [CDC], 2019a). On an emotional level, distress can lead to a person feeling fearful, angry, sad, worried, numb, or frustrated. It can affect their sleep, appetite, and energy levels. Distress can even worsen chronic health problems and cause headaches, body pains, stomach issues, and skin rashes (CDC, 2019b).

For children and adolescents (ages 11–19), these reactions can be heightened by the physical, mental, emotional, and social changes that normally occur at this stage of development. In response to trauma, adolescents might act out, argue with their families, and spend less time with friends. They might also find it harder to express their feelings or really understand what is bothering them; they might claim to be fine when they are not, stay silent, or complain of physical pains or aches (Substance Abuse and Mental Health Services Administration, 2013).

Mental health is already a growing concern among our nation's youth. According to the Centers for Disease Control and Prevention's (CDC) Youth Risk Behavior Survey (2020a), more than 1 in 3 high school students in 2019 experienced persistent feelings of sadness or hopelessness, 40% higher than in 2009. Rates of suicide are also on the rise for adolescents—in 2019, approximately 1 in 6 reported making a suicide plan in the past year. Because adolescents are already vulnerable to poor mental health, it is important that we address their unique needs by providing the resources they need after a natural disaster. By doing so, they might be better able to manage their feelings and make healthier decisions.

Healthy Coping Strategies Can Help Adolescents Find Resilience and Hope During Difficult Times

In late 2020, CDC launched a new website (www.cdc.gov/disasters/teens.html) to help adolescents who are dealing with the aftermath of a natural disaster. The site features a video series, *Finding a New Normal: Life After a Natural Disaster*, that highlights the expe-

FIGURE **1**

Example of a Social Media Post

Text from the post: If you've been through a natural disaster, remember that you're not alone. Watch Jaylon's story and learn ways to feel better at https://www.cdc.gov/disasters/teens.html. #LifeAfterDisaster

FIGURE **2**

Example of a Poster From the Centers for Disease Control and Prevention's Finding a New Normal Video

Video available at www.cdc.gov/disasters/teens.html.

rience of four youths who have experienced different natural disasters, including hurricanes and wildfires. They share their stories and advice to help others better cope after natural disasters.

In one of the videos, Mariana, an adolescent who dealt with the aftermath of Hurricane Maria in Puerto Rico, talks about the importance of staying connected to loved ones. "Stay close to the people that love you and help each other get through this difficult time. Always share and help people—and try not to take anything for granted," Mariana said in her segment. Jaylon, another adolescent, talks about how helping his community helped him feel better (CDC, 2020b; Figure 1).

The adolescents also talked about how their hobbies helped them get through those difficult times. Alexis, who experienced wildfires, spoke about how swimming helped her cope with her stress (Figure 2). "What helped me most when I'm stressed and overwhelmed is swimming. I play water polo, I surf, and I'm on the swim team, so being in the water really helps me," Alexis said in her video. Abby discussed how her artwork helped her stay relaxed (CDC, 2020b).

Adolescents and youths can use the website as a source for tips and suggestions to help them cope with any difficult feelings they might be experiencing. Tips include eating healthy, getting plenty of sleep, taking breaks, and exercising on a regular basis. They are also encouraged to talk to others about their problems and seek help if needed. Instructions on how to reach the Substance Abuse and Mental Health Services Administration's Disaster Distress Hotline are included (CDC, 2020c). In addition, the website also hosts a series of social media graphics, messages, and posters that adolescents can use and share with their friends and communities.

These resources are available in English and Spanish. Teachers, mental health professionals, parents, and others who work closely with adolescents can use the information on this website to share with them. You can access the website at www.cdc.gov/disasters/teens.html.

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Did You Know?

NEHA has updated the Registered Environmental Health Specialist/Registered Sanitarian (REHS/RS) exam, which will be released on September 1, 2021. NEHA has posted an FAQ document and the revised blueprint of the exam to provide more information. Learn more at www.neha.org/rehs.

DIRECT FROM THE PRIVATE WATER NETWORK

Lessons Learned From Evaluating the Effectiveness of the Private Water Network

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Gina Bare, RN
Jesse Bliss, MPH
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David T. Dyjack, DrPH, CIH
National Environmental Health Association

Editor's Note: **The National Environmental Health Association (NEHA) launched the Private Water Network (PWN) in partnership with the Centers for Disease Control and Prevention (CDC) and the National Network of Public Health Institutes in 2019. The mission of PWN is to 1) build a sustainable community for those working to support private water programs; 2) connect them with their peers to share experiences, insights, and resources, and to gain access to timely and relevant guidance for existing and emerging issues; and 3) build capacity to do the work more effectively and efficiently to protect the public's health from contaminants in private water sources. PWN is supported by CDC.**

The conclusions in this column are those of the author(s) and do not necessarily represent the official position of CDC.

Background

Prior to the launch of the Private Water Network (PWN), there was no comprehensive, active resource for peer learning and information exchange for environmental health specialists and public health workers who serve communities with private drinking water sources and systems. To address this gap, the National Environmental Health Association (NEHA) launched PWN in 2019 through a partnership with the Centers for Disease Control and Prevention and the National Network of Public Health Institutes.

PWN is a virtual community of practice for public health professionals and safety specialists working to protect the public's health from contaminants in private drinking water sources. PWN was launched in December 2019 to serve two purposes: 1) to gather, organize, and share all existing and relevant resources regarding private water; and 2) to build an online resource to support future stakeholder goals. Currently, PWN serves over 150 members. Through PWN, a series of expert discussion forums, webinars, newsletters, roundtable talks, and Twitter chats have been held to foster membership engagement. Furthermore, PWN hosts a resource repository on its virtual platform with more than 250 resources on private water.

In December 2020, NEHA conducted an evaluation of PWN to assess if it was meeting the goals of the target audience. The evaluation highlighted membership attitudes toward PWN engagement opportunities, resources, and platform accessibility.

Methods

NEHA fielded a PWN evaluation survey from December 4, 2020 through January 25, 2021. The aim of the survey was to assess how PWN is implemented, including its reach, the ease of participation in its activities, and the usefulness of tools provided. The outcome evaluation included an assessment of member attitudes, knowledge, and skills related to private water. The survey was sent to all PWN members through a PWN newsletter in December. Furthermore, the survey was promoted during the "A Year Since Launch" event series that celebrated the 1-year anniversary of PWN. The event series included a webinar, roundtable discussion, blog post, and Twitter chat.

Results

NEHA received a total of 44 responses from public and environmental health personnel working across various sectors of the field such as governmental public health agencies (e.g., local, state, federal, tribal, territorial), academia, industry, and nonprofit organizations. Of the 44 PWN survey respondents, 45% (n = 20) were PWN members and 55% (n = 24) were not members of PWN. The survey respondents were asked to indicate the state or territory in which they work (Figure 1).

Survey Respondent Demographics for Private Water Network Members

Approximately 65% of PWN members who completed the survey have been with the PWN for ≥9 months. Nearly 20% of the members who took the survey had been PWN members for <3 months, 10% had been members between 3 and 6 months, and

FIGURE **1**

Work Location Data From Respondents of the Private Water Network (PWN) Survey

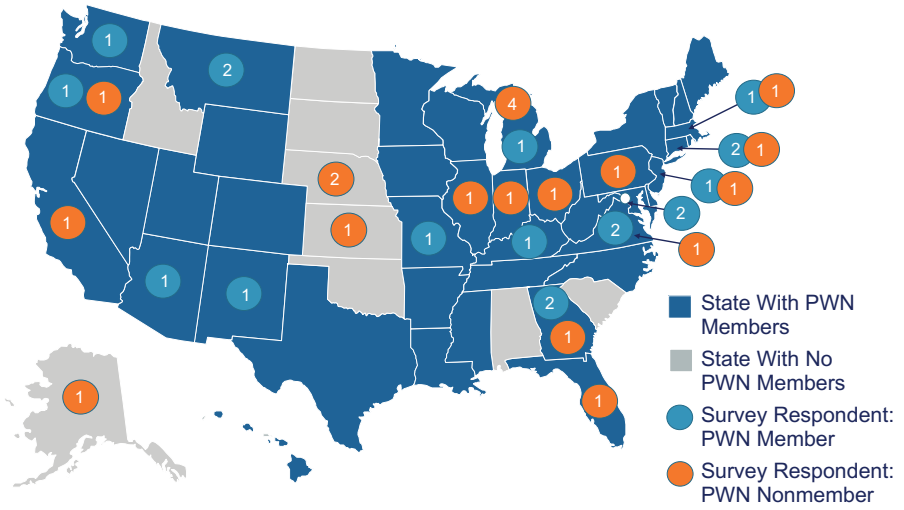
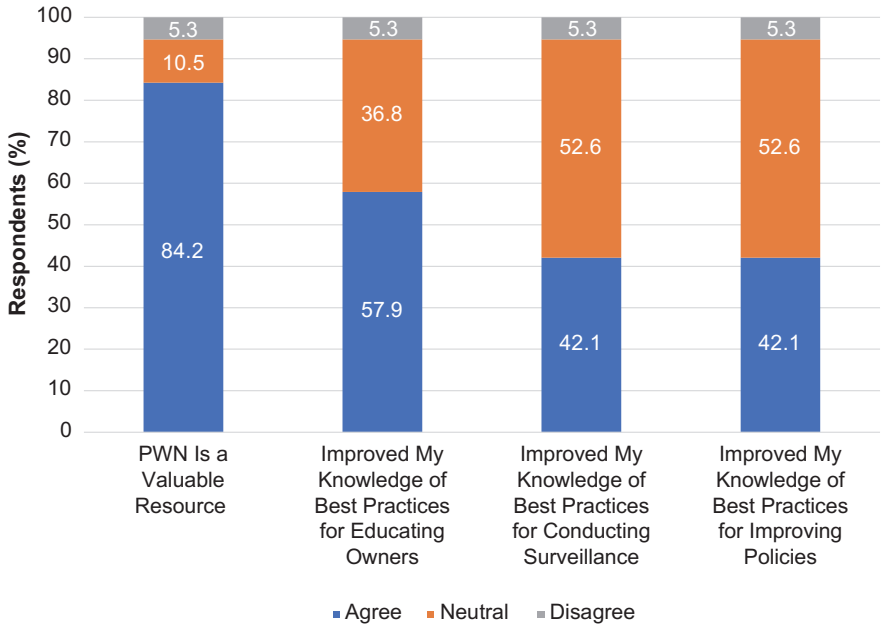


FIGURE **2**

Member Satisfaction and Perceived Value of the Private Water Network (PWN)



approximately 5% had been members for 6–9 months.

According to the survey, many PWN members work within a state or territorial health department (40%). A few (20%) were with an independent nonprofit organization or nongovernmental organization. Of those respondents that selected "Other," two were retired, one worked for a state environmental health department, and one identified their work as academic. Nearly 10% of the respondents work for a city or county health department. The remainder of the survey respondents (10%) work at a federal agency.

Member Satisfaction and Perceived Value

Overall, the PWN members expressed positive feedback related to the benefits of PWN and the knowledge gained through their membership. Figure 2 illustrates member attitudes toward the perceived benefits and value of PWN.

Furthermore, survey respondents were asked to share what they have been able to achieve or implement because of their participation in PWN. Several respondents indicated that membership in PWN had given them a clearer understanding of private water issues. Some also highlighted that they were able to share the relevant information they learned with others through the platform. For example, a few people shared resources with other staff and one person shared resources with private landowners. A couple of people indicated that learning and sharing information through PWN enabled them to find others they were not aware of who were experiencing similar problems.

Access and Member Engagement

Generally, PWN members agreed PWN increased their access to other peers and to resources related to private water sources. Figure 3 highlights member attitudes toward engagement activities and access to information on private water issues through PWN.

Survey respondents were asked to indicate which PWN offering they found to be most engaging. The most utilized PWN offering is the PWN newsletter (71%), followed by attending a flash webinar (59%) and listening to flash webinar recordings (53%). The least used PWN offerings are the discussion forum (12%) and posting an item to the resource library (12%). Many PWN members commented they had limited time to explore and utilize the offerings on PWN. In addition, others explained they had not utilized the offerings available because they were new to the network or had just joined.

More specific feedback on PWN suggest members were satisfied with the offerings

and agreed they provided opportunities to learn about different topics, share information, and access resources. Figure 4 illustrates these data. Notably, of the members who utilized each offering, 80% agreed the resource library provides access to replicable tools and resources. Close to three quarters of members (71%) agreed they can easily find what they need in the resource library. Similarly, 71% of the PWN members agreed that the PWN Ask the Expert sessions and the PWN flash webinars provide opportunities to learn from subject matter experts. A slightly smaller percentage of PWN members (69%) agreed that the PWN newsletter keeps them informed of events, emerging issues, and resources. Lastly 60% of the PWN members agreed the discussion forum is a useful mechanism for sharing with and querying peers.

Private Water Network Nonmember Feedback

Nearly three fourths of nonmembers who completed the survey work at a health department in either a city or county (58%) or a state or territory (13%). An overwhelm-

FIGURE **3**

Member Attitudes Regarding Information Access and Engagement Activities of the Private Water Network

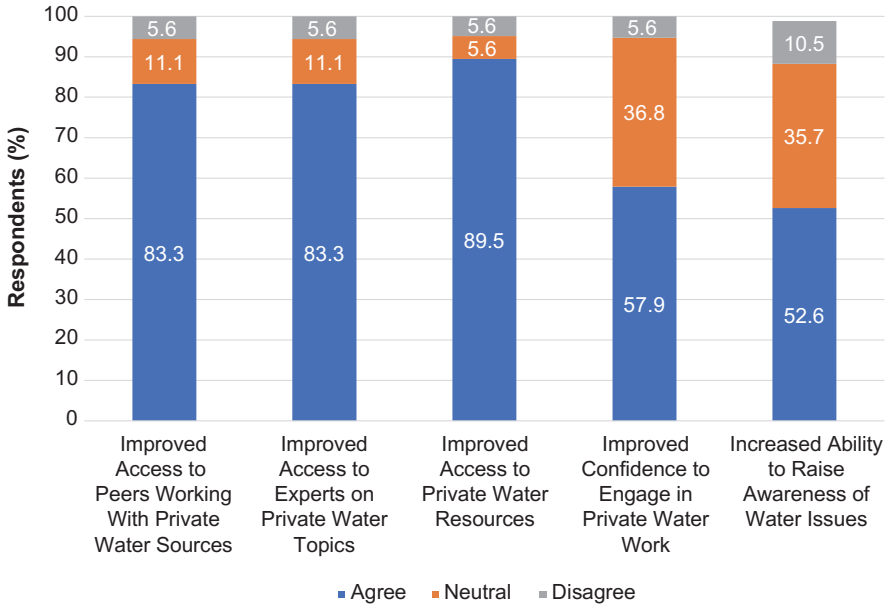
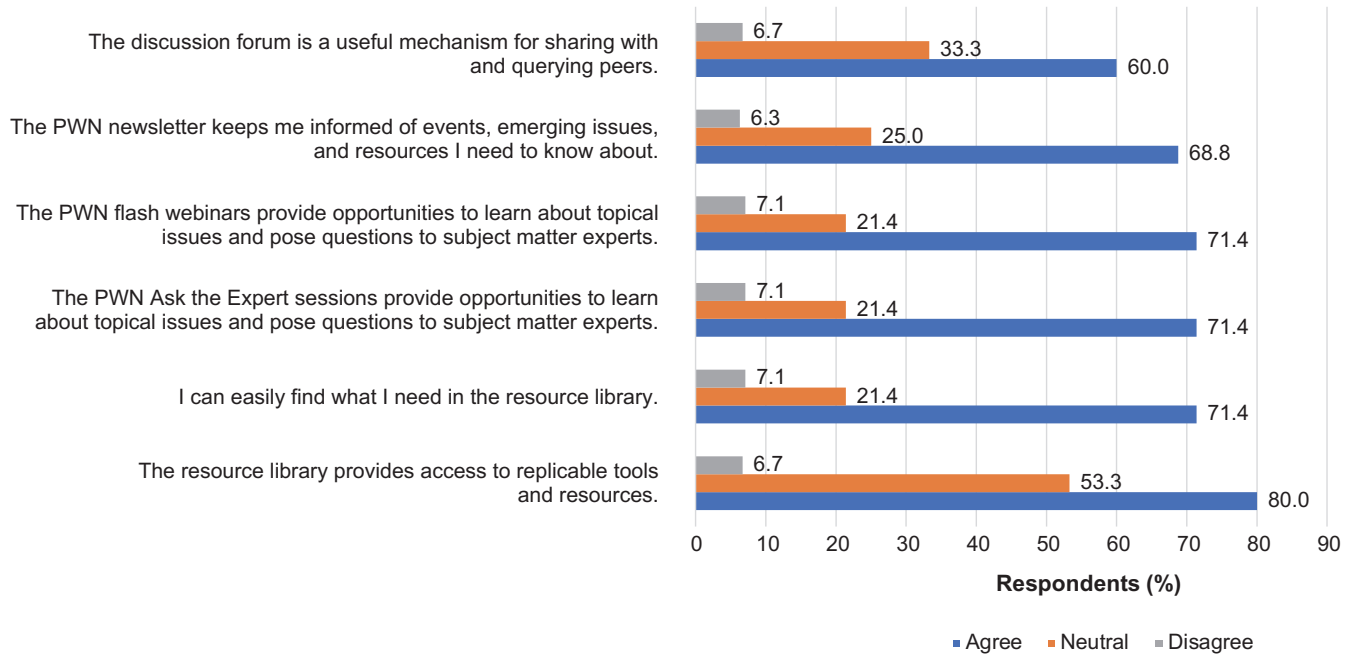


FIGURE **4**

Member Satisfaction With Offerings From the Private Water Network (PWN)



ing majority of nonmembers recognized the value of the PWN with 86% strongly agreeing or agreeing that PWN is a valuable resource. Nonmembers do have access to PWN webinars, Twitter chats, panel sessions, and roundtable discussions. They do not have access to the PWN resource library, discussion forum, and newsletter. Most nonmembers attended a PWN flash webinar (77%) or listened to a recording of a PWN flash webinar (35%). Of those who participated or listened to a PWN flash webinar, 89% strongly agreed or agreed that the webinars provide opportunities to learn about topical issues and pose questions to subject matter experts.

Nonmembers commented they had just learned of PWN and many noted they planned to research it more. Nonmembers also highlighted how they were applying the knowledge gained from PWN. For example, one nonmember commented that they were able to answer people's questions better due to information from PWN and another nonmember applied their knowledge for private well consultation. Additionally, one nonmember applied their knowledge of testing and treatment to their own home well water. An encouraging data point is that 100% of nonmembers who took the survey indicated they will continue to participate in PWN.

Overall Reflections and Future Directions

The survey asked for respondents to suggest improvements to PWN. Survey respondents had just a few suggestions for improvement. One member indicated that online information should be more accessible and another preferred longer discussions on topics. One nonmember suggested more online webinars with common issues such as arsenic. One member suggested that PWN include more resources on groundwater surveillance and monitoring. NEHA has already begun addressing these improvements by switching the online community platform provider to make PWN more accessible and easier to navigate.

Overall, PWN members and nonmembers who completed the survey had a positive experience participating in PWN. This finding is most evident in their intent to continue participating in PWN.

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EH CALENDAR

UPCOMING NATIONAL ENVIRONMENTAL HEALTH ASSOCIATION (NEHA) CONFERENCE

July 14–15, 2021: Part 3 of the NEHA 2021 Annual Educational Conference & Exhibition Three-Part Virtual Series. On-demand access for Parts 1 and 2 is available to all registrants. Visit www.neha.org/aec.

June 28–July 1, 2022: NEHA 2022 Annual Educational Conference & Exhibition, Spokane, WA

NEHA AFFILIATE AND REGIONAL LISTINGS

Colorado
September 14–17, 2021: 65th Annual Education Conference, Colorado Environmental Health Association, Pueblo, CO, http://www.cehaweb.com

Illinois
September 13–14, 2021: IEHA South Chapter Annual Educational Conference, Illinois Environmental Health Association South Chapter, Marion, IL, https://ieha.coffeecup.com/index.html

November 8–9, 2021: IEHA Annual Educational Conference, Illinois Environmental Health Association, Oglesby, IL, https://ieha.coffeecup.com/index.html

Indiana
September 20–22, 2021: 70th Annual Fall Educational Conference, Indiana Environmental Health Association, Lawrenceburg, IN, https://www.iehaind.org/Conference

Missouri
August 10–13, 2021: Annual Educational Conference, Missouri Environmental Health Association, Springfield, MO, https://mehamo.org

National Capital Area
July 19, 2021: 2020/2021 Annual Awards Ceremony (Virtual), National Capital Area Environmental Health Association, http://www.ncaeha.org/events

North Carolina
October 6–8, 2021: NCPHA Fall Educational Conference, North Carolina Public Health Association, Asheville, NC, https://ncpha.memberclicks.net

Texas
October 6–8, 2021: 65th Annual Educational Conference, Texas Environmental Health Association, Round Rock, TX, https://www.myteha.org

Utah
September 29–October 1, 2021: UEHA Fall Conference, Utah Environmental Health Association, Tooele, UT, http://www.ueha.org/events.html

Virginia
October 28–29, 2021: VEHA Virtual Fall Conference & Interstate Environmental Health Seminar, Virginia Environmental Health Association, https://veha32.wildapricot.org/events

Wisconsin
September 22–24, 2021: WEHA Educational Conference, Wisconsin Environmental Health Association, Eau Claire, WI, https://weha.net/events

TOPICAL LISTINGS

Water Quality
RESCHEDULED: Spring 2022: *Legionella* Conference: **Prevention of Disease and Injury From Waterborne Pathogens in Health Care (In-Person),** NSF Health Sciences and NEHA, https://www.legionellaconference.org

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2	**Scott A. Damon, MAIA, et al.** Mold Cleanup Practices Vary by Sociodemographic and Allergy Factors	83.5 Dec 2020 Pages: 18–21	Indoor Air	Public Health/ Safety			
3	**Garry Dine, MSc, et al.** Occupational Health and Safety Issues Faced by Environmental Health Officers: A Perspective From Western Australian	83.8 April 2021 Pages: 20–28	International	Management/ Policy	Occupational Health/Safety	Workforce Development	
4	**Cathy Egan, MBA, CPHI(C), CIC, et al.** Assessing Potential Public Health Concerns in Airbnb Venues in Four Canadian Cities	83.3 Oct 2020 Pages: 8–12	Food	Indoor Air	International	Public Health/ Safety	Risk Assessment
5	**Justin A. Gerding, DHA, REHS, et al.** Exploring the Benefits and Value of Public Health Department Internships for Environmental Health Students	83.4 Nov 2020 Pages: 20–25	Education/ Training	Institutions and Schools	Management/ Policy	Workforce Development	
6	**David A. Hewitt, PhD, et al.** Environmental Infection Risks for Outdoor Athletes	83.3 Oct 2020 Pages: 22–27	Emerging Pathogens	Management/ Policy	Microbiology	Public Health/ Safety	Recreational Environmental Health
7	**Jennifer A. Horney, MPH, PhD, CPH, et al.** Resident Perceptions of Environmental Pollution in Recreational Areas Flooded by Hurricane Harvey in Houston, Texas	83.1 July/Aug 2020 Pages: 8–16	Community Nuisances/ Safety	Disaster/ Emergency Response	Recreational Environmental Health		
8	**Charles E. Idjagboro, MPH, et al.** A Matter of Time: Exploring Variation in Food and Drug Administration Food Code Adoption Among State Retail Food Regulatory Agencies	83.2 Sept 2020 Pages: 8–15	Food	Management/ Policy	Public Health/ Safety		
9	**D.J. Irving, MPH, REHS, et al.** Use of an Environmental Swabbing Strategy to Support a Suspected Norovirus Outbreak Investigation at a Retail Food Establishment	83.9 May 2021 Pages: 24–26	Emerging Pathogens	Food	Management/ Policy		
10	**Adrienne Katner, DEnv, et al.** Natural Disaster Emergency Response to Private Well User Needs: Evaluation of a Pilot Outreach Approach	83.2 Sept 2020 Pages: 16–24	Disaster/ Emergency Response	Drinking Water	Education/ Training	Public Health/ Safety	
11	**Thuy N. Kim, MPH, CFOI, et al.** Disclosing Inspection Results at Point-of-Service: Affect of Characteristics of Food Establishment Inspection Programs on Foodborne Illness Outcomes	83.6 Jan/Feb 2021 Pages: 8–13	Epidemiology	Food	Management/ Policy	Public Health/ Safety	

Code	Corresponding Author/Title	Volume/Issue	Subject 1	Subject 2	Subject 3	Subject 4	Subject 5
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SPECIAL **LISTING**

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NEHA **NEWS**

NEHA Visits Congress Virtually for Fourth Annual Hill Day

By Doug Farquhar, JD (dfarquhar@neha.org)

For this year's Earth Day on April 22, the National Environmental Health Association (NEHA) spread the word about environmental health among the nation's policy makers in Washington, DC. With the COVID-19 pandemic and other restrictions, visiting Congress in person was not an option this year but the NEHA Board of Directors and staff leadership made the trek virtually through Zoom meetings.

NEHA board members and staff have visited Congress each spring since 2017 to talk with senators, representatives, and staff members about the needs and challenges facing the environmental health profession. For past Hill Days, NEHA board members and staff traveled to Washington, DC, to meet with these individuals in person, allowing for a more personal setting. Due to the COVID-19 pandemic, Hill Day 2020 was canceled. For 2021, NEHA decided to transition the event to a virtual platform, which provided some advantages compared with past Hill Day events.

The fourth annual Hill Day allowed NEHA to meet with 44 Congressional offices to discuss the environmental health profession, federal funding of environmental health, and enactment of the Environmental Health Workforce Act (H.R. 2661, www.congress.gov/bill/117th-congress/house-bill/2661). The visits focused on members of the House and Senate Appropriations committees, both Democrat (NEHA visited 24 offices) and Republican (NEHA visited 18 offices). Beginning early in the morning and lasting into the evening, NEHA board members and staff met with and discussed the challenges facing the profession due to COVID-19, the need for support from the nation's federal policy makers, and the decimation of trained staff due to funding cuts and overwork.

Congresswoman Brenda Lawrence (D-Michigan) spoke with NEHA President Sandra Long, President-Elect Roy Kroeger, Executive Director Dr. David Dyjack, and Government Affairs Director Doug Farquhar, providing her thoughts regarding the profession. As the lead sponsor of the Environmental Health Workforce Act, she was honored to speak with and support NEHA, acknowledging the stresses the workforce is suffering. The Environmental Health Workforce Act would provide much needed training and credentialing nationwide, she commented, and she believes the Act has a good chance of advancing through Congress this year. The bill is still awaiting a Senate companion, which was introduced in previous sessions by Senator Debbie Stabenow (D-Michigan).

Meetings with other offices led to several takeaways. NEHA shared information on the state of the environmental health workforce and profession, discussing how many people our profession touches from food safety to drinking and wastewater to environmental hazards, such as lead and per- and polyfluoroalkyl substances (PFAS).

NEHA board members and staff shared the following:

- The importance of the environmental health workforce to the nation and each state.
- The introduction of the Environmental Health Workforce Act by Representative Brenda Lawrence.
- The value of federal support to state, tribal, local, and territorial environmental health workforces through funding of the Centers for Disease Control and Prevention's (CDC) National Center for Environmental Health (NCEH). Specifically, for the government to provide at least $322 million to NCEH to ensure all if its programs are adequately funded, including $93.72 million for the Environmental Health Activities line item that includes $20.4 million for the All Other Environmental Health Activities subline item.
- The value of federal support for the Agency for Toxic Substances and Disease Registry (ATSDR). Specifically, for the government to provide $93 million for ATSDR in the Interior, Environment, and Related Agencies Appropriations bill for fiscal year (FY) 2022.
- The value of federal support for food safety programs at the Food and Drug Administration (FDA) and to appropriate at least $510 million in FY 2022 toward the food safety needs of FDA.

Certain Congressional offices would only meet with their constituents. As such, NEHA had to recruit Bob Custard and David Riggs, NEHA past presidents, to speak with members from their states (Virginia and Washington, respectively). Jesse Anglesey, president of the Idaho Environmental Health Association, spoke with staff from the office of Representative Mike Simpson (R-Idaho). NEHA member Peggy Mitchell from Delaware spoke with staff from the office of Senator Chris Coons (D-Delaware).

Some NEHA board members had several visits. NEHA President Long had 10 meetings on Hill Day. "I had positive feedback from all that I spoke with. It was a great day filled with energy," commented Long after her meetings. NEHA had seven meetings with Congressional members on Appropriations committees from California. Being from California, Region 2 Vice-President Michele DiMaggio had a busy day. "I learned a lot about representation and I learned a lot about my own capabilities," stated DiMaggio.

"The year's Hill Day demonstrated the value of collaboration among out board, members, and staff in support of our collective efforts to advance our association's mission and secure resources for boots-on-the-ground environmental health professionals," commented Dr. Dyjack.

Conducting Hill Days virtually might be the wave of the future. With security and health restrictions, it is becoming much easier for both Congress and visitors to meet virtually. What we lose in having face-to-face meetings, however, we gain in being able to visit more offices to spread the word about the importance of environmental health.

In total, NEHA spoke to and shared information with 44 members of Congressional Appropriations committees, both from the House and Senate, leaving behind NEHA letters of support and

advocating for the Environmental Health Workforce Act. NEHA set the stage for its fifth annual Hill Day scheduled for spring 2022.

For more information regarding NEHA Hill Day, please contact Doug Farquhar at dfarquhar@neha.org.

Introduction of the Environmental Health Workforce Act

By Doug Farquhar, JD (dfarquhar@neha.org)

The Environmental Health Workforce Act (H.R. 2661) was introduced by Representative Brenda Lawrence (D-Michigan) on April 19, 2021 (www.congress.gov/bill/117th-congress/house-bill/2661). The act would require the Secretary of the U.S. Department of Health and Human Services to:

- Develop model standards and guidelines for credentialing environmental health workers.
- Develop a comprehensive and coordinated plan to develop the environmental health workforce.
- Issue a report on best practices.
- Make credentialed environmental health workers eligible for the Public Service Loan Forgiveness program.

As many NEHA members know, the environmental health profession has seen a significant decrease in workforce capacity since 2008. This public health workforce, second in size only to nursing, is facing challenges to maintain sufficient staff to perform environmental health services. Since 2008, 22% of state and local environmental health jobs have been lost (National Association of County and City Health Officials, 2019). Insufficient staffing has been reported in 64% of state environmental health programs, 60% of local programs, and 67% of tribal programs mainly due to the strain the COVID-19 pandemic has caused the profession (National Environmental Health Association, 2020). Workers express concern regarding insufficient access to training and the high level of burnout. This trend will be exacerbated with the oncoming retirement of the Baby Boom generation.

Funding for environmental health workforce training and retention has decreased. Local health department budgets have either stagnated or decreased in 2019, with over one half of local health departments experiencing a reduction. As this nation struggles with the COVID-19 pandemic, the local public health workforce is strained, with essential environmental health services being neglected as resources are being redirected to the pandemic response.

At present, only 27 states require a credential for environmental health workers. NEHA believes that education and training of existing and new environmental health professionals should be a national public health goal.

"Education and training for new and existing environment health professionals is vital to our national public health. Public health crises, like the Flint water crisis and the COVID-19 pandemic, underscore the critical role that the environmental health workforce plays in keeping our communities safe and healthy," said Representative Lawrence. "Environmental health workers are more important now than ever before. I'm proud to introduce legislation that invests in and strengthens our environmental health workforce while providing them with the necessary tools and training so they can better serve our country."

These impacts on the environmental health workforce are occurring in light of the infrastructure bills proposed by the Biden Administration. The laudable goal of these bills is to increase job opportunities for people in the U.S., but at a time when the nation is lacking a sufficient number of trained and certified environmental health workers. The environmental health profession is needed to rebuild drinking water systems; build, renovate, and retrofit housing; and rebuild the transportation network to improve air quality and limit greenhouse gas emissions. Many of the efforts in the proposed bills will be waylaid or incomplete without an adequate and skilled environmental health workforce.

The bill is endorsed by NEHA, the Association of Environmental Health Academic Programs, and the National Environmental Health Science and Protection Accreditation Council. NEHA has drafted a sign-on letter of support to congressional leaders that highlights the importance of this bill. Organizations and individuals can sign-on to the letter online to show their support. Sign-on letters are a way to amplify the impact of the support for this bill. We would appreciate having your support on this important piece of legislation. Please view the sign-on letter and fill out the form at www.neha.org/node/61961 to be included in the list of supporting organizations and individuals.

Through the enactment of the Environmental Health Workforce Act, this nation can ensure that its environmental health workforce is trained, credentialed, and ready to handle the environmental threats that impact public health. For more information regarding the Environmental Health Workforce Act, please contact Doug Farquhar at dfarquhar@neha.org.

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FDA Announces New Cooperative Agreement Program to Advance Retail Food Safety

On May 14, 2021, the Food and Drug Administration (FDA) announce that NEHA had been awarded the Advancing Conformance With the Voluntary National Retail Food Regulatory Program Standards (VNRFRPS) by State, Local, Tribal, and Territorial (SLTT) Retail Food Regulatory Agencies Cooperative Agreement.

The intended outcome of this cooperative agreement program is to advance the national integrated food safety system by assisting retail food regulatory programs in achieving conformance with VNRFRPS (also called the Retail Program Standards).

The cooperative agreement will also help FDA to leverage NEHA's strengths to assist SLTT retail food programs in their efforts to reduce the occurrence of foodborne illness risk factors, implement and attain conformance with the Retail Program Standards, and fully leverage SLTT retail food programs strengths to advance retail food safety. The total funding for the cooperative agreement program is expected to be up to $40 million over 3 years. The cooperative agreement directly supports FDA's efforts to modernize the nation's retail food protection program under the New Era of Smarter Food Safety.

As part of the 3-year cooperative agreement program, NEHA will work collaboratively with FDA to achieve the following objectives:

- Develop and implement a system to administer financial assistance to SLTT retail regulatory food programs based on the FDA's VNRFRPS flexible funding model.
- Develop and implement a standardized method to assess training needs of retail food regulatory jurisdictions and facilitate meeting those needs.
- Develop and implement a tracking system that quantifies the extent of standardization of regulatory food safety inspection personnel within and among regulatory retail food jurisdictions.

According to NEHA President Sandra Long, REHS, RS, "NEHA is honored to partner with FDA on their revolutionary framework for retail food safety. We are committed to leveraging our association's unique reach and relationship with the local retail food regulatory community as we endeavor to build their capacity to ensure all families across our country enjoy the promise of food free from recognized hazards."

In addition, Laurie Farmer, director of the Office of State Cooperative Programs at FDA, offered her thoughts on the announcement of the new award: "This is a momentous time in the history of retail food protection with FDA providing a significant amount of funding to support SLTT retail programs! This funding model was uniquely designed with our stakeholders and is intended to not only drive behavior change but also measure our progress in reducing foodborne illness at retail in this country. Retail jurisdictions, reach out to your FDA retail food specialist and get yourselves ready to apply for this funding!"

Foodborne illness remains a major public health concern in the U.S. Foodborne diseases cause approximately 48 million illnesses, 128,000 hospitalizations, and 3,000 deaths each year (Scallan et al., 2011). The annual economic burden from health losses due to foodborne illness is estimated at 77.7 billion dollars (Scharff, 2012). According to the Centers for Disease Control and Prevention (CDC, 2016), more than one half of foodborne illness outbreaks that occur each year are associated with food from restaurants or retail food establishments.

Surveillance data from CDC have consistently identified five major risk factors related to food safety practices within the retail food industry that contribute to foodborne illness: poor personal hygiene, improper food holding/time and temperature, contaminated equipment/lack of protection from contamination, inadequate cooking, and food obtained from unsafe sources. Most regulatory retail food inspection programs throughout the U.S. monitor these risk factors in their routine inspections and each necessitates specific food safety behaviors and practices.

The full press release can be viewed at www.neha.org/node/61968. Please visit www.neha.org/retailgrants for more information.

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Task Force on Pandemics: Preparing Buildings and Communities for Disease-Related Threats

Many jurisdictions have already developed guidelines and policies in response to the COVID-19 pandemic. The International Code Council (ICC) has been tracking these efforts and provides a compilation of resources for the building industry at www.iccsafe.org/coronavirus-response-center.

Due to the complex and nonuniform approaches implemented globally, it is imperative that all aspects of the built environment be thoroughly analyzed to develop a comprehensive response. Recognizing this critical threat to both new and existing construction, ICC and NEHA have established a new task force on pandemics to help communities respond to COVID-19 and prepare for the next health threat.

The design and layout of buildings can have a significant impact on occupant health and safety. This diverse task force will research the effects of the COVID-19 pandemic on the built environment. The group will then develop a road map and propose needed resources—including guidelines, recommended practices, publications, and updates to the International Codes (I-Codes)—that are necessary to overcome the numerous challenges faced during pandemics to construct safe, sustainable, and affordable structures.

ICC anticipates that the task force will complete:

- A comprehensive review of current code requirements as they relate to prevention of the transmission of diseases and other serious health concerns. Any suggested revisions to current

code requirements based on this assessment will be processed as proposed code changes to the I-Codes.
- A comprehensive review of existing guides, executive orders, white papers, reports, and standards as they relate to design standards, preparedness, health considerations, and tools for operating during a pandemic.
- Identification of best practices and guides to address the design and layout of new and existing buildings.
- A comprehensive package of public information materials.

The new task force will include a broad cross section of experts from the building safety, construction, design, health, and insurance industries. The ICC Board of Directors, in consultation with NEHA, will appoint the members of this task force. More information about the task force can be found at www.iccsafe.org/advocacy/pandemic-taskforce.

NEHA Updates the *REHS/RS Study Guide*

By Sharon D. Unkart, PhD (sdunkart@neha.org)

Since 1937, NEHA has conferred many credentials and certifications including our flagship credential, the Registered Environmental Health Specialist/Registered Sanitarian (REHS/RS). From 2019 to date, 1,158 NEHA or state REHS/RS exams have been administered, with over 500 exams forecasted for 2021. Currently, there are 3,243 REHS/RS credential holders, with approximately 41% of our members holding this credential or in some stage of acquiring it.

In 2020, NEHA began the process of revising the REHS/RS exam. As part of that process, a new job task analysis was conducted and new exam questions were written utilizing teams of subject matter experts (SMEs) from across the environmental health profession. Outcomes of these processes include a new knowledge, skills, and abilities (KSA) chart that covers many fields including air, water, waste, vectors, and emergency preparedness. This chart was then used to create the new exam questions that resulted in a revised REHS/RS exam blueprint. These two documents, the KSA chart and the exam blueprint, were then used to guide the next steps in the process.

With the new credentialing exam comes the need for new study materials. Currently, NEHA offers a study guide, *A Guide for Environmental Health Responsibilities and Competencies, 4th Edition*, that was published in 2014 (aka the *REHS/RS Study Guide*). This study guide was the starting point for the revisions that were led by Dr. Sharon D. Unkart, associate director of the Entrepreneurial Zone (EZ) within NEHA. She began with the list of NEHA technical advisors, searching LinkedIn for each person's specialty area within the field of environmental health. From there, she continued searching LinkedIn for current REHS/RS credential holders to fill in the areas that were not covered by the NEHA technical advisors.

Dr. Unkart reached out to the list of 45 potential SMEs via email, of which 16 received no response or were returned undeliverable. She was thrilled, however, when only five of the remaining 29 professionals from academia, industry, and the regulatory community replied that they could not help. Dr. Unkart then parsed out the chapters based on the specialty areas she had identified using LinkedIn. While most of the SMEs agreed with the initial assessment of their content specialty, a few requested to be moved to a different content area. These changes resulted in some chapters, such as food safety, having as many as four editors. Other chapters, however, were not as well covered by the identified content area specialties.

The lack of coverage on certain chapters left some SMEs with much larger writing assignments. The SMEs were asked for referrals to augment the content area coverage with additional writers. As a result, five individuals were identified and added to the list of SMEs, bringing the final total of editors for the upcoming new edition of the study guide to 29. Some SMEs also volunteered to review more than one chapter, essentially lessening the task for some but increasing it for others.

Each SME was provided with the chapter text from the 4th edition of the *REHS/RS Study Guide*, portions of the KSA chart relevant to their chapter assignment, and the new exam blueprint. From there, their tasks were to
- incorporate the knowledge, skills, and abilities as identified in the job task analysis conducted in 2020;
- revise, edit, update, and add new content as they deemed necessary to bring their chapter current;
- revise and update the references in each chapter; and
- add any new references they felt were important to supporting the updated content of the chapter.

Each SME was given access to the electronic file of the chapter on NEHA's SharePoint (a web-based document management and storage system). This process worked well for many and they were able to make changes directly to the shared files. Some SMEs, however, had trouble using SharePoint, either because they could not access the files or the formatting within their web browser made working with the text difficult. At that point, electronic files of the chapters were emailed to these SMEs, allowing them to track their changes in the files and return the revised files via email to NEHA. The SMEs were given 8 weeks to update the 15 chapters and almost all content revisions were completed by mid-May.

While these revisions were being made to the text, staff members of the EZ creative team were also hard at work. Jaclyn Miller, EZ editor/copy writer, and Seth Arends, EZ graphic designer, worked together to create a new InDesign template that will be used moving forward to publish all NEHA publications. Prior to this process, many of the books published by NEHA are in older, dated file formats that make revising them difficult. This new template will enable EZ to respond to content update needs more quickly, including other publications from NEHA such as

NEHA **NEWS**

the *CP-FS Study Guide* and *HACCP: Managing Food Safety Hazards at the Retail Level*.

In appreciation for their service to the profession, each SME was given 10 continuing education contact hours from the NEHA Credentialing Department and a letter of professional service in recognition of their contributions. They will also have their names and biographies listed in the new edition. The new *REHS/RS Study Guide* is expected to be published and available for purchase by late June. Visit www.neha.org/store for more information.

The following is a list of SMEs who contributed to the new edition of the *REHS/RS Study Guide*:

Timothy Callahan
Tracynda Davis
Derek DeLand, REHS
Zachary Ehrlich, REHS
Doug Farquhar, JD
Jason Finley, REHS
David Gilkey, PhD
Stan Hazan
Greg Kearney, DrPH
Nichole Lemin, REHS
Adam Mannarino, REHS
Cynthia McOliver, PhD
Timothy Murphy, PhD
Crispin Pierce, PhD
Therese Pilonetti, REHS, CP-FS
Clint Pinion, DrPH
Richard Pollack, PhD
Jason Ravenscroft, REHS
Cindy Rice, CP-FS
Welford Roberts, PhD
Michéle Samarya-Timm, REHS
Kari Sasportas, REHS
Zia Siddiqi
Sara Simmonds, REHS
Christopher Sparks
Tom Vyles
Felix Zemel
Tyler Zerwekh, DrPH
Jodi Zimmerman, REHS

New NEHA History Project Webpage

By Kristen Ruby-Cisneros (kruby@neha.org)

In 2020, NEHA President Dr. Priscilla Oliver (2019–2020) appointed a committee to study and review the rich history of NEHA, as well as that of the environmental health profession. In light of the many advances and new innovations that have occurred in environmental health over the past decades, it is important to examine where we have been and what we have accomplished to position our profession for the future. As such, the NEHA History Project Task Force was created.

The NEHA History Project Task Force is charged with making the important history of NEHA and the environmental health profession available to all NEHA members, as well as other practitioners, students, and the general public. The task force, made up of luminaries from across the environmental health field, convened in March 2020 to assess the history we have recorded, gather data and historical documents, collect historical artifacts, and review records.

In April 2021, the NEHA History Project Task Force launched a webpage—www.neha.org/neha-history-project—to start showcasing its work and the history it has collected. The NEHA History Project webpage endeavors to preserve our rich history and share our story with all.

From the NEHA History Project webpage you can find an overview of the project and a list of task force members and how to get involved. You can also view the current History in the Spotlight, which highlights the history of NEHA logos. The first logo used by the National Association of Sanitarians (later to be renamed NEHA in 1970) was a shield with a beacon in the center that reflected of the slogan of the association, "Sanitarians—The Beacon Light of Public Health." The current logo used by NEHA first appeared in the March/April 1975 *Journal of Environmental Health*.

Other NEHA History Project resources highlighted on the webpage include:

- **The NEHA Green Book: A History From 1937 to 1987:** Published in 1987 by NEHA, *Environmental Health 1937–1987, Fifty Years of Professional Development With the National Association of Sanitarians/National Environmental Health Association* (affectionately referred to as the "Green Book"), provides a brief overview of the association's first 50 years, including its creation, significant events, and past presidents. The book also provides chapters on credentialing, environmental health education, continuing education, *The Sanitarian/Journal of Environmental Health*, awards, women in environmental health, industry, and the American Academy of Sanitarians. To share the history of NEHA's first 50 years, the NEHA History Project Task Force has digitalized the book for all to access and explore.
- **NEHA Virtual Museum:** You can peruse the NEHA Virtual Museum to learn more about the fascinating artifacts, instrumentation and tools, publications, and miscellaneous items from our past. Over 50 items have been posted to the Virtual Museum. Each items includes a photo and description to help you understand what each item is and how it relates to our profession. View a pin from the first Earth Day in 1970, learn about the use of sidewalk bricks to convey public health messages, and more! The NEHA History Project Task Force thanks Dr. Robert Powitz for providing photos and descriptions from his personal collection for the Virtual Museum.
- **Past NEHA AECs:** The NEHA Annual Educational Conference (AEC) & Exhibition is the premier environmental health conference that brings together professionals from around the globe to learn and discuss current and emerging environmental health topics and issues. The first AEC was held on June 25, 1937, in Long Beach, California. Since that time, 83 AECs have been held across the U.S., including Hawaii, Alaska, and Canada. A listing of AEC dates has been posted, as well as access to PDFs of AEC wrap-up reports published in the *Journal* from 1980–2019. The task force will continue to update this page with all available AEC reports.
- **NEHA Past Leaders and Award Winners:** A listing of past NEHA presidents, secretaries and executive secretaries, and executive directors can be found on this page. The task force is

currently working on posting information about NEHA award winners in the near future.

- **Notable Figures in Environmental Health:** Still under construction, this part of the webpage will highlight stories of trailblazing individuals who have shaped the environmental health profession.
- **Additional NEHA History Project Resources:** This webpage will enable you to explore more of the resources created and discovered by the task force.

Please visit the NEHA History Project webpage at www.neha.org/neha-history-project to learn more about the task force and to start exploring the rich history of our organization and profession.

NEHA Staff Profiles

As part of tradition, NEHA features new staff members in the *Journal* around the time of their 1-year anniversary. These profiles give you an opportunity to get to know the NEHA staff better and to learn more about the great programs and activities going on in your association. This month we are pleased to introduce you to two NEHA staff members. Contact information for all NEHA staff can be found on page 50.

Terryn Laird

In my role as public health communications specialist at NEHA, I serve primarily as a communications leader in the Retail Food Safety Regulatory Association Collaborative (www.retailfoodsafetycollaborative.org). I maintain the Collaborative's various communication channels and website, provide writing and design support for other NEHA food safety initiatives both internally and externally, and participate on the Awareness & Communications Workgroup of the Environmental Health & Equity Collaborative.

Before coming to NEHA I worked in retail food at Starbucks and in a nursing home. I also worked as a writing tutor in the Writing Center at Metropolitan State University of Denver. I hold a bachelor of science in human nutrition and a bachelor of art in English from Metropolitan State University of Denver. This varied education provides me with the tools to act as an effective science communicator as well as a storyteller.

I was born and raised in Boulder County, Colorado, and have a deep love for the state and all of the natural beauty here, which fuels my passion for environmental health, conservation, and working to mitigate the effects of climate change. Outside of work I am a collector of hobbies and passions that include (but are not limited to): hiking, camping, backpacking, cooking and baking (currently I am into sourdough and traditional pastry), writing, Dungeons and Dragons, and plants. I'm sure, however, that I will have picked up a few new ones by my next anniversary!

Tyler Linnebur

I joined NEHA in August 2020 as a staff accountant in the Finance Department. My goal is help automate processes and put more data online so that we can work more efficiently and flexibly at home or in the office. I am passionate about the environment and want to contribute to NEHA's mission of advancing environmental health through improving our finance and accounting functions.

I attended the University of Denver where I obtained my bachelor's degree in finance in 2018 and my master's degree in accounting in 2019. While completing my graduate degree I started working as a staff auditor at a public accounting firm. There I gained experience auditing the financial statements of private corporate, not-for-profit, and governmental clients. I was laid off in May 2020 due to economic challenges caused by the COVID-19 pandemic but was fortunate to join NEHA as a contractor in May 2020 and later as a staff accountant in August 2020.

While at NEHA I passed the last of my Certified Public Accountant (CPA) exams and became licensed in December 2020. My goal over the next several years is to pursue the other valuable credentials such as the Chartered Financial Analyst (CFA) and Chartered Global Management Accountant (CGMA).

As a staff accountant at NEHA, I record accounting transactions weekly, prepare journal entries and monthly reconciliations of our accounting records, assist in preparing the annual budget and Form 990 tax form, deposit checks, process accounts payable, and perform any other tasks that make the jobs of the accounting manager and finance director easier. I also assist the Partnership and Program Development (PPD) Department at NEHA in preparing its budget and tracking payroll expenses with a sophisticated spreadsheet the PPD director and I have created.

When I am not at work you will find me hiking, camping, mountain biking, running, or doing anything outdoors in my home state of Colorado. I enjoy reading, especially about history and politics, and you can find me discussing either with a group of friends. I also enjoy walking my dog, Cruz, around our neighborhood. Additionally, I run a chapter of the American Conservation Coalition, a free-market environmental organization, and through it go on hikes, do trash cleanups, and hopefully in the near future meet with political leaders to discuss ways to help our environment.

I grew up as a Boy Scout and loved the adventures my troop would go on in the great outdoors. The memories I made sleeping under the stars in the fresh mountain air inspired me to conserve our nature's beauty for future generations to enjoy and make memories of their own. NEHA's work in environmental health is relatively new to me but it has taught me the breadth of environmental health work and how important it is for us all.

DirecTalk
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a calling, not a job or a career. The accolades and public acclaim are secondary to our interests, which is killing us.

If I see or hear one more unqualified physician on TV, Twitter, or the radio pontificating on the safety of pandemic dining, travel, or returning to school, I am going to go ballistic. These people are talking heads who in most cases are filling a void of our own creation. I do not question their competence as clinicians or commitment to the public health enterprise. I question their expertise in environmental health. We must claim our space.

The NEHA Board of Directors has expressed to me their desire that this association do more to advocate for the profession. While I feel we have made substantial progress in recent years, I agree with them. The question is what does that look like in practice? How do we sustainably support that endeavor? How do we make that advocacy effective in over 3,000 regulatory jurisdictions, our affiliated U.S. territories, the uniformed services, and the private sector, the latter of which comprise an increasingly larger segment of our association membership?

The core of this conundrum is anchored in my earlier observations about the awards. If we don't take time to recognize and congratulate ourselves for a job well done, then

Retail food is a growing priority for the National Environmental Health Association. Photo courtesy of David Dyjack.

are we surprised that the medical profession has grabbed the spotlight and has become the focal point for health issues? Environmental health is a local issue. We need to own the local press and social networks. We need to own our professional self-recognition. We need to rally around ourselves because no one else is going to do it for us.

We have embarked on an association rebranding journey. This endeavor will likely lead to a new logo and a new identity. I hope we can instill a growing and revitalized sense of pride in our profession. It is time to remove that invisibility cloak that has shrouded us in secrecy for far too long.

ddyjack@neha.org
Twitter: @DTDyjack

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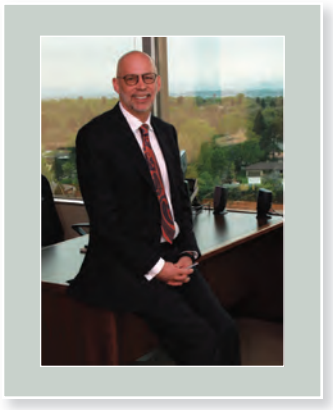

David Dyjack, DrPH, CIH

Pull the Red Wagon

The electronic message from the Food and Drug Administration arrived after midnight Eastern Time last night. Our association has been awarded a 3-year, $40 million cooperative agreement to advance the knowledge, skills, and abilities of National Environmental Health Association (NEHA) members and others who are engaged in the retail food safety regulatory sphere. Since the arrival of the award letter, 12 hours have passed and my mind is twisted and contorted with the prospect of the amount of work involved in launching this effort.

While a major grant is good news, we have other initiatives under development intended to recognize the impactful progress being achieved by dedicated environmental health professionals. Let us begin by reviewing some of newer opportunities for recognition and note that the deadline for 2021 submissions will have passed by the time you read this column.

First, there is the Dr. Bailus Walker, Jr. Diversity and Inclusion Awareness Award. This award will be presented annually to recognize an individual or group who has made significant achievements in the development or enhancement of a more culturally diverse, inclusive, and competent environment. The qualified individual or group will demonstrate support for diversity in their organization and community.

The second major award is notable because it recognizes our members with accolades and cash. Our association, in partnership with the Centers for Disease Control and Prevention and the Agency for Toxic Substances and Disease Registry, is recognizing environmental health heroes who have used innovative environmental health services or practice strategies to improve the health and wellness of their communities during the COVID-19 pandemic. Environmental health practitioners have been on the front lines of this pandemic, working tirelessly to not only slow the spread of COVID-19 but also carry out essential environmental health work in new, different, safer, or more efficient ways. We want to profile these health department teams that are using new and creative solutions that can forever change the way we do environmental public health and offer awards between $500 and $10,000, depending on the number of applicants.

We must claim our space.

We also have our usual stable of esteemed awards. We recognize stellar lifetime contributions through our Walter S. Mangold Award, and in partnership with NSF International, the Walter F. Snyder Award. These awards, along with the Samuel J. Crumbine Consumer Protection Award, are widely considered some of the most prestigious in the U.S. We have a trove of others. In collaboration with the U.S. Department of Housing and Urban Development we offer the Healthy Housing Awards, as well as scholarships in collaboration with the American Academy of Sanitarians and the Joe Beck Education Contribution Award for excellence in educational contributions. Each of these awards showcases the exceptional performance in our profession.

What do these awards generally have in common? Each year we have difficulty securing a suitable pool of qualified applicants. We try social media. We make announcements in our E-News. We use word of mouth. We start early and keep the nomination process open late. The results generally are anemic. Not just this year but every year.

You might be thinking I am going to chastise you about the volume of award nominees. Not true. In fact, this month's column is intended to be more self-reflective. What are we doing wrong? The Association of Environmental Health Academic Programs gave me an award a few years ago that I prominently showcase in my house. I am overwhelmed to this day. Dr. Jason Marion secured Kentucky Colonel status for me. I framed that signed declaration and have it proudly displayed in my home office. I don't think I'm unusual.

Are we so busy that we can't invest a few minutes to nominate our deserving colleagues for recognition? Are we collectively too modest? Is NEHA not doing a good job promoting or showcasing these opportunities? Some combination of the above or something different?

Please allow me to scale this discussion up a bit and possibly be a little controversial. I believe our profession is by nature modest and distracted by the interesting science that envelops us. For many of us, our work is

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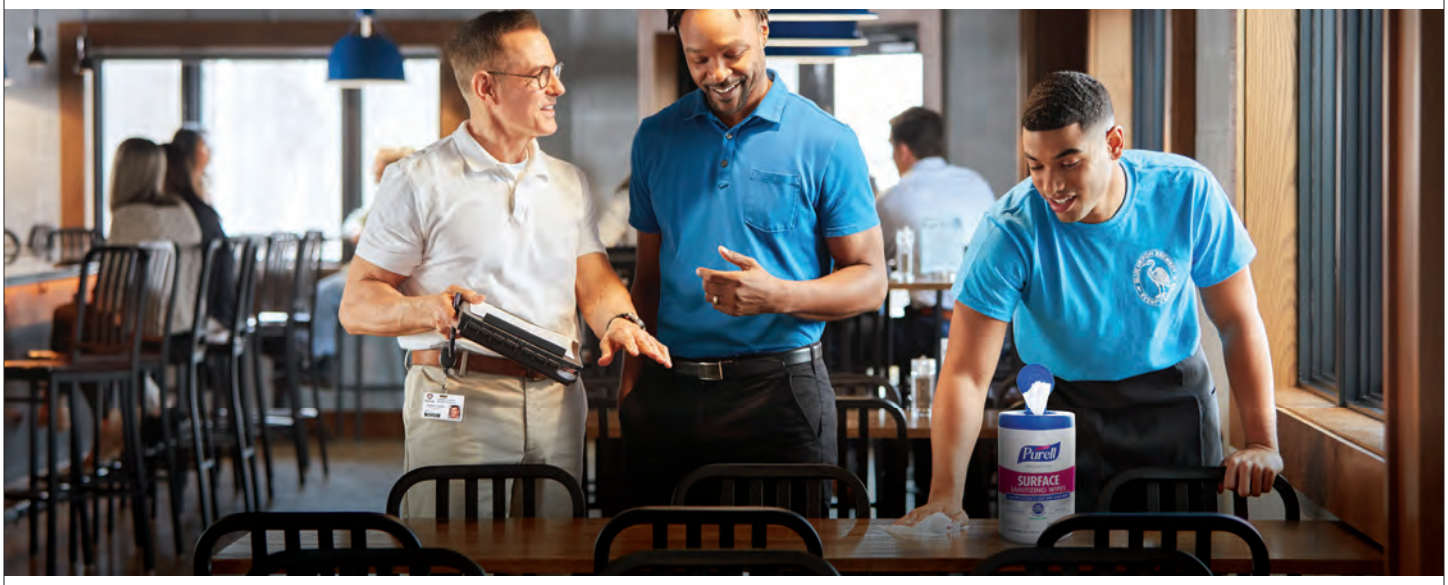

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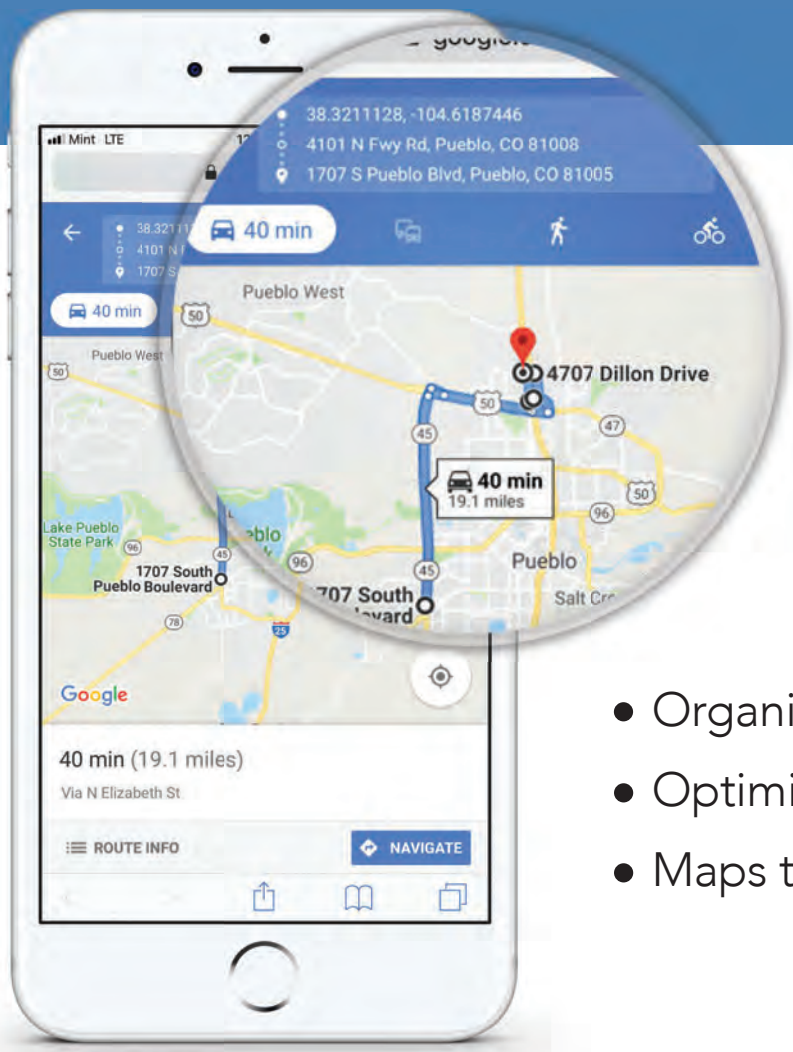

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