

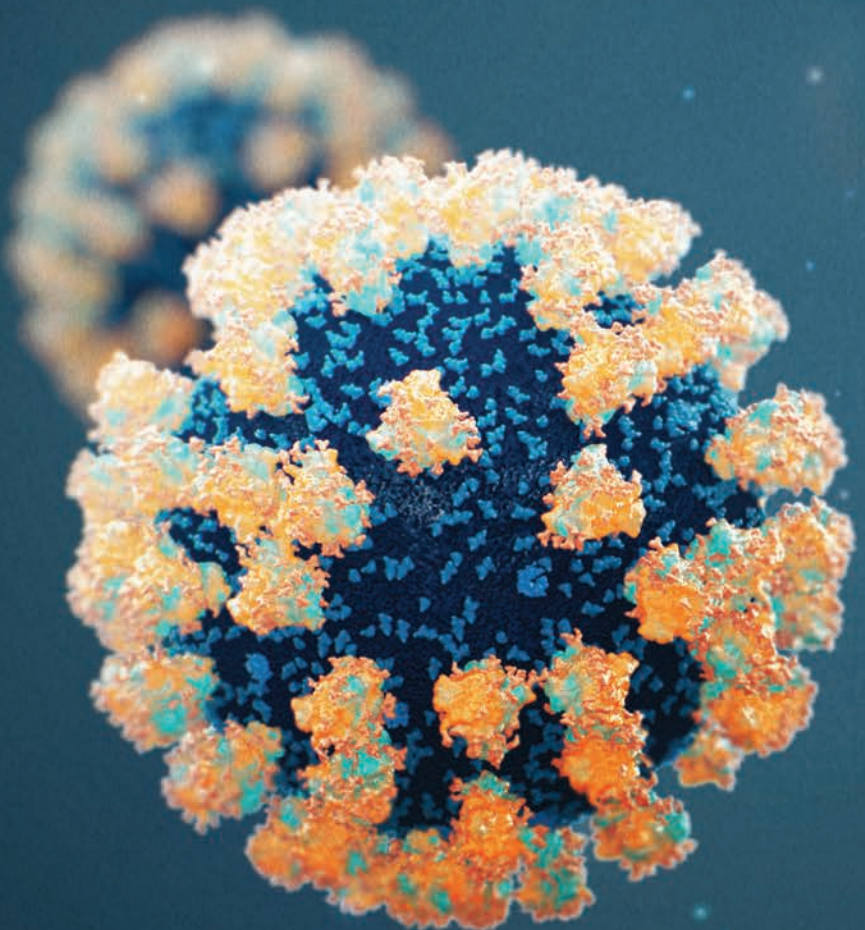
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Volume 82, No. 9 May 2020



An All-Hazards Approach to Pandemic COVID-19

A Special Guest Editorial

Also, NEHA's COVID-19 Response and Resources

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ABOUT THE COVER



The World Health Organization declared coronavirus disease 2019 (COVID-19) a pandemic on March 11, 2020. The National Environmental Health Association (NEHA) is closely monitoring

COVID-19 developments and is working to provide members and stakeholders with access to critical information and updates. Across the U.S. and around the globe, environmental health professionals are on the frontlines of preventive public health services delivery and we are committed to supporting the environmental health workforce to effectively and safely do their jobs. As such, this month's issue features a special guest editorial, "An All-Hazards Approach to Pandemic COVID-19: Clarifying Pathogen Transmission Pathways Toward the Public Health Response." The issue also features information about NEHA's COVID-19 response and resources, and includes information about various different COVID-19 resources throughout the issue in the Did You Know boxes.

See page 28.

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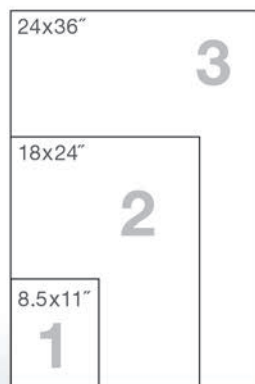


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Official Publication



Journal of Environmental Health
(ISSN 0022-0892)

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Published monthly (except bimonthly in January/February and July/August) by the National Environmental Health Association, 720 S. Colorado Blvd., Suite 1000-N, Denver, CO 80246-1926. Phone: (303) 756-9090; Fax: (303) 691-9490; Internet: www.neha.org. E-mail: kruby@neha.org. Volume 82, Number 9. Yearly subscription rates in U.S.: \$150 (electronic), \$160 (print), and \$185 (electronic and print). Yearly international subscription rates: \$150 (electronic), \$200 (print), and \$225 (electronic and print). Single copies: \$15, if available. Reprint and advertising rates available at www.neha.org/JEH. CPM Sales Agreement Number 40045946.

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All technical manuscripts submitted for publication are subject to peer review. Contact the managing editor for Instructions for Authors, or visit www.neha.org/JEH.

To submit a manuscript, visit <http://jeh.msubmit.net>. Direct all questions to Kristen Ruby-Cisneros, managing editor, kruby@neha.org.

Periodicals postage paid at Denver, Colorado, and additional mailing offices. POSTMASTER: Send address changes to *Journal of Environmental Health*, 720 S. Colorado Blvd., Suite 1000-N, Denver, CO 80246-1926.



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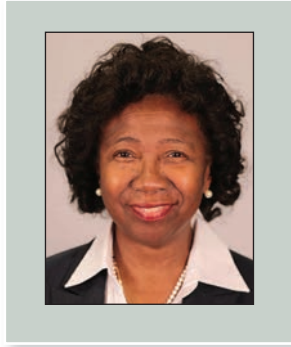
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► PRESIDENT'S MESSAGE



Priscilla Oliver, PhD

Networking in Environmental Health

What is keeping you from enjoying the career success you richly deserve? Education, training, credentials, and experience clearly help to get some of what one wants, needs, and deserves. For some, these components may be all that is needed. If you are missing some ingredients and want to still progress, however, let me suggest networking to aid the progress toward the goal. There is a saying, "It is not what you know but who you know." Certainly, this statement has meaning to some. In most of life, people can open doors or help one to get more out of living. We learn frequently from others in many professions. Thus, the importance of apprenticeship, internships, and understudy is realized often. All of these are ideal settings and a form of networking.

Aside from formalized training, explore networking. Networking is the process of connecting with people in a chosen or related profession and sharing information in the profession, which in this case is environmental health. Networking is the sharing of skills, knowledge, abilities, talents, culture, the dos and don'ts, and enjoying the relationship of being connected. One may network with a group, organization, or individual. Networking may occur with champions, experts, professors, colleagues, supervisors, coworkers, students, family, and friends. Networking may occur with local, county, state, federal, corporate, business, private, and international officials. The extent of networking is endless.

The late Phillip Oliver, my brother, was most experienced at networking. He was a social worker and basketball player. It was

amazing to watch him in action. He loved people. He networked with folks from all walks of life, from the bottom to the top of society. I am known as Phil's sister, one of my prized titles. I dedicate this column to his memory. You can go far with people for they can make dreams come true, change hearts, and open doors. So, if you are not very smart with knowledge, education, skills, and talents, and have little experience, get busy with networking with good people. Be genuine. Be real and engaged. Be in the network to reap the benefits of our profession.

Let us focus on you and your career. If you do not have a résumé or curriculum vitae, get that done. All of us need business cards, too. Students need business cards with their name, major, e-mail, and expected graduation date. Find mentors and keep them for life. Remember, the recommendations of teachers and faculty are golden. They can and will speak about you all of their life. It touched me when I ran into my kindergarten teacher, Bessie Brady (she was 90 years old at the time.) Brady remembered me, calling out my whole name and repeatedly saying, "She never gave me a minute of trouble." Dr. Richard Barbe, retired Georgia State University professor and my dissertation committee chair, wrote in a great letter of recommenda-

*Ready, set,
go network!*

tion for me that I was loyal. I had not even recognized that trait about myself. Please get to know your professors for they are trained to know you and can even guide you in your career path.

Keep your résumé updated as you work. You need to have the résumé ready when it is requested. Even in retirement, network to keep active and alive. Networking and movement of your mind and body will keep you living that best life. Enlarge your network to include persons of all ages, diversity, and socioeconomic backgrounds. Dr. Charles Mouton, provost and dean of medicine at the University of Texas Medical Branch, spoke about networking as community engagement. Networking connects us to the community.

Utilize acceptable social media to expand your networking activities. LinkedIn is a popular networking tool. Every day, professionals are connecting through the Internet. There are limitless possibilities in networking through the Internet and print media.

Now, I realize some of you are content with where you are and do not want to move up or on from where you are. That is okay. Networking should not end in retirement. Please consider networking to help others and to make an even more valuable contribution to the profession.

We need you as mentors for the National Environmental Health Association (NEHA). You can help students, young professionals, and others. Networking is expanding in NEHA. Consider being a member and mentor for NEHA. We thank Brian Collins, past-president and former interim execu-

tive director of NEHA, for being our champion for the Student and Young Professional NEHA Mentoring Program. It will kick off this summer at the NEHA 2020 Annual Educational Conference & Exhibition in New York City (www.neha.org/aec). Please join us. There is professional and personal satisfaction in networking.

Lastly, consider networking to have fun. All work and no play make life dull and not what is needed in environmental health. Have some fun in the connectivity of the networking process. Many networking events are held at conferences or special meetings and are social in nature. Let us have fun with these events that might include music, food,

drink, laughter, and lively décor. Ready, set, go network! 🍷

Priscilla President@neha.org

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Gambling With Your Health, Part 2: The Effect of Two Sanitation Procedures on the Disinfection of Bacterial Contamination on Casino Cheques

Edward G. Mc Keown, PhD

Abstract In a previous study, casino cheques (sometimes referred to as gaming chips) were shown to be a possible public health hazard based on levels of bacterial and fungal contamination (Mc Keown, 2019). The purpose of this study was to evaluate two different sanitation procedures and evaluate their effectiveness at reducing bacterial and fungal contamination levels found on casino cheques. To test for bacterial and fungal contaminants, 19 cheques were placed in one of three test methods to evaluate a dishwasher, aerosol disinfectant, or control (no test) on contaminant levels found on the cheques. Test results showed that the average number of bacterial contaminants increased across all test methods except for the dishwasher one, which did not show a significant change from the original study. This study demonstrates that more research needs to be conducted to find effective ways of reducing bacterial contaminants from casino cheques.

Introduction

When it comes to cleaning and sanitizing casino gaming cheques, most casinos do not have policies in place. The Centers for Disease Control and Prevention (CDC), which has a Vessel Sanitation Program for cruise ships, does not include mention of cleaning or sanitizing areas in the casino or casino cheques (CDC, 2011; Marti, 1995). In Las Vegas, Nevada, however, the Southern Nevada Health District's *Guidelines for the Prevention and Control of Norovirus in Hotel/Casinos* include recommendations for frequently cleaning and sanitizing areas in a casino that are frequently touched. These areas include but are not limited to casino cage counters, contact areas of gaming tables, and table game cup holders (Southern Nevada Health

District, 2007). The previous study showed that cheques can be as dirty and contaminated with harmful bacteria as other fomites (Mc Keown, 2019).

It has been noted that proper hand washing as a part of personal hygiene is one of the major ways to fight the spread of infectious diseases. Based on a study by Altekruise and coauthors (1999), approximately 35% of the U.S. population does not wash their hands after using the restroom, which has resulted in public restrooms being deemed a source of bacterial and viral contamination (Altekruise, Yang, Timbo, & Angulo, 1999; Bakalar, 2005; Byrd-Bredbenner et al., 2007; "Did you wash your hands," 1996; Filion, Kukanich, Chapman, Hardigree, & Powell, 2011). In the previous study that was performed specifi-

cally on casino cheques, it was determined that statistically significant levels of bacterial (such as *E. coli*) and fungal contamination occurred on the cheques (Mc Keown, 2019), thus warranting further study.

Effective cleaning and sanitation of work areas and equipment are essential in the food service industry to maintain a healthy food supply (Addis & Sisay, 2015; Altekruise et al., 1999; Terpstra et al., 2007). On occasion, cross-contamination has occurred via workers from one item to another, and from one fomite to another (Addis & Sisay, 2015; Allwood, Jenkins, Paulus, Johnson, & Hedberg, 2004; Altekruise et al., 1999; Byrd-Bredbenner et al., 2007; de Kort & Velthuisen, 2011; Saldmann, 2008; Terpstra et al., 2007). Unfortunately, there is a lack of research in areas outside the food service industry or medical fields with respect to contamination, cross-contamination, or sanitation. Food service operations have been studied regarding cleanliness and sanitation. Even mobile communication devices have had extensive research showing levels of contamination and methods for effectively cleaning and sanitizing the devices. Research related to cleanliness and sanitation in the field of casino gaming, however, is severely lacking (Arora, Devi, Chadha, & Malhotra, 2009; Brady, Fraser, Dunlop, Paterson-Brown, & Gibb, 2007; Rutala, White, Gergen, & Weber, 2006).

When it comes to cleaning and sanitizing fomites within the medical field, studies have shown the effectiveness of cleaning programs in preventing further contamination of patients (Filion et al., 2011; Gaonkar, Geraldo, Shintre, & Modak, 2006; Kramer, Schwebke, & Kampf, 2006; Terpstra et al.,

FIGURE 1

Casino Chip Tray Showing Placement of Test Cheques



Note. Letters indicate where test cheques were placed.

2007). This research is important because patients in healthcare establishments tend to have weakened immune systems, thus, careful preparation of equipment is required to ensure that harmful microorganisms are not transferred to the patients. In contrast, most commercial food service operations are not aware of the health condition of guests, so it is imperative that procedures ensuring cleanliness and sanitation be adhered to in case a guest with a weakened immune system visits the food service establishment.

The purpose of this study is to determine the effectiveness of two different sanitation procedures on casino cheques that are contaminated with bacteria. This study is a continuation of the previous study that found statistically significant amounts of bacterial and fungal contamination on casino cheques, which could pose a potential public health risk (Mc Keown, 2019). This study aimed to determine if two methods of sanitation could be viable ways to effectively reduce the bacterial and fungal contamination on casino cheques.

For this article, the term “cheque” is used to replace the term “chip” that was used in Mc Keown (2019). This change was made to be more in line with the industry. Specifically, in the casino industry, a small round clay or plastic disk that has monetary value is referred to as a cheque and a nonvalue disk is referred to as a chip (Ferris, 2013).

Methods

This study used a majority of the previous study’s methodology to ensure the cheques were tested the same way as before and after the different sanitation procedures (Mc Keown, 2019). In total, 19 casino cheques from the previous study—13 that were in use at a casino and 6 direct from a manufacturer—were used. A total of three test methods were employed to determine the effectiveness of different sanitation procedures on the casino cheques. The cheques were split into three sections. The first section was the control, on which no sanitation procedures were applied to the cheques. The second and third sections evaluated the effectiveness of using an aerosol disinfectant and a commercial high-temperature (>180 °F) dishwasher, respectively.

In the previous study, a total of 20 cheques (\$5 denomination each) were collected from four different casinos, with 5 coming from a casino in the Gulf Coast and the other 15 (5 each) coming from three different casinos in Las Vegas, Nevada. Cheques were randomly chosen in equal numbers from the four casinos until 13 cheques had been placed into the different testing sections. The odd number of cheques (i.e., 13) meant the dishwasher test had a total of 5 used cheques, while the control and disinfectant sections had 4 cheques each. The 6 cheques that came direct from

the manufacturer were divided equally among the test methods.

Each gaming cheque contains three sides—obverse (front), reverse (back), and edge (side)—so a total of 57 tests were performed: 21 for the dishwasher and 18 each for the control and aerosol disinfectant methods. Obverse and reverse sides of the cheques were determined based on the cheque design and positioning of colored stripes in relation to wording and casino label. Cheque labels closely oriented with the wording on the edge were considered the obverse side. As with the previous study, two biologists performed the tests and directly tested the cheques after they went through the testing methods.

A standard 9-row casino chip tray can hold a maximum of 450 cheques; however, because casinos rarely completely fill a tray, a total of 313 chips and cheques were placed in a tray. For the aerosol disinfectant, the six cheques to be tested were randomly placed in central areas within the nine rows where, counting from the left side of the tray, one cheque was placed in approximately the center of row two (A), two cheques were placed in row four with one toward the top (B) and the other toward the bottom (C), one cheque was placed approximately in the center of row six (D), one cheque was placed near the bottom of row seven (E), and the last cheque was placed approximately in the center of row nine (F) (Figure 1).

Once the cheques were placed into the casino chip tray, an aerosol disinfectant was used according to its label directions. The active ingredients of this disinfectant are alkyl (50% C₁₄, 40% C₁₂, 10% C₁₆) dimethyl benzyl ammonium saccharinate (0.10%); ethanol (58.0%); and other ingredients (41.9%). The aerosol disinfectant was held 6–8 in. from the chips and cheques, and was sprayed for 5 s until the surface was covered with a mist and then allowed to dry for 3 min. Once the chips and cheques were dry, they were removed from the tray and placed in a sterile container for transport to the laboratory.

For the dishwasher test, the test cheques, along with another 313 chips, were placed in a casino chip tray. The chips and cheques were then transferred from the tray and placed in a standard flat dish rack. Another rack was placed on top to keep items from flying out from the water pressure. The dishwasher used was a Hobart Hot Water Sanitizing pass-

TABLE 1

Characteristics and Testing Method Results of Casino Cheques for Bacterial Colonies and Fungi

Casino (Cheque #)	Size	Shape	Color	Margin	Elevation	Surface	# of Bacterial Colonies	# of Fungi
Dishwasher								
1 (1)	SM, MD, LG	Round	White, yellow, gray	Smooth	Raised	Obverse	22	0
						Reverse	11	1
						Edge	13	0
2 (2)	MD, LG	Round	White	Smooth	Raised	Obverse	6	0
						Reverse	5	1
						Edge	5	0
3 (3)	SM	Round	Gray	Smooth	Raised	Obverse	34	0
						Reverse	28	1
						Edge	44	2
4 (4)	SM, LG	Round, rigid	White, yellow, gray	Smooth	Raised	Obverse	10	1
						Reverse	13	7
						Edge	9	0
1 (5)	SM, MD	Round	Yellow, gray	Smooth	Raised	Obverse	5	0
						Reverse	25	1
						Side	9	0
Manufacturer (6)	SM	Round	White, yellow	Smooth	Raised	Obverse	2	0
						Reverse	13	0
						Edge	6	0
Manufacturer (7)	SM, MD	Round	Yellow, gray	Smooth	Raised	Obverse	13	0
						Reverse	10	1
						Edge	9	2
Disinfectant								
1 (8)	SM, LG	Round, rigid	White, gray	Smooth	Raised	Obverse	117	1
						Reverse	232	0
						Edge	9	0
2 (9)	MD, LG	Round	Yellow, gray	Smooth	Raised	Obverse	48	2
						Reverse	47	2
						Edge	55	1
3 (10)	SM, MD	Round	Yellow, gray	Smooth	Raised	Obverse	38	0
						Reverse	25	1
						Edge	63	2
4 (11)	SM, MD, LG	Round, rigid	White, yellow, gray	Smooth	Raised	Obverse	68	4
						Reverse	98	3
						Edge	152	0
Manufacturer (12)	SM, MD	Round	Yellow, gray	Smooth	Raised	Obverse	46	0
						Reverse	78	1
						Edge	80	2
Manufacturer (13)	SM, MD	Round	Yellow, gray	Smooth	Raised	Obverse	78	3
						Reverse	55	4
						Edge	65	5

continued ►

TABLE 1 continued

Characteristics and Testing Method Results of Casino Cheques for Bacterial Colonies and Fungi

Casino (Cheque #)	Size	Shape	Color	Margin	Elevation	Surface	# of Bacterial Colonies	# of Fungi
Control								
1 (14)	SM, MD, LG	Round, rigid	White, gray	Smooth	Raised	Obverse	13	0
						Reverse	4	1
						Edge	53	3
2 (15)	SM, MD, LG	Round, rigid	White, yellow, gray	Smooth	Raised	Obverse	15	0
						Reverse	7	2
						Edge	23	0
3 (16)	SM, MD, LG	Round, rigid	White, yellow, gray	Smooth	Raised, flat	Obverse	74	3
						Reverse	62	2
						Edge	59	5
4 (17)	SM, MD, LG	Round, rigid	White, yellow, gray	Smooth	Raised	Obverse	19	9
						Reverse	19	2
						Edge	18	0
Manufacturer (18)	SM, MD	Round	Yellow, gray	Smooth	Raised	Obverse	46	0
						Reverse	68	0
						Edge	62	0
Manufacturer (19)	SM, MD	Round	Yellow, gray	Smooth	Raised	Obverse	32	0
						Reverse	59	0
						Edge	45	0

Note. We performed bacterial morphology, isolated colonies, and fungi tests only on cheques/Petri dishes/colonies that were different. A lot of the colonies throughout the plates looked identical, so we isolated one of the colonies as a representation of the group. We isolated at least one colony out of all the colonies of the same group.

SM = small; MD = medium; LG = large.

through dishwasher that uses Ecolab Apex detergent: sodium carbonate (60–100%), sodium metasilicate (1–5%), alcohol ethoxylate (1–5%), sodium dichloro-s-triazinetriene dihydrate (1–5%), and potassium hydroxide (0.1–1%). Apex rinse was also used: oxirane, methyl-, polymer with oxirane (30–60%), urea (30–60%), and alcohols, c10-16, ethoxylated (10–30%).

The dishwasher was empty before the study began, then it was filled and allowed to reach the proper wash temperature of 150 °F. The dishwasher was activated for one cycle before the actual test began to ensure that the wash and hot water sanitizing rinse were at proper temperatures of 150 °F and 180 °F, respectively. Once the proper temperatures were verified, the previously described dish rack of 320 chips and cheques was placed into the dishwasher as previously specified and shaken a few times to spread the chips

and cheques out over the base of the rack. Then another full dishwasher cycle was run. After completion of the cycle, the rack was removed and allowed to sit for 60 s. After 60 s, researchers wearing sterilized gloves removed the cheques and placed them into a sterilized container for transport to the laboratory.

The dishwasher operates with a water pressure of 20 ± 5 psi. While the chips and cheques were spread out over the entire rack when they went into the dishwasher, they got jostled during the wash and rinse cycles and were observed to be on one side of the rack when removed from the dishwasher. Without the additional rack placed on top, the test would have resulted in items needing to be fished out of the base of the dishwasher, which would have invalidated the results.

Keeping in line with the previous study, the testing methodology was completed the same way. The microbiologists wore neoprene

gloves while handling the cheques for testing. Between the testing of each cheque, the testing area and gloves were sterilized with an alcohol solution of 70% ethanol. Each gaming cheque was then swabbed for bacteria using 6-in. sterile cotton tipped applicators that had been dipped into a sterile solution of glove elution fluid containing 1% Tween and 0.3% lecithin (Gaonkar et al., 2006). The obverse side of the cheque surface area was swabbed first, followed by the reverse side, and then the edge.

To gauge the degree to which the swabbing process might generate unique findings, the swabs were reversed halfway through to determine if swabbing order affected the results of the study. Furthermore, a different bottle of sterile elution fluid was introduced at swab number 29. Both bottles of sterile elution fluid were made at the same time and tested before and after the study was completed to determine that they were not contaminated.

TABLE 2

Summary of Testing Method Results for Bacterial Colony and Fungi Counts

Testing Method	# of Bacterial Colonies				# of Fungi			
	Total	Mean (SD)	Minimum	Maximum	Total	Mean (SD)	Minimum	Maximum
Dishwasher	292	13.90 (10.76)	2	44	17	0.81 (1.57)	0	7
Disinfectant	1,354	75.22 (51.21)	9	232	31	1.72 (1.56)	0	5
Control	678	37.67 (23.29)	4	74	27	1.50 (2.38)	0	9
All methods	2,324	40.77 (40.71)	2	232	75	1.32 (1.87)	0	9

As with the previous study, larger Petri dishes were acquired, so lines were drawn to create three equal areas. Each area was labeled with an O, R, or E to reference the obverse, reverse, or edge of the cheque. The Petri dishes were also labeled with an identifier indicating which casino it came from. Once all the Petri dishes had been swabbed, they were placed in an upside down position for optimal growth in an incubator at 37 °C for 48 hr. After 48 hr, the Petri dishes were removed from the incubator and placed in a refrigerated cooling area until the results were analyzed. This protocol for growing bacterial from contaminated surfaces is standard procedure (Bykowski & Stevenson, 2008). At the end of the study, the purchased casino cheques were returned to the respective casinos and redeemed for the cash value.

Results

Analysis of variance (ANOVA) was used to measure the bacterial growth comparisons between the control, disinfectant, and dishwasher treated cheques. The statistical program STATA version 13.1 was used to perform these tests. A probability of $p < .05$ was used for determining significant differences in bacterial growth between the control, disinfectant, and dishwasher test methods. A total of 57 samples gathered from 18 control, 18 disinfectant, and 21 dishwasher sets offers enough statistical power (for $\alpha = .05$, $SD = 0.50$, $N = 57$; power = 0.9980) to determine the statistical significance.

Microscopic examination was used to identify cellular morphology: the bacteria cultured from the control, disinfectant, and dishwasher casino cheques were morphologically similar throughout each plate. The

bacteria on the casino cheques consisted of gram-positive bacillus (rod-like) populations on all plates analyzed.

According to the World Health Organization, *Corynebacteria*, *Propionibacteria*, and *Staphylococcus epidermidis* are common gram-positive bacteria that colonize human hands. Although gram-positive bacteria colonize on hands to a greater extent than gram-negative bacteria, a greater diversity of bacteria, fungi, and viruses are key features in the human hand microbiome compared to alternative sources of bacterial populations on inanimate objects (Cosseau et al., 2016; Wenzler, Fraidenburg, Scardina, & Danziger, 2016).

Of the 57 tests completed, each test produced results that were considered usable for this study (Table 1). The number of bacteria or fungi colonies that grew in the Petri dishes were counted. For bacteria, the 57 usable results had a mean of 40.77 colonies, a standard deviation of 40.71, and a range of 2–232 colonies (Table 2), while the original study found 14.03 colonies, a standard deviation of 7.61, and a range of 1–33 colonies. Additionally, this study registered an average of 1.32 fungi colonies, a standard deviation of 1.87, and a range of 0–9 colonies (Table 2), while the original study of fungi resulted in a mean of 1.44 colonies, a standard deviation of 1.92, and a range of 0–10 colonies.

When broken down by each test section for bacteria, the control test method had a mean of 37.67, standard deviation of 23.29, and a range of 4–74, while the dishwasher test method had a mean of 13.90, standard deviation of 10.76, and a range of 2–44 colonies (Table 2). Finally, the disinfectant test method had a mean of 75.22 colonies, a standard deviation of 51.21, and a range of 9–232 colonies (Table 2).

For fungi, the control test method had a mean of 1.5 colonies, a standard deviation of 2.38, and a range of 0–9 colonies, while the dishwasher test method had a mean of 0.81 colonies, a standard deviation of 1.57, and a range from 0–7 colonies (Table 2). The disinfectant test method had a mean of 1.72 fungi colonies, a standard deviation of 1.56, and a range of 0–5 colonies (Table 2). The *E. coli* and coliform tests were not repeated for this part of the study.

The ANOVA results [$F(2,54) = 17.65$, $p < .001$] indicate a statistically significant difference among the level of bacteria found after the three tests were completed. This study's measure of explained variation shows that 39.54% of the variance in bacteria levels is explained by the differences between sanitation procedures. For the evaluation of fungi, the ANOVA results [$F(2,54) = 1.29$, $p = .2830$] indicate that the differences between the amount of fungi were not statistically significant after the three tests were performed.

Discussion and Conclusion

This study was a continuation of the previous gaming cheque sanitation study and used the same casino cheques that had been tested in that study. The results of this study conclude that using a standard aerosol disinfectant or using a dishwasher to clean contaminated casino cheques caused increased contamination as opposed to reducing the contamination. The results of this study show that future research needs to be conducted in several areas.

First, a study on proper cleaning and disinfecting of casino cheques as a public health concern needs to be conducted. Second, a study on the effectiveness of commercial dishwashers at reducing bacterial contami-

nants needs to be conducted. It might be that commercial dishwashers are not as effective as they should be, or it could be that dishwashers are not designed for casino cheques. These issues should be considered for future research as well as for product development.

As stated in the Results section, bacteria were found in statistically significant amounts even after sanitation procedures were used; however, the fungi results did not show a statistical significance. In fact, the sanitation procedures resulted in a net increase of contamination of the casino cheques from the previous study (average colonies increased from 14.03 to 40.77). An increase in statistically significant contamination is an issue, especially as this study documented that doing nothing (control) with regards to sanitation also showed a statistically significant increase in the average number of bacterial colonies (increased from 14.03 to 37.67 for all cheques). Further research should be done to better understand why and how this increase occurred. Research

into the design and makeup of the cheques (generally made of clay) would aid in determining how they harbor bacteria, allowing the bacteria to multiply.

The results of this study are surprising, as the sanitation procedures used are common ways in which sanitation is achieved in the hospitality industry. As mentioned previously, there are no set procedures for the cleaning and sanitation of casino chips and cheques; however, several casinos and cruise ships have stated that in the event of an outbreak such as norovirus, the chips and cheques are sanitized through a commercial dishwasher.

This study has several limitations. Although the chips used to simulate a full tray of cheques were sanitized along with the cheques for the study, we do not know what numbers or types of contaminants could have been on the simulation (i.e., fill-in chips). It could be possible that major contaminants could have transferred from one chip to another, which could have caused the increase

in bacterial counts. Unfortunately, research has not been located that discusses bacterial transfer between fomites; however, research is available that discusses bacterial transfer with human touch and fomites (Arora et al., 2009; Kramer et al., 2006; Rutala et al., 2006; Terpstra et al., 2007). More research would need to be conducted to determine if bacteria can transfer between fomites. 🐞

Acknowledgements: The author wishes to thank graduate students Ryan Moreno and Victor Jimenez with the Northern Arizona University Biology Department for helping run the laboratory tests on the casino cheques. Partial funding for this research was provided by the School of Hotel and Restaurant Management in the W.A. Franke College of Business at Northern Arizona University.

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Mandatory Follow-Up Radon Testing Noncompliance Among Schools, Child Care Centers, and Adult 24-Hour Care Facilities in Florida

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Florida Department of Health
Radon Program
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Abstract Radon causes approximately 21,000 lung cancer deaths every year in the U.S. Facilities that are required to test for radon in Florida include public and private schools, state-regulated child care centers, and adult 24-hour care facilities. All these facilities are required to perform an initial test with a 5-year follow-up test. This study examined noncompliance among facilities with mandatory testing, the effectiveness of outreach to noncompliant facilities, and whether certain groups are more likely to be noncompliant. To determine noncompliance, a sample of 656 facilities was selected from the state-operated database on mandatory radon testing. Outreach to noncompliant facilities was attempted to alert them of their noncompliant status and what they needed to do to become compliant. The database was consulted to determine which facilities became compliant after outreach. The results showed a 50% success rate in outreach. There were no statistically significant relationships between noncompliance and any of the groupings examined. It is recommended that the methods of outreach employed only be used as a supplement to other forms of outreach when seeking to reduce noncompliance among mandatory testing facilities in Florida.

Introduction

Radon is a colorless, odorless, tasteless gas that is formed when radium undergoes radioactive breakdown. Radium is naturally present in most of the soil in Florida. Radon gas can enter buildings through small openings in the foundation and accumulate, leading to an increased indoor concentration. The primary risk from radon comes from exposure to its decay products. The decay process leads to the formation of alpha particles that can damage the DNA of human lung cells. Long-term exposure can lead to lung cancer and higher radon concentrations are associated with

high rates of lung cancer. In the U.S., radon is the leading cause of lung cancer among non-smokers and 21,000 deaths are attributed to radon every year. In Florida, elevated levels of radon above the U.S. Environmental Protection Agency (U.S. EPA) established action level of 4 pCi/L are found in 20% of homes tested (Florida Health, 2019; U.S. Department of Commerce, 1980; U.S. EPA, 2016).

The Radon Program was created by the Florida legislature in 1988 with three primary missions: 1) to educate the public about radon and its health effects, 2) to protect the public from deceptive radon measurement and mitigation

practices by certifying radon professionals, and 3) to oversee the state mandatory radon testing program (Florida Health, 2015a). This study examines the third mission.

Specific facilities in Florida are required to test for radon. These facilities include all public and private school buildings or school sites housing K-12 students; all state-owned, operated, regulated, or licensed adult 24-hour care facilities; and all state licensed child care centers for children or minors that are located in counties designated within the Department of Business and Professional Regulation's Florida Radon Protection Map categories as "intermediate" or "elevated radon potential."

An initial test and a 5-year follow-up test are required. Additional testing is not required unless the building has a structural change, an addition, or receives approval for a new or amended license (Environmental Radiation Standards and Projects, 2019; Florida Health, 2015b, 2017). Structural changes are defined as any modification, replacement, or repair of foundation, walls, floors, ceilings, or roof assembly, or any addition to the existing building. Some counties in Florida have operating procedures where a specific individual is responsible for radon testing of public schools, which is the case in Pasco, Miami-Dade, Broward, Pinellas, and Palm Beach counties.

The Florida Radon Program keeps a database of all mandatory radon tests performed and reported to the Florida Department of Health. The radon test results examined in this study were recorded on the Department of Health's mandatory testing forms DH1777 (Nonresidential Radon Measurement Report for buildings other than single- or multi-family dwelling) and DH1778 (Residential Radon Measurement Report

TABLE 1

Overall Compliance Status of Facilities (N = 656)

Facility Status	#	%
Compliant	401	61.1
Noncompliant	192	29.3
Closed	63	9.6

for buildings built as and used as a home or apartment). Results were then sent to the Florida Radon Program where they were entered into the database.

This study sought to examine noncompliance with mandatory radon testing rules by county and facility type in Florida, as well as the efficacy of outreach to facilities that were determined to be noncompliant. It was hypothesized that there would be a significant difference in noncompliance among facility types. Additionally, it was hypothesized that there would be a significant difference in noncompliance among those counties with a specific individual designated responsible for radon testing of public schools and those counties who do not have such a designated individual.

Methods

The radon database was examined to determine 5-year follow-up test compliance among those who had previously submitted a radon test in the years 2010 or 2011. Noncompliance was determined for facilities that a) did not have a 5-year follow-up test on record, b) performed their 5-year follow-up test too early, c) made significant structural changes or additions to the building and did not retest, or d) received approval for a new or amended license.

If there was a large gap of time between the initial test and the follow-up test, for example 1995–2010, then the property appraiser's website specific for that county was consulted to determine if structural changes had been permitted that would necessitate a new test to be performed. If it was established that such structural changes had been made, noncompliance was determined.

Facilities determined to be noncompliant and still in operation were contacted by phone and by mail to notify them of their

TABLE 2

Submission of Follow-Up Mandatory Test Reports Among Noncompliant Facilities (n = 192)

Submitted Report	#	%
Yes	96	50.0
No	96	50.0

possible noncompliance with Florida Statute 404.056. Contact information was obtained from the corresponding mandatory testing record. When there was a county-specific individual responsible for radon testing in public schools, that person was contacted rather than or in addition to the facility.

Initial attempts to contact noncompliant facilities were made by phone using the contact number(s) provided on the mandatory testing report from their initial radon test and/or the facility's website. If no response was received within 2 weeks, a letter stating that the Florida Department of Health was unable to determine the facility's compliance with the statute was sent to the address given on the application and/or business website. Noncompliant facilities were given a minimum of 30 days from the date the letter was sent to have a new radon test performed and send their mandatory testing report to the Radon Program. Reports were received by mail, fax, and e-mail. Both paper records and database entries were assessed to determine if reports had been received for noncompliant facilities.

The following data points were gathered:

- Total number of facilities assessed.
- Number of facilities that were no longer operating or licensed.
- Number of noncompliant facilities.
- Number of compliant facilities.
- Number of noncompliant facilities to which contact was attempted and they did not send in their follow-up mandatory test report.
- Number of noncompliant facilities to which contact was attempted and they did send in their follow-up mandatory test report.
- County for each facility assessed.
- Type of facility assessed.

In addition to the above data points, this study intended to examine noncompliance among rural counties that are considered eco-

nomic distressed. A rural county is defined as a county with a population of $\leq 75,000$ or a population of $\leq 125,000$ that is contiguous to a county with a population of $\leq 75,000$ (Rural Economic Development Initiative, 2019). An economically distressed rural county will, in addition to those factors described above, exhibit three or more economic distress factors. Economic distress factors include low per capita income, low per capita taxable values, high unemployment, high underemployment, low weekly earned wages, low housing values, high percentages of the population receiving public assistance, and high poverty levels.

Noncompliance was examined using SPSS statistical software. The categories for the compliance variable were transformed into noncompliance and compliance with closed facilities being coded as missing. Those facilities that were compliant and those that submitted reports were coded as compliant. Facilities that did not submit reports were coded as noncompliant.

The variable for facility type was transformed into a new variable with the following four categories: child care center, private school, public school, and adult 24-hour care. Child care center included the facility type: day care, foster care, or family day care. Adult 24-hour care included the facility type: assisted living facility, nursing facility, or adult family care home. Other facility types were not specifically examined because of small sample sizes. The new variable was further transformed with each category becoming a dichotomous variable with categories being "belonging to that facility type" and "not belonging to that facility type." Closed facilities were coded as missing.

The variable for counties was transformed into counties that have a specific individual responsible for radon testing in public schools or those that do not. Counties for which the sample size was zero were coded as missing. County-designated individuals are responsible for radon testing only within public schools; therefore, facility types that were not public schools were not included within the county variable. Closed facilities were coded as missing.

A binomial logistic regression was performed to determine significance among the facility type variables and noncompliance. A binomial logistic regression was chosen because it was desirable to understand if

TABLE 3

Compliance by Facility Type

Facility Type	#	Compliant		Noncompliant: Submitted Report		Noncompliant: Did Not Submit Report		Closed	
		#	%	#	%	#	%	#	%
Child care center	97	49	50.5	21	21.6	14	14.4	13	13.4
Public school	209	177	84.7	15	7.2	15	7.2	2	1.0
Private school	244	129	52.8	44	18.0	41	16.8	30	12.3
Adult 24-hour care	84	30	34.5	13	15.5	23	27.4	18	22.6
Hospital	8	4	50.0	1	12.5	3	37.5	0	0
Alcohol, drug, and mental health	11	10	90.9	1	9.1	0	0	0	0
Detention center	3	2	66.7	1	33.3	0	0	0	0
Total	656	401		96		96		63	

noncompliance could be predicted based on facility type. In this way, certain facility types could be targeted for outreach. Such information could be useful when outreach resources are limited. A chi-square test was performed to determine significance among noncompliance and counties with a designated individual for public schools. This test was chosen because it sought to examine the relationship between two categorical variables. If a relationship was found, then additional statistical tests would have been performed to determine the nature of the relationship. A $p < .05$ was considered statistically significant.

Results

Of the 656 facilities assessed, 401 were compliant, 192 were noncompliant, and 63 were found to be closed (Table 1). Noncompliant facility values and percentages are shown in Table 2. Values and percentages for the facility and county variables are shown in Tables 3 and 4, respectively. There were several counties with the mandatory testing requirement that had zero facilities sampled. Upon examination of the data, it was found that the sample size for noncompliant economically distressed rural counties was too small to make any meaningful conclusion about their noncompliance.

For the facility type variables, a Hosmer-Lemeshow goodness of fit test was performed and the p -value ($p = .814$) indicated a good fit model (the observed event matches the

expected event rates). The results of the binomial logistic regression are shown in Table 5. The regression weights indicate that those facilities classified as child care center have a greater likelihood of being noncompliant ($B = 0.24$), but the relationship was not statistically significant ($p = .73$). Those facilities classified as public school were shown to have a lower likelihood of being noncompliant ($B = -0.70$), but the relationship was not statistically significant ($p = .30$). Those facilities classified as private school were shown to have a greater likelihood of being noncompliant ($B = 0.41$), but the relationship was not statistically significant ($p = .53$). Those facilities classified as adult 24-hour care were shown to have a greater likelihood of being noncompliant ($B = 1.22$), but this relationship was not statistically significant ($p = .07$). The predictor variables do not appear to have a significant impact on the odds of facilities being noncompliant. The null hypothesis regarding facility types was not rejected, indicating that there is no apparent difference in noncompliance among facility types.

For the designated individual variable, the p -value indicated that there was no statistically significant relationship between noncompliance and counties with a designated individual for public schools [$\chi^2 (1, N = 207) = 1.374, p = .241$]. The null hypothesis regarding county designated individuals for public schools was not rejected, indicating that there is no apparent difference in noncom-

pliance among those counties with a specific individual designated responsible for radon testing of public schools and those counties who do not have a designated individual.

Discussion

Examination of the overall compliance among facilities with the mandatory testing requirement revealed that less than one third of the facilities examined were noncompliant. This finding shows that most of the facilities are following the mandatory testing requirement.

All the facility types examined in this study did not show a statistically significant relationship to noncompliance. As such, it is not recommended to implement an outreach approach that targets specific types of facilities. Implementing a process to routinely reach out to facilities prior to and immediately following the 5-year follow-up test date might be more effective, but further research is needed.

Counties with a designated individual responsible for testing of certain facilities did not exhibit a statistically significant relationship to noncompliance. It should be noted that all the counties with a designated individual have population densities >250 persons per square mile (Rayer & Wang, 2018), which places these counties among the most densely populated areas within Florida. It might be necessary for these counties to have a designated individual due to the increased number of public schools rather than as a measure to ensure greater compliance. Based on the results found

TABLE 4

Facility Compliance Among Counties With Mandatory Testing Requirements

County	#	Compliant		Noncompliant: Submitted Report		Noncompliant: Did Not Submit Report		Closed	
		#	%	#	%	#	%	#	%
Alachua	6	4	66.7	1	16.7	0	0	1	16.7
Brevard	40	24	60.0	1	2.5	8	20.0	7	17.5
Broward	54	32	59.3	5	9.3	13	24.1	4	7.4
Charlotte	5	3	60.0	2	40.0	0	0	0	0
Citrus	2	1	50.0	1	50.0	0	0	0	0
Columbia	1	1	100	0	0	0	0	0	0
De Soto	1	1	100	0	0	0	0	0	0
Duval	44	24	54.5	4	9.1	9	20.5	7	15.9
Gadsden	1	0	0	0	0	0	0	1	100
Hernando	7	4	57.1	2	28.6	1	14.3	0	0
Highlands	2	2	100	0	0	0	0	0	0
Hillsborough	37	24	64.9	5	13.5	4	10.8	4	10.8
Holmes	1	1	100	0	0	0	0	0	0
Indian River	6	5	83.3	0	0	1	16.7	0	0
Leon	6	3	50.0	1	16.7	2	33.3	0	0
Manatee	7	1	14.3	2	28.6	2	28.6	2	28.6
Marion	8	2	25.0	2	25.0	1	12.5	3	37.5
Martin	1	0	0	1	100	0	0	0	0
Miami-Dade	95	50	52.6	24	25.3	12	12.6	9	9.5
Okaloosa	2	1	50.0	0	0	1	50.0	0	0
Osceola	7	4	57.1	0	0	2	28.6	1	14.3
Palm Beach	143	103	72.0	20	14.0	8	5.6	12	8.4
Pasco	16	6	37.5	6	37.5	3	18.8	1	6.3
Pinellas	59	40	67.8	6	10.2	11	18.6	2	3.4
Polk	9	4	44.4	2	22.2	3	33.3	0	0
Putnam	1	0	0	0	0	0	0	1	100
St. Johns	3	1	33.3	0	0	1	33.3	1	33.3
St. Lucie	4	2	50.0	1	25.0	1	25.0	0	0
Sarasota	22	15	68.2	2	9.1	4	18.2	1	4.5
Seminole	35	27	77.1	2	5.7	5	14.3	1	2.9
Sumter	11	9	81.8	1	9.1	0	0	1	9.1
Taylor	1	0	0	1	100	0	0	0	0
Volusia	16	5	31.3	4	25.0	3	18.8	4	25.0
Walton	3	2	66.7	0	0	1	33.3	0	0
Total	656	401		96		96		63	

Note. The following counties had no sampled facilities: Calhoun, Dixie, Gilchrist, Gulf, Hamilton, Hardee, Jackson, Jefferson, Levy, Liberty, Madison, Nassau, Suwannee, and Union.

in this study, it is not recommended for every county to have a designated individual, as not having one could not be shown to have a significant association with noncompliance.

The success rate of the forms of outreach used in this study, as measured in the number of noncompliant facilities that sent in their mandatory testing reports, was exactly 50%. Based on this finding, it is recommended that the forms of outreach used in this study be used only as a supplement to other forms of outreach.

The reason for the small sample size of non-compliant facilities in economically distressed rural counties can be attributed to the fact that there are many economically distressed rural counties which lack a mandatory radon testing requirement for the facility types examined in this study. These counties lack this requirement because they have not been designated by the Department of Business and Professional Regulation's Florida Radon Protection Map categories as having "intermediate" or "elevated radon potential." Additionally, population size within these counties tends to be relatively small and therefore they have fewer facilities that must abide by the mandatory radon testing requirement (Office of Economic and Demographic Research, 2019).

There are a few limitations in this study that should be considered. Some of the facility types and the facility statuses might not have been appropriately classified. Facility type data were based on how the facilities listed themselves on their testing reports. Facility status was based on the reports and information gathered about facilities from their licensing agency, website(s), and listed contact person(s). Information received from the Florida Department of Education after the study had been completed revealed that several facilities had misclassified their facility type and/or not maintained their registration with

TABLE 5
Results of Regression Analysis

Facility Type	B	SE	df	p-Value	Exp(B)	95% CI for Exp(B)
Child care center	0.24	0.69	1	.73	1.27	0.33, 4.87
Public school	-0.70	0.68	1	.30	0.50	0.13, 1.86
Private school	0.41	0.65	1	.53	1.50	0.42, 5.32
Adult 24-hour care	1.22	0.67	1	.07	3.39	0.91, 12.67

CI = confidence interval; *df* = degrees of freedom; *SE* = standard error.

the Florida Department of Education. Those facilities that had not maintained their registration should have been classified as closed. Additionally, during the status assessment process, only the statuses of noncompliant facilities were assessed. This assessment could have skewed the results, as several of the compliant facilities might have been closed.

Future studies involving the mandatory reporting of radon testing within Florida should include an assessment of the effectiveness of outreach to facilities near their follow-up test date and an evaluation of compliance among schools that do and do not participate in state scholarship programs.

Conclusion

After examining compliance status among 656 facilities with the mandatory testing requirement, the statistical analysis concluded that there is no statistically significant difference among facility types or among those counties with a specific individual designated responsible for radon testing of public schools and those counties that do not have a designated individual. The null hypothesis was not rejected for either hypothesis. There-

fore, it is not recommended to implement outreach approaches that target facilities based on their facility type or county.

It is recommended that the forms of outreach used in this study be implemented as a supplement to other forms of outreach. A 50% improvement in compliance is good, but 50% of facilities remain noncompliant, and that must be addressed. 🐼

Acknowledgements: This work would not have been possible without the financial support of the U.S. EPA state indoor radon grant. I thank my colleagues who provided insight and expertise that greatly assisted this research: Joseph Kidder, environmental specialist III; Jorge Laguna, MS, environmental manager; Ferda Yilmaz, MS, environmental administrator, Radon and Indoor Air Program; and Elke Ursin, PMP, CPM, public health toxicology lead, Florida Department of Health.

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Did You Know?

NEHA has posted two COVID-19 food safety resources: COVID-19 FAQs for Food Establishments and COVID-19 FAQs for Food Safety Regulators. NEHA is committed to supporting the environmental health workforce to effectively and safely do their jobs, as well as have access to critical information and updates. As new information comes to light, updates to these FAQs will be posted on NEHA's COVID-19 resources page at www.neha.org/covid-19.



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Task, Role, and Fire Engine Noise Levels During a Live Fire Training

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Abstract Previous research has revealed that firefighters have an increased risk for noise-induced hearing loss; however, firefighters do not reach an 8-hr time-weighted average (TWA) of ≥ 85 dB. The high variability in occupational tasks and intermittent noise exposure of firefighters offers an explanation for the low 8-hr TWA. Our study evaluated specific occupational tasks, firefighting positions, and fire engine noise during a live fire training exercise. Researchers then identified the tasks and firefighting positions that presented the greatest risk to firefighters' hearing health. Firefighting positions were statistically significantly different ($p = .04$) in terms of decibel levels; we determined that the firefighter in the position of water pump operator experienced the greatest decibel level (91 dBA). Noise exposure while traveling in a response vehicle varied by the type of vehicle ($p = .009$), with the newest vehicle having the smallest noise level (81 dBA). Analysis of the data revealed that the occupational tasks with the highest noise levels were cleanup at the scene and cleanup at the fire station (88 dBA each).

Introduction

Occupational noise exposure is one of the leading causes of noise-induced hearing loss (NIHL) (Agrawal, Platz, & Niparko, 2008). The regulations protecting the hearing of workers, however, are not always effective. Police officers, firefighters, and construction/trade workers are all occupations for which the Occupational Safety and Health Administration (OSHA) does not have sufficient guidelines for hearing-loss prevention (Martínez, 2012; Occupational Noise Exposure, 2008). Many individuals in these professions have documented NIHL but low 8-hr time-weighted averages (TWAs) (Chung, Chu, &

Cullen, 2012; Lesage, Jovenin, Deschamps, & Vincent, 2009; Seixas et al., 2005; Tubbs, 1991). Complexities within these professions limit the usefulness of hearing conservation rules that are delineated in the manufacturing industry. For example, in public safety professions, noise is often unpredictable, transient, and varies acoustically from one instance to the next. Sirens, vehicle noises, radio communications, and equipment noises are all encountered to varying degrees when public safety professionals are on duty.

Public safety professionals function in unpredictable soundscapes and communica-

tion is important for safety; thus, it is necessary to address their hearing health needs in order to maintain employability, prevent injuries, and reduce worker compensation claims. As an example, roughly 4% of retirements caused by illness among firefighters in the UK were a result of audiological problems (Ide, 2007). In the U.S., there are more than 1 million firefighters (Evarts & Stein, 2020). Given the published incidence of ill-health retirements, at least 40,000 firefighters in the U.S. retire due to hearing-related injuries. Many of these firefighters experience hearing loss early in their career, leading to hearing health issues over their lifetime (Ide, 2011). In 2010, there were >18,600 reported cases of workplace hearing loss in the U.S. (Martínez, 2012). Reports published by the Wisconsin Department of Workforce Development (2016) show the average claim amount for loss of hearing in Wisconsin was >\$14,000.

Hearing loss not only impacts communication and employee job function but also increases an individual's risk for other health conditions. Data suggest that hearing loss can increase the risk of depression and dementia (Li et al., 2014; Lin et al., 2011). Some data support that hearing loss can lead to hypertension; hypertension is a risk factor for cardiovascular disease (Chang et al., 2011). The health and safety effects of hearing loss are significant. As such, it is important to overcome the unique occupational environment challenges related to noise reduction that firefighters face.

Some of the complications of noise reduction for public safety professionals are equipment limitations and procedure modifications. Firefighters pose one of the

greatest challenges for hearing conservation programs because the high temperatures, moisture, and smoke can affect measurement equipment and hearing protection. In addition, firefighters have limited ability to use hearing protection during live fire activities due to the importance of monitoring environmental sounds and communicating clearly for safety. Adding to these obstacles are the negative beliefs firefighters have toward hearing protection use. Many firefighters have reported understanding the importance of hearing for their occupational success, yet many also admit an aversion to available hearing protection solutions (Hong, Samo, Hulea, & Eakin, 2008).

The first step in addressing these complex work environments and their impact on hearing health is to collect noise exposure measurements while firefighters complete occupational tasks. Researchers have started to categorize the noise levels created by various types of occupational tasks among firefighters (National Institute for Occupational Safety and Health, 2013; Neitzel, Hong, Quinlan, & Hulea, 2013; Root et al., 2013; Tubbs, 1990, 1994). The most prevalent source of noise information collected for professional firefighters is their use of equipment specifically during rescue events, not fire events. This study aims to expand upon the data currently available by further investigating individual variations in noise exposure based on specific occupational tasks, positions or job titles, and use of fire engines during a live fire training.

Methods

Three volunteer firefighters wore a noise dosimeter during a live fire training exercise. The firefighters were paid on-call personnel from a fire department in southern Wisconsin. At the time of the training, 42 firefighters were associated with the fire department, but not all firefighters were present at the training. Three different vehicles were used in the training: one standard engine, one ladder engine, and one water truck with a 3,500-gallon capacity.

The training included a driving portion and a fire portion. The fire portion used a burn building, which is a building specific for fire training that will not catch fire or collapse during an exercise. Instructors bring flammable items into the building to

create a fire that can be extinguished and then re-lit multiple times during the training exercise. The training occurred over 2 nights and lasted approximately one hour the first night and four hours the second night. The first night of training only had a driving portion that began at the fire station; the firefighters rode in or drove the engines and support trucks to the facility where the burn building was located and then back to the fire station in order to practice driving the different vehicles. The second night of training also began at the fire station. The firefighters drove the vehicles to the training facility where the burn building was located. The fire training portion then took place at the burn building, after which the firefighters drove the vehicles back to the fire station. During training, the instructors had the firefighters attack the fire three times using multiple approaches and gave them feedback after each attack.

Noise Dosimetry

Researchers conducted personal noise dosimetry monitoring using noise dosimeters (EDGE eg5 and NoisePro DLX). The dosimeters simultaneously measured noise in three virtual dosimeters so that comparisons could be made to three industry standards. The measurement settings for all three virtual dosimeters included A-weighting, slow-response, and a 1-min logging interval. The first and second virtual dosimeters were based on OSHA criteria.

Researchers programmed the first virtual dosimeter (OSHA-HC) to meet OSHA hearing conservation requirements: a noise threshold of 80 dBA, criterion level of 85 dBA, and 5-dB exchange rate. Researchers programmed the second virtual dosimeter (OSHA-PEL) to meet the permissible exposure limit: a noise threshold of 90 dBA, criterion level of 90 dBA, and a 5-dB exchange rate. Researchers programmed the third virtual dosimeter (ACGIH) based on criteria from the American Conference of Governmental Industrial Hygienists (ACGIH): a noise threshold of 80 dBA, criterion level of 85 dBA, and a 3-dB exchange rate (Berger, Royster, Royster, Driscoll, & Layne, 2003).

The EDGE noise dosimeters and the NoisePro DLX microphone were attached to the firefighter's side to match the dominant hand. All dosimeters were calibrated before

and after monitoring using a sound calibrator (QC-10). Once researchers conducted the monitoring, they calibrated the dosimeters again and downloaded the noise exposure data as 1-min noise levels into a spreadsheet that linked the task information to the 1-min noise levels.

To prevent damage to the dosimeters from heat and water, the dosimeters were worn only by individuals who were in positions that did not enter the burn building. Each of the firefighters who wore the noise dosimeters had different overall shift responsibilities or positions during the live fire training. One firefighter (operations) was the scene operation manager and controlled the operations near the active fire scene. A second firefighter (water pump operator) was responsible for operating the water pump and hoses. The third firefighter (command) was responsible for relaying and responding to communication from the other fire squad members on scene.

During both nights, a member of the study team recorded the firefighters' occupational activities and the times the activities occurred in order to link the task with specific noise levels recorded during the corresponding time on the dosimeter. Tasks logged included travel (to and from the burn building, and by which vehicle), paperwork (firefighters signed releases before they were allowed to use the fire training facilities), setup on scene (removing equipment from trucks and placing it around the burn building), active training scenarios (by position), ambulance response, instructor feedback, cleanup on scene (putting equipment into trucks), and cleanup at fire station (cleaning hoses and filling air tanks). One firefighter being monitored left before training was completed so only two measurements of cleanup at the fire station were analyzed.

Analysis

Using the 1-min noise levels from the dosimeter data and correlating those levels with the logs, the study team determined the noise exposure for all tasks recorded on the firefighters' log forms and calculated descriptive statistics for all three virtual dosimeters (Berger et al., 2003). The ACGIH virtual dosimeter data determined if all task category noise levels were equivalent in a one-way analysis of variance (ANOVA). Because of post hoc interest in the tasks of travel and

active training scenarios, the study team calculated a one-way ANOVA with a Bonferroni multiple comparison test on each task category. The team calculated one ANOVA with a Bonferroni multiple comparison test to determine if noise exposure while traveling in the different vehicles was equivalent and to identify which vehicles were statistically different. The team calculated another ANOVA with a Bonferroni multiple comparison test to determine if all of the active training scenario positions (operations during fire, water pump operator during fire, command during fire) were equivalent and to identify which positions were statistically different. The confidence level in the statistical significance for all tests was 95%. The analysis was performed using SAS version 9.3.

Results

Table 1 shows the descriptive statistic results for each of the three virtual dosimeters. During an actual fire event, each firefighter would be assigned a specific position and thus would not likely complete all the tasks. The tasks with the greatest noise levels were cleanup at the scene and cleanup at the fire station. The times for each task varied and likely are not equal to the time for each task in an actual fire event. The one-way ANOVA of the mean ACGIH levels did not find the noise levels of the eight tasks to be significantly different ($p = .10$).

Table 2 shows the results of noise levels for travel by vehicle. There were significant differences between the noise levels of the three fire engines during the travel to and from the fire station to the live fire training site ($p = .009$). A Bonferroni multiple comparison test found that the ladder engine and the standard engine were significantly different. The noise level for travel in the ladder engine was 81 dBA, while the noise level for travel in the standard engine was significantly greater at 89 dBA.

Table 3 shows the results of noise levels for active training scenarios by position. There were significant differences between the ACGIH noise levels of the positions ($p = .04$). A Bonferroni multiple comparison test found that the positions of command and water pump operator were significantly different. Furthermore, the position of operations had the largest standard deviation (4.5 dBA) of the positions measured.

TABLE 1

Task Results

Task	# of Measurements	Mean ACGIH Criteria (SD)	Mean Task Time (SD)
Travel	11	83 (4.2)	22 (4.7)
Paperwork	6	79 (3.1)	27 (1.6)
Setup on scene	6	85 (4.9)	18 (6.6)
Active training scenarios	8	84 (4.8)	21 (8.7)
Ambulance response	3	84 (6.2)	22 (7.7)
Instructor feedback	6	82 (5.9)	9 (1.1)
Cleanup at scene	3	88 (3.6)	4 (0)
Cleanup at fire station	2	88 (4.2)	26 (0)

ACGIH = American Conference of Governmental Industrial Hygienists.
 Note. Mean ACGIH criteria is in dBA. Mean task time is in minutes.

TABLE 2

Noise Levels for Travel by Vehicle

Vehicle	# of Measurements	Mean ACGIH Criteria (SD)	Bonferroni Results*
Ladder engine	7	81 (3.0)	A
Water truck	2	87 (0.7)	AB
Standard engine	2	89 (0.7)	B

ACGIH = American Conference of Governmental Industrial Hygienists.
 Note. Mean ACGIH criteria is in dBA.
 *Results with the same letter are not statistically different.

Discussion

Implementing a noise reduction strategy is required if the OSHA-PEL results have an 8-hr TWA >90 dBA. Additionally, a hearing conservation program is required if the OSHA-HC results have an 8-hr time-weighted average above 85 dBA (Occupational Noise Exposure, 2008). Firefighters have a highly variable job in which day-to-day noise exposure depends on the amount and type of calls they receive. Using only legal compliance to address firefighter noise exposure is insufficient. Instead of focusing on the legal requirements of firefighters' noise exposure, it might be more beneficial to break down the exposure in terms of position, tasks, and equipment operated.

Our study revealed statistically different noise exposure based on firefighter position. For example, the OSHA-HC results for the position of water pump operator were greater than both the OSHA-HC requirement of 85 dBA and the ACGIH recommendation of 85 dBA (Berger et al., 2003). Root and coauthors (2013) reported OSHA-PEL values of 81 dBA for the position of water pump operator and 78 dBA for the position of scene operations. In our study, the position of operations was lower, with a level of 68 dBA. Therefore, one method for preventing NIHL among firefighters could be to rotate their positions or responsibilities for each live fire event. If operating the water pump creates the highest noise levels, then reducing the time of expo-

TABLE 3

Noise Levels for Active Training Scenario by Position

Position	# of Measurements	Mean OSHA-HC (SD)	Mean OSHA-PEL (SD)	Comparable OSHA-PEL*	Mean ACGIH Criteria (SD)	ACGIH Bonferroni Results**
Command	3	77 (1.1)	63 (2.8)	–	81 (0.6)	A
Operations	3	81 (5.3)	68 (13.4)	78	84 (4.5)	AB
Water pump operator	2	89 (0.8)	84 (2.9)	81	91 (0.7)	B

ACGIH = American Conference of Governmental Industrial Hygienists; HC = hearing conservation; OSHA = Occupational Safety and Health Administration; PEL = permissible exposure limit.

Note. Mean OSHA-HC, mean and comparable OSHA-PEL, and mean ACGIH criteria are in dBA.

*Comparable levels are from Root et al. (2013).

**Results with the same letter are not statistically different.

sure would benefit hearing health. Training multiple firefighters to operate the pump and then rotating the responsibility during each fire call would prevent a single firefighter from routine high noise exposure and reduce the risk of occupation-related hearing loss.

By focusing on frequently occurring tasks in controlled environments, hearing conservation interventions can be effectively applied. Cleanup at the fire station measured one of the longest durations among firefighter tasks and one of the highest mean noise levels. Although the noise exposure while cleaning up at the fire station was one of the greatest exposures to firefighters, there is ample opportunity to reduce the noise level. For instance, while cleaning up at the fire station, firefighters used compressed air located in the middle of the garage area to refill the air tanks. Isolating the compressed air and providing readily accessible hearing protection would reduce the noise exposure of both the compressor operator and the other firefighters conducting additional cleanup tasks in the fire station.

Our study data revealed not only noise level variation based on position and task but also noise variation based on the type of fire engine. Previous research reported a noise level of 75 dBA when a fire engine was in route—when the siren was used, the noise increased by 9 dBA to a noise level 84 dBA. The type of fire engine, however, was not specified (Root et al., 2013).

The three vehicles measured in our study had statistically significantly different mean ACGIH decibel levels, ranging from 81–89

dBA. The vehicle that produced the lowest noise level was the ladder truck, which was also the newest vehicle. Understanding the features of fire engines that contribute to noise output might be helpful when fire departments purchase new fire engines or refurbish old fire engines. Investing in equipment that has been designed to operate with a lower noise output has the potential to preserve hearing health, extend years of active service, and reduce the number of workplace injuries for firefighters.

Limitations

There were limitations to this study. Only three volunteer firefighters wore noise dosimeters during the live fire training exercise. This sample size was small because dosimeters were worn only by individuals with positions that did not enter the burn building. This approach was taken to prevent heat and water damage to the dosimeters, as current noise dosimeters are not heat or water resistant.

Another limitation of this study was that it was limited to tasks related to live fire. In addition to these tasks, volunteer firefighters also spend significant amounts of time responding to requests to rescue individuals. Rescue tasks involve the use of additional equipment, such as saws, that might cause significant noise exposures. Additional research is needed to measure noise levels during rescue activities.

Conclusion

One focus of environmental health is to prevent human injury and illness by identifying

environmental sources that can cause harm (National Environmental Health Association, 2013). There is a focus on preventing injury and illness to professional firefighters because of the occupational risks they face. Many volunteer firefighters, however, face similar risks and it is important for local governmental agencies to be aware of the hazards associated with volunteer firefighters' service.

Lowering the noise exposure of volunteer firefighters cannot be accomplished by simply providing conventional hearing protection, as has been done in other industries. By focusing on the positions, tasks, and equipment with the highest noise exposures and evaluating the physical limitations of those tasks, large noise exposures can be addressed. The occupational activity that posed the greatest risk to firefighters' hearing health was the operation of the water pump on the engine. The firefighter who ran the pump on the engine would need to be enrolled in a hearing conservation program if the noise exposure lasted a full 8 hr. Due to the significant differences in noise levels generated by different fire engine vehicles, further investigation into the acoustic properties of the passenger space of fire engines is needed. 🚒

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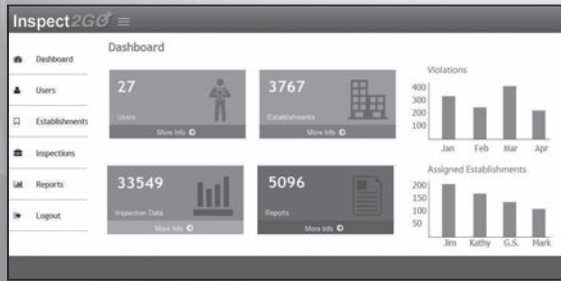
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The Centers for Disease Control and Prevention has posted guidance on its COVID-19 website on how to disinfect a facility if someone is sick. Guidance is provided on what to do when cleaning and how to clean and disinfect different surfaces. It also provides guidance to managers regarding worker education and safety. Find the guidance at www.cdc.gov/coronavirus/2019-ncov/prepare/disinfecting-building-facility.html.

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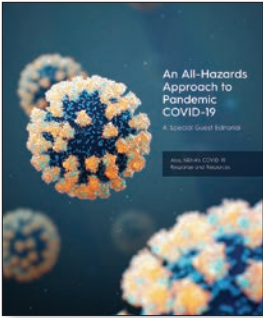
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▶ GUEST EDITORIAL



An All-Hazards Approach to Pandemic COVID-19: Clarifying Pathogen Transmission Pathways Toward the Public Health Response

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Editor's Note: The vision for this guest editorial came about in late February 2020 before the World Health Organization declared coronavirus disease 2019 (COVID-19) a pandemic. While the *Journal* strives to provide its readership with relevant and up-to-date information, the timeliness of the information printed can be hindered by review and production timelines. As such, the *Journal* felt it was vital to provide information about COVID-19 in the May issue by publishing the following article as a guest editorial. It is important to note that as an editorial, this article was not peer reviewed. Furthermore, the information and conclusions presented are those of the authors and do not necessarily represent the views or official position of the National Environmental Health Association (NEHA) or of the authors' affiliations. NEHA and the *Journal* are not liable or responsible for the accuracy of or actions taken on the basis of any information stated herein. The information presented in the article was current as of March 18, 2020. Information regarding COVID-19 case numbers and actions taken by governments will undoubtedly be outdated at the time of publication; however, that does not lessen the value of the information and conclusions provided in this guest editorial.

Summary

Coronavirus disease 2019 (COVID-19) is caused by SARS-CoV-2 (Centers for Disease Control and Prevention [CDC], 2020a). The World Health Organization (WHO) declared COVID-19 as a pandemic on March 11, 2020, the first caused by a coronavirus (WHO, 2020a). Severe acute respiratory

syndrome (SARS) in 2003–2004 was the last unproclaimed pandemic with such terrifying potential. It was a harbinger of forthcoming emerging and reemerging infectious disease, severe enough to initiate the revision of the International Health Regulations (WHO, 2008), including the powerful Public Health Emergency of International Concern that

was declared for COVID-19. This virtually unknown pathogen has no associated vaccine and people have no immunity to it.

The world's vulnerable populations could face long-term clinical sequelae that might later develop. For example, evidence of liver damage has been observed through COVID-19 research processes and in over 50% of SARS patients (Gu, Han, & Wang, in press).

In this guest editorial, we clarified known transmission pathways of SARS-CoV-2 and epidemiological commonality from a literature review, and organized descriptors into three categories (zoonotic, person-to-person, and environmental) with discussion of infection dynamics. Our nomenclature system unifies veterinary, environmental public health, and medical terminology by following a One Health concept with a simplified categorization of transmission pathways to enable effective prevention strategies in a straightforward public health message based upon an all-hazards theory that focuses on risk and severity. We analyzed prevention, facilitate behavior modification, and shorten incident mitigation in the absence of full human, animal, and environmental transmission dynamics of COVID-19.

Part 1: The Public Health Response to SARS-CoV-2/COVID-19

On December 31, 2019, WHO was informed of a cluster of COVID-19 cases in Wuhan, China

(WHO, 2020b). The initial human cases of this disease were linked with the Huanan Seafood Wholesale Market where a novel zoonotic coronavirus transmitted from wild animals to humans (CDC, 2020a; Kaplan, 2020).

Concepts of global health security and national health security in the U.S., as described by the WHO 2005 International Health Regulations and the Office of the Assistant Secretary for Preparedness and Response (ASPR) 2019–2022 National Health Security Strategy, is protected by powerful enforcement tools that enable the control of infectious disease threats (ASPR, 2019a; WHO, 2008). On January 30, 2020, WHO proclaimed that COVID-19 constituted a Public Health Emergency of International Concern (WHO, 2020c). The following day, the U.S. Department of Health and Human Services (HHS) ASPR declared a public health emergency in the country (ASPR, 2020b). The U.S. president also declared a nationwide emergency by implementing the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Federal Emergency Management Agency, 2020).

The WHO's Public Health Emergency of International Concern is designed to recognize and control public health risks from crossing national borders while enabling a coordinated international response (WHO, 2020c). The U.S. public health emergency declaration enables coordination of the Centers for Disease Control and Prevention (CDC), Federal Emergency Management Agency (FEMA), HHS, and other federal partners toward a unified and integrated approach to pandemics, natural disasters, or chemical or radiological threats (CDC, 2018).

Specialists in environmental health are specifically designated to assist in the assessment of risk among a coordinated partnership between state, local, tribal, and territorial governmental jurisdictions. From global to local public health, and in particular the practice of environmental health, plurality of government in the U.S. represents the intention of the constitutional framework and presents challenges to uniformity of service (Gable, 2012). By March 16, 2020, all 50 U.S. states independently declared public health emergencies.

Global Situation

The Chinese government locked down the original hot spot of COVID-19 (Wuhan

City) to contain the outbreak on January 23, 2020 (Du et al., 2020). In the ocean nearby, on February 1, 2020, an international cruise ship traveling with 3,711 passengers and crew found that an already-disembarked passenger tested positive for COVID-19 in Hong Kong (Princess Cruise Lines, 2020). The cruise ship, operated by the world's largest leisure travel company, Carnival Corporation, arrived at Yokohama, Japan, and isolated passengers who tested positive with COVID-19 in Japanese hospitals and quarantined the rest on the ship on February 3, 2020. The Disaster Infection Control Team under the Japanese Society for Infection Prevention and Control intervened to manage/mitigate infection on the ship until all disembarked on March 1, 2020 (Japan Ministry of Health, Labour, and Welfare, 2020a). By March 8, 2020, 696 former passengers and crew tested positive, 357 were discharged, and 7 died (Japan Ministry of Health, Labour, and Welfare, 2020b). Experiencing surging numbers of suspected cases, South Korea conducted drive-thru virus tests that were capable of completion in 10 min (Yonhap, 2020). With an approximate population of 52 million, South Korea counted 7,869 COVID-19 cases with 66 deaths on March 12, 2020 (Yonhap, 2020).

U.S. Situation

Human cases of COVID-19 erupted onboard a series of cruise ships that caused the initiation of an unprecedented U.S. repatriation response, the first of which involved careful coordination between HHS/ASPR, CDC, and the U.S. Department of State. Infected American citizens were extracted from the Diamond Princess, transported in buses to U.S. aircraft in Japan, and flown to U.S. Air Force bases to be medically assessed, quarantined, and processed for their return home (U.S. Department of State, 2020). As the repatriated, infected American citizens were sequestered in quarantine, the first cases of community-acquired COVID-19 were recorded in the U.S. (EveryCRSReport.com, 2020).

When asked if the U.S. had already moved from containment to mitigation phases of outbreak response, CDC director Dr. Robert Redfield stated that we are in “a blended containment/mitigation phase” as human cases increased across the U.S. (C-SPAN, 2020). Meanwhile, states and cities individually

declared states of emergency, adopting policies and procedure uncoordinated with other states (Government of the District of Columbia, 2020).

Part 2: Pathogen Transmission Pathways and an All-Hazards Approach

Increasing cases demonstrate that the experts have neither fully assessed the virus risk yet, nor is there consensus on the methods to prevent its spread. WHO guidelines have no clear definition of a pandemic and its pandemic alert seven-phase descriptions are influenza specific (WHO, 2009). Current biosurveillance is inadequate—creating vulnerabilities to future epidemics by novel pathogens—and public health messaging about zoonotic disease reservoirs and modes of transmission is lacking (Eddy, Sase, & Schuster, 2010; Eddy, Stull, & Balster, 2013).

An Equivocal Source of a Pandemic

The origin of SARS-CoV-2 is still being investigated, including “...wild animals sold illegally in the Huanan Seafood Wholesale Market” (Huang, 2020; Tan et al., 2020). Considering the biological evolution of COVID-19, WHO finds that although the novel pathogen, SARS-CoV-2, moved from animal to human reservoirs, the intermediate host animal has not been identified, stating that it could be “a domestic food animal, a wild animal, or a domesticated wild animal which has not yet been identified” (WHO, 2020d). WHO is investigating the capacity for food to directly, and indirectly through cross-contamination, transmit COVID-19 if mishandled (WHO, 2020d). New research supports the concept of food as a pathogen transmission source (Pung et al., 2020).

Pathogen Transmission Pathways

SARS-CoV-2 transmission pathways have not been clearly identified, although body fluids are specifically mentioned and the importance of sanitizing services is emphasized in definitive guidance documents from U.S. agencies (CDC, 2020b; Pung et al., 2020). CDC reports that “like other close-contact environments, ships may facilitate transmission of respiratory viruses from person-to-person through exposure to respiratory droplets or contact with contaminated surfaces” (CDC, 2020b), which

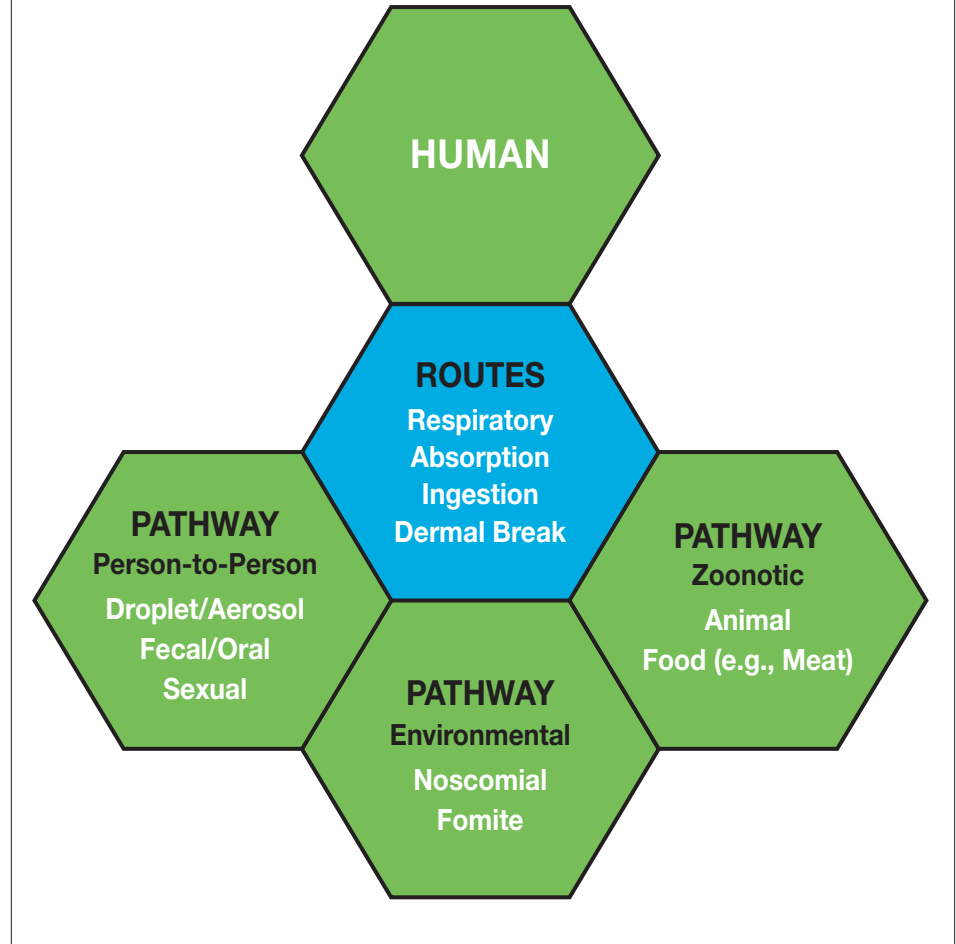
would account for other indirect contact pathogen transmission pathways in the cruise ship outbreaks that directly amplified pandemic COVID-19 (Carlton, 2020; Pung et al., 2020). Mounting evidence shows the association of gastrointestinal/fecal-oral SARS-CoV-2 transmission capacity (Gu et al., in press; Pung et al., 2020; Xiao et al., in press), which would also account for other aspects of cruise ship onboard pathogen transmission and should be added to pandemic mitigation strategies. Similar to some influenza strains, there is evidence that shows the conjunctiva of the eye to be a primary point of infection, thus necessitating the reevaluation for eye protection in the hazard vulnerability assessment process of an unknown pathogen (Besler, Lash, Garg, Tumphey, & Maines, 2018; Chang, Xu, Rebaza, Sharma, & Dela Cruz, 2020; Yan, 2020).

In our previous article on the Ebola virus and in our forthcoming article on the Zika virus, we establish transmission pathway descriptions and associated hazard vulnerability assessments that drive selection of personal protective equipment (PPE) according to assessed and expected worker hazards (Eddy & Sase, 2015a, 2020), which might be highly applicable to pandemic COVID-19. Regarding the Zika virus, we report relevant descriptors that should be clarified to include discussion about fecal-oral pathways and fomites, such as car keys, charge and ID cards, smartphones, purses, and luggage, in plain language that must drive effective public health outreach to correctly educate the public in order to advocate positive community behaviors (Eddy & Sase, 2020).

In this editorial, we characterized pathogen transmission pathways of COVID-19 and epidemiological commonality from a literature review—reservoirs (e.g., food and pets), hosts (e.g., recipient and amplifier), and points of environmental contamination (e.g., fecal-oral and fomite), among many other terms—to describe pathogen transmission pathways. We organized known descriptors into three categories (zoonotic, person-to-person, and environmental contamination) with discussion of infection dynamics below.

Our nomenclature system unifies veterinary, environmental public health, and medi-

FIGURE 1
Pandemic Coronavirus Disease 2019 (COVID-19) Potential Pathogen Transmission Pathway Model



cal terminology with a simplified categorization of transmission pathways to enable effective prevention strategies that follow One Health ideologies (Eddy et al., 2013; Nolen, 2007). In the absence of consensus regarding human, animal, and environmental transmission dynamics, Figure 1 clarifies our perspective of pathogen transmission pathways, generally and as applicable to pandemic COVID-19, as a possible model to be used for PPE selection at residential and institutional levels.

Human

Variably identified descriptors, such as close contact, has led to vague and politically sensitive public health outreach messag-

ing (Eddy & Sase, 2020). In several studies performed during the 2003 SARS global epidemic, SARS was identified in 100% of patient stool samples (WHO, 2003). As researchers struggle to identify and differentiate potentially mutated COVID-19 viral strains, well-documented initial onset of disease in Wuhan, China, included diarrhea and other gastrointestinal symptoms (Li et al., 2020; Phan et al., 2020; Tang et al., 2020; Zhang et al., 2020). COVID-19 has been detected in feces and urine, through sexual contact, and from fomite and contaminated surfaces, which are all factors to consider in nosocomial source transmission (National Health Commission of China, 2020; Pung et al., 2020).

Snohomish County Health Department in the State of Washington, sharing a border with nearby King County, reported its first human COVID-19 case on January 21, 2020 (Q13 News Staff, 2020). In a press release published on February 29, 2020, the county reported a positive case in a high school student but provided no advancement of preventive pathogen transmission strategies, stating that “this case suggests that local transmission of COVID-19 is occurring” (Snohomish Health District, 2020). The State of Washington governor proclaimed a state of emergency on February 29, 2020, (State of Washington, 2020). On March 18, 2020, the city of Kirkland, located in King County, reported 562 COVID-19 cases and 56 deaths in Seattle and King County, including 35 of those cases (10 of which were fatalities) linked directly to the Life Care Center of Kirkland nursing home (City of Kirkland, 2020; Walker, 2020). Observing the presence of COVID-19 within institutions such as hospitals and nursing homes, nosocomial infection prevention strategies must be in a heightened state of readiness.

The first two human COVID-19 cases in San Francisco reported on February 5, 2020, were not related and did not share common contacts with known COVID-19 positive cases or with people who had recently traveled to nations experiencing epidemics. The infectious disease pathway is described as community transmission (Holmes, 2020).

Regarding cruise ships as amplifiers of disease, applicable and relevant guidelines from CDC state the following, “Like other close-contact environments, ships may facilitate transmission of respiratory viruses from person-to-person through exposure to respiratory droplets or contact with contaminated surfaces” (CDC, 2020b). According to CDC (2017a), “Quarantine separates and restricts the movement of people who were exposed to a contagious disease to see if they become sick.”

Quarantine has become a major part of the multinational mitigation effort to control pandemic COVID-19. Millions have been quarantined on multiple continents. This process of separation has been applied to cities and regions of the world in this pandemic. It is unclear if it has worked and it is clear that human rights are severely impacted by the quarantine process. First introduced by

the Venetians in the 14th century, ships were made to wait 40 days at anchor (hence *quaranta*, which is forty in Italian) before being allowed to dock. It was codified in the U.S. originally in 1878 and has been modified a number of times since (CDC, 2012). During the mass immigration to the U.S. in the 19th and early 20th centuries, it was used extensively to attempt to limit the arrival of people with contagious diseases from entry into the country. Although Ellis Island is famous as the entry point for so many in the U.S., Hoffman and Swinburne Islands in New York Harbor were dreaded by those arriving from overseas as they became quarantine sites for those suspected of contagious diseases (ellisland.se, 2006).

To prevent worker exposure to a pathogen, both international and national occupational health authorities require a provision of PPE and training on how to carefully operate and don and doff the equipment (CDC, 2017b, 2020c, 2020d; Occupational Safety and Health Administration, 2020). There are numerous reports of healthcare workers infected while being at the frontline of COVID-19 containment and mitigation (Chang et al., 2020; Klompas, 2020; Wee & Wang, 2020). Dr. Li Wienliang (33 years old) died on February 7, 2020, in Wuhan, China, while engaged in the treatment of COVID-19 patients (Green, 2020).

In some cases, healthcare workers continued to perform their services after developing COVID-19-like symptoms (Kim, 2020). This trend suggests that an already strained healthcare workforce (e.g., due to shortage issues) is not able to take sick leave. Nevertheless, if healthcare workers continue to provide service, they could be at higher risk of infecting vulnerable populations such as older adults with existing conditions. Moreover, nearly 20% of home-care workers lack health insurance (PHI, 2018), which makes it difficult for them to seek medical care.

Furthermore, this situation might significantly increase required epidemiological work, such as contact tracing (e.g., at outpatient clinics) as it has been done at a number of healthcare facilities. Additionally, according to the U.S. Bureau of Labor Statistics (2017), 46% of workers in service occupations and 47% of workers in construction, extraction, farming, fishing, and forestry occupations have no sick leave benefit enti-

tlements. Therefore, some people will not be financially able to stay home when sick. A particularly large percentage of that population might be involved in the service supply chains, involved directly in food service, lodging, sanitation processes, and various aspects of the transportation and entertainment industries.

Environment

While coronavirus survival in general is known to be limited by conventional cooking temperatures (heat labile), survival on frozen foods might extend for years (WHO, 2020d). New research showing that SARS-CoV-2 can survive on hard surfaces for up to 9 days must be taken into consideration in the adequacy of PPE and prevention/avoidance guidelines (Kampf, Todt, Pfaendar, & Steinmann, 2020). Potential fomites, or contaminated environmental surfaces, can be identified and controlled, such as currency, printed media, etc.

Both nosocomial disease (hospital-acquired infection) and notorious outbreaks of norovirus and other unidentified pathogens on cruise ships are well-documented (CDC, 2020e; Eddy & Sase, 2015a). The closest comparators to COVID-19 are SARS and Middle East Respiratory Syndrome (MERS): 58% and 70% of cases were nosocomially transmitted, respectively (Munster, Koopmans, van Doremalen, van Riel, & de Wit, 2020). Asymptomatic transmission might severely complicate quarantine and pathogen transmission strategies (Nishiura, Linton, & Akhmetzhanov, 2020; Pung, 2020).

Animal

As in the case of Ebola and Zika, the bat has been determined to be the primary reservoir of SARS-CoV-2. Exotic animals sold at the Huanan Seafood Wholesale Market in China were identified as the probable source (Tan et al., 2020; Tang et al., 2020; WHO, 2020e).

Recognizing that animals, specifically pets, are part of the community pathogen transmission calculus, CDC guidelines have been established for people infected with COVID-19. Symptomatic patients should “avoid direct contact with pets, including petting, snuggling, being kissed or licked, and sharing food. Service animals should be permitted to remain with their handlers” (CDC, 2020f). The Global Research Collab-

oration for Infectious Disease Preparedness determined that future COVID-19 research must key upon “the natural history of the virus, its transmission and diagnosis, and animal and environmental research on the origin of the virus, including management measures at the human–animal interface” (WHO, 2020f).

Hazard Severity and Risk Assessment

The thrust of this editorial centers from an all-hazards perspective: the source of the biological hazard must be well understood to initiate the most effective prevention, containment, and mitigation strategies, especially regarding public health outreach messaging and associated recommended PPE. From an all-hazards perspective, the greatest separation between SARS-CoV-2 and H1N1 is knowledge and vaccination capacity (CDC, n.d.), while acknowledging much knowledge regarding H1N1 but little regarding SARS-CoV-2. Aside from the obvious unavailability of a vaccine for SARS-CoV-2, it is possible that multiple strains can present with different sets of epidemiological factors (Tan et al., 2020; Tang et al., 2020).

Our forthcoming articles state that the Zika virus brought microcephaly in human babies, human sexual transmission, and adult onset of neurological symptoms into the severity calculus, and that previously held understandings of West Nile virus-impacted human age spectrum was broader than previously believed (Eddy & Sase, 2020). When assessing the severity of a novel hazard, such as pandemic COVID-19, unknown characteristics such as long-term consequences, vulnerabilities, uncertainties, and hazard characteristics must be anticipated in the risk assessment process (Eddy & Sase, 2015a, 2015b).

The Occupational Safety and Health Administration’s Occupational Safety and Health Standards (2013) provide strictly enforced guidelines that require employers to fully evaluate the PPE need of employees based specifically upon the analysis of hazards anticipated in the workplace, including various vulnerabilities that should be reasonably anticipated (Eddy & Sase, 2015a). The 2014 U.S. Ebola crisis in Dallas, Texas, provided ample lessons learned regarding the insertion of a not well anticipated pathogen into the U.S. healthcare system. Adequacy of PPE was argued at federal, state and local agency

levels. The National Nurses United (2020a) reports that dozens of healthcare workers have been exposed to pathogens due to employers’ lack of protections. It surveyed 6,500 nurses nationwide and found that only 30% of the nurses’ employers have sufficient PPE stock if a rapid surge in patients with possible COVID-19 infections occurs (National Nurses United, 2020b).

It is also recommended that preparatory protection be utilized by symptomatic patients to avoid infection of their pets (CDC, 2020f), revealing the necessity to include zoonotic disease discussion in public health outreach communications as a core aspect of the One Health concept.

In the U.S., the public health message to prevent COVID-19 parallels the prevention strategy for influenza, although forming characterization of COVID-19 reveals pathogen transmission pathways that could challenge conventional strategies, such as stay home when sick, coughing into the elbow, and other social distancing strategies.

Conclusion

All phases of disaster planning and public health emergency response, including the opportunity for prevention, containment, and mitigation, from an all-hazards and public health combined perspective require the best available characterization of the pathogen (hazard) transmission pathways. Additionally, significant social economic factors, such as sick leave availability in the industry that can directly and indirectly impact the chain of pathogen transmission in the community, must be taken into consideration when reassessing public health countermeasures.

Like SARS-CoV-1, Ebola, Zika, and avian influenza global public health emergencies, pandemic COVID-19 began in animals and we must not underestimate their impact upon our own infection control practices. Animals and humans can cause human infection directly and indirectly while asymptomatic. Although asymptomatic pathogen transmission pathways must be better understood through further study (Pung et al., 2020), it might prove to provide invaluable evidence for future public health community outreach. Contact with urine, feces, and vomit can cause infection as aerosolized transmission is possible. A new international prevention message that recognizes an expanding

universe of avoidable infection pathways and guides people toward ways to prevent disease in their communities is essential to reducing future outbreaks of zoonotic pathogens.

Continuing to empower vulnerable populations and the general public with the knowledge to prevent and control infectious disease is crucial. It will avert unnecessary quarantine enforcement, which is a primary public health defense especially in the absence of an effective vaccine or authorized treatment. Future study should attempt to consolidate the broad language presently utilized to describe pathogen transmission pathways and motivate public health, medical, and veterinary professionals toward a rational discussion of pathways as promoted by the environmental health profession and the concept of One Health (CDC, 2020g).

In this editorial, we provide information that might enable community health initiatives to bolster individual readiness, independent of agency. As the international and national response mission shifts from pathogen containment to mitigation phases of response toward recovery, we posit that containment/mitigation processes can be shortened by effective prevention strategies developed and leveraged across the preparedness and response continuum.

We should enable all people, including those who are immunocompromised such as people living with HIV and/or cancer, to be able to make the best choices about infection prevention in their homes and communities. In the midst of a novel infectious disease pandemic, such as pandemic COVID-19, people need information regarding health determinants, which are outside individual control. Public agencies managing environmental and community health must provide up-to-date information and science-based guidance to the public in a timely manner. 🌱

Acknowledgement: We would like to thank Kristen Ruby-Cisneros, managing editor of the *Journal of Environmental Health*, for guidance and significant input on the construction of this editorial.

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Did You Know?

NEHA has created a COVID-19 resources page for environmental health professions at www.neha.org/covid-19. The current resources page provides links to pandemic situation reports; information about the disease; guidance for work, schools, and homes; food safety; and related *Journal of Environmental Health* articles. The page will be updated as more information and resources become available.

▶ DIRECT FROM CDC ENVIRONMENTAL HEALTH SERVICES



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Tools To Help Conquer the Model Aquatic Health Code

Editor's Note: 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, we feature 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.

All authors are from the Water, Food, and Environmental Health Services Branch in the National Center for Environmental Health. CDR Joe Laco is an environmental health scientist with the U.S. Public Health Service. Shannon McClenahan is a former Oak Ridge Institute for Science and Education (ORISE) fellow. Brian Hubbard is the Safe Water Section team lead.

Swimming and other water-related activities are excellent ways to get the physical activity and health benefits needed for a healthy life. In the U.S., we swim and bathe over 300 million times in pools, oceans, lakes, rivers, and hot tubs/spas each year, and most of the time it is healthy, safe, and enjoyable. There are, however, risks associated with swimming and other recreational water activities. In fact, the number of outbreaks associated with recreational water has increased substantially over the last few decades (Centers for Disease Control and Prevention, 2011). Drowning, near-drowning, and pool chemical injuries continue to occur. These occurrences underscore the need to build, maintain, and inspect public pools, hot tubs/spas, and water parks to help keep

bathers and aquatics staff healthy and safe.

The Model Aquatic Health Code (MAHC) is a guidance document based on the latest science and best practices. It was developed to help local and state authorities and the aquatics sector make swimming and other aquatic activities healthier and safer. States and localities can save time by voluntarily using the MAHC to create or update existing pool codes to reduce the risk of outbreaks, drownings, pool chemical exposures, and other injuries. The MAHC guidelines are all-inclusive and aim to prevent illness and injury in the design, construction, operation, and management of public aquatic facilities.

The Centers for Disease Control and Prevention (CDC) regularly update the MAHC in partnership with the Council for

the Model Aquatic Health Code (CMAHC, www.cmahc.org), which collects, assesses, and relays national input on MAHC versions. The updates keep the MAHC current with the latest advances in the aquatics industry while also responding to public health reports of disease and injury. The 2018 MAHC (3rd edition) is currently in use and the next edition will be released in summer 2021. To prepare for the new edition, CMAHC received input for MAHC change requests in late 2019 and early 2020. Proposed changes will be presented and discussed at the 2020 CMAHC conference in Houston, Texas, in October. At that time, CMAHC members will vote to accept or reject change requests to be incorporated into the 2021 MAHC (4th edition).

Even though the MAHC provides excellent prevention strategies, it is long and can be difficult to digest, which can pose challenges for users and potential adopters. Useful material that addresses a certain topic can be found in multiple sections of both the Code Language and the Annex (supporting rationale) documents.

To better serve state and local pool officials, CDC worked with many partners to develop resources to make the MAHC easier to use and navigate. The tools listed include an inspection form, electronic applications, reporting forms, and MAHC-specific checklists. They are posted on CDC's MAHC website at www.cdc.gov/mahc/networks-tools-forms.html#adoption.

MAHC Aquatic Facility Inspection Report (Form)

Model inspection form with approximately 50 MAHC elements for healthy and safe pool

FIGURE 1

Online Pool Inspection Training for Environmental Health Professionals



BENEFITS OF POOL INSPECTION TRAINING FOR ENVIRONMENTAL HEALTH PROFESSIONALS

- Improve pool inspections in your community by better understanding and applying the Model Aquatic Health Code (MAHC) and the MAHC inspection form.
- Take the courses you want and when you want to in this online training.
- Obtain continuing education contact hours (optional) from the National Environmental Health Association upon completing the lessons and final evaluation.
- Walk through a pool inspection using the MAHC inspection form.
- Learn about the various elements and systems of operating safe aquatic facilities including recirculation systems, filtration systems, water disinfection, water chemicals, equipment room, hygiene facilities, and records room.

FIGURE 2

Aquatic Inspector Application for iPads



AQUATIC INSPECTOR APP

- Is free and compatible with iPad (iOS 9 or later).
 - Note, the Aquatic Inspector app is only for iPads and might not show up in App Store searches on smartphones.
- Offers the complete and searchable Model Aquatic Health Code text.
- Can take and link photos to inspection reports.
- Can record data on site and print, save, and share inspection reports.

operation and management to minimize illness and injury risk and protect public health.

Cheat Sheet

Instructional guide for each inspection item found on the MAHC Aquatic Facility Inspection Report.

Cross-Reference Guide

The Cross-Reference Guide links the MAHC Aquatic Facility Inspection Report to content

in the Code Language and Annex documents. The guide allows an inspector to quickly locate Code Language requirements and supporting information in the Annex needed to develop a comprehensive and detailed inspection report.

Online Pool Inspector Training

This online training (Figure 1), developed in partnership with the National Environmental Health Association (NEHA), provides the

basics of performing an aquatic facility inspection. Based on the 2016 MAHC (2nd edition), the training addresses aquatic facility systems and walks the user through a pool inspection using the MAHC-based inspection form.

Aquatic Inspector App

The Aquatic Inspector app (Figure 2) provides a digital version of the MAHC inspection form, along with embedded MAHC text. The app allows environmental health practitioners to integrate the latest science and best practices into routine, follow-up, and investigative inspections of public treated aquatic venues.

MAHC Network

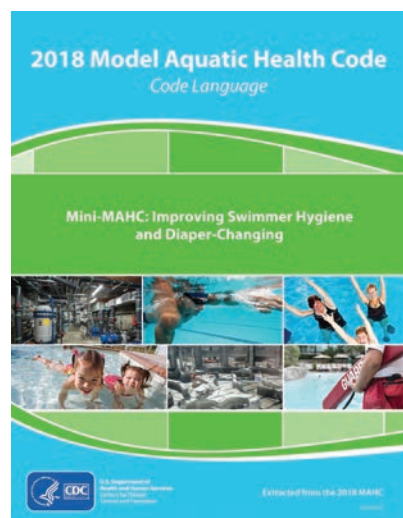
The MAHC Network, established through a CDC partnership with National Association of County and City Health Officials, is a community of MAHC users, subject matter experts, and others hoping to learn about the code. Members receive updates on the code, have access to and provide input into newly developed resources, and join bimonthly webinars featuring the code and user experiences.

Mini-MAHCs

CDC developed Mini-MAHCs (Figure 3) to make the MAHC more concise and easier to use and to tackle specific public health concerns. The Mini-MAHCs focus on content in the Code Language and Annex documents and allow a user to quickly locate information to address important topics. All Mini-MAHCs reference content from the 2018 MAHC. Four

FIGURE 3

Mini-MAHC Cover



Did You Know?

- Drowning is a leading cause of unintentional injury-related death for children ages 1–14 years (Centers for Disease Control and Prevention, 2012). Nonfatal drowning can cause brain damage resulting in learning disabilities or even permanent loss of basic functioning (Spack, Gedeit, Splaingard, & Havens, 1997).
- Injuries linked to pool chemicals account for 3,000–5,000 emergency department visits each year (Hlavsa, Robinson, Collier, & Beach, 2014). One third to almost one half of those patients are under 18 years old (Vanden Esschert et al, 2019).
- Nearly 500 disease outbreaks linked to pools, hot tubs/spas, and water playgrounds were reported to the Centers for Disease Control and Prevention for 2000–2014 (Hlavsa et al, 2018).
- *Cryptosporidium* is a leading cause of treated recreational water-associated outbreaks in the U.S. and can cause diarrhea for up to 3 weeks (Hlavsa et al., 2018).
- Recent studies found that routine inspections resulted in immediate closure of 1 in 8 public pools (11.8%) and 1 in 7 public hot tubs/spas (15.1%) due to health hazards (Hlavsa et al, 2016).

Mini-MAHCs are currently available at www.cdc.gov/mahc/mini-mahcs.html:

- Reducing the Spread of *Cryptosporidium*
- Improving Swimmer Hygiene and Diaper Changing
- Preventing Pool Chemical Injuries
- Preventing In-Line Production of Toxic Chlorine Gas Events

CDC continues to support and work with NEHA and other partners to develop recreational water and MAHC-related tools. Currently NEHA is working with health departments across the U.S. to understand how they manage and publicly share aquatic facility inspection data. NEHA conducted a scan and identified only six states that published aquatic facility inspection data online and in a usable format. An additional tool emerging from NEHA's work will be an open data standard for sharing aquatic facility inspection data. 🐼

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Did You Know?

In late March 2020, NEHA distributed a rapid needs assessment to assess environmental health activities and needs in response to the COVID-19 pandemic. The findings have been summarized into a report and can be found at www.neha.org/NEHA-Issues-Key-Findings-COVID-19.

Mobilizing Environmental Health CDPmobile²

Transform your inspection workflows into a mobile-first process that enhances your department with faster business cycles.

- > Online or offline access.
- > Using business rules, prefill capabilities, and data validation to enhance data quality.
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JEH QUIZ

FEATURED ARTICLE QUIZ #6

Mandatory Follow-Up Radon Testing Noncompliance Among Schools, Child Care Centers, and Adult 24-Hour Care Facilities in Florida

Available to those with an active NEHA membership, *JEH* Quiz, offered six times per calendar year through the *Journal of Environmental Health*, is an easily accessible means to accumulate continuing education (CE) contact hours toward maintaining your NEHA credentials.

1. Read the featured article carefully.
 2. Select the correct answer to each *JEH* Quiz question.
 3. a) Complete the online quiz found at www.neha.org/publications/journal-environmental-health,
b) Fax the quiz to (303) 691-9490, or
c) Mail the completed quiz to
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Denver, CO 80246.
- Be sure to include your name and member number!
4. One CE contact hour will be applied to your account with an effective date of May 1, 2020 (first day of issue).
 5. Check your continuing education account online at www.neha.org.
 6. You're on your way to earning CEs!

Quiz Registration

Name _____

NEHA Member Number _____

E-mail _____

JEH Quiz #4 Answers January/February 2020

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

→ Quiz deadline: August 1, 2020

1. In the U.S., radon is the leading cause of lung cancer among nonsmokers.
 - a. True.
 - b. False.
2. In Florida, elevated levels of radon above the U.S. Environmental Protection Agency established action level of 4 pCi/L are found in ___ of homes tested.
 - a. 10%
 - b. 20%
 - c. 30%
 - d. 40%
3. The Florida Radon Program has the following mission(s):
 - a. oversee the state mandatory radon testing program.
 - b. educate the public about radon and its health effects.
 - c. protect the public from deceptive radon measurement and mitigation practices by certifying radon professionals.
 - d. all the above.
 - e. none of the above.
4. This study sought to examine noncompliance with mandatory radon testing rules by county and facility type in Florida, as well as the efficacy of outreach to facilities that were determined to be noncompliant.
 - a. True.
 - b. False.
5. Initial attempts to contact noncompliant facilities were made by
 - a. mail.
 - b. e-mail.
 - c. phone.
 - d. none of the above.
6. Noncompliant facilities were given a minimum of ___ days from the date a letter was sent to have a new radon test performed and to submit the test report to the Radon Program.
 - a. 30
 - b. 60
 - c. 90
7. A total of ___ facilities were assessed in this study.
 - a. 63
 - b. 192
 - c. 401
 - d. 656
8. The submission of follow-up mandatory radon test reports among noncompliant facilities was
 - a. 9.6%.
 - b. 29.3%.
 - c. 50.0%.
 - d. 61.1%.
9. Of the facilities assessed, ___ were shown to have a lower likelihood of being noncompliant.
 - a. adult 24-hour care
 - b. private schools
 - c. public schools
 - d. child care centers
10. All the facilities types examined in this study ___ a statistically significant relationship to noncompliance.
 - a. did show
 - b. did not show
11. Counties with a designated individual responsible for testing of certain facilities ___ a statistically significant relationship to noncompliance.
 - a. did exhibit
 - b. did not exhibit
12. The author recommends that the forms of outreach used in this study be implemented as a supplement to other forms of outreach.
 - a. True.
 - b. False.

Did You Know?

NEHA's membership structure includes five different membership categories—Professional, Emerging Professional, Retired Professional, International, and Life. Members within these categories receive the electronic version of the *Journal*. Members based in the U.S. also have the option to purchase a print subscription of the *Journal* for \$35. Learn more at www.neha.org/join.

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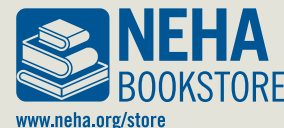
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Did You Know?

NEHA released its 2019 Annual Report, which looks at the association's myriad programs and activities through the lens of advancing environmental health through connectivity. The report is available in an interactive format or as a PDF at www.neha.org/about-neha/neha-annual-reports.

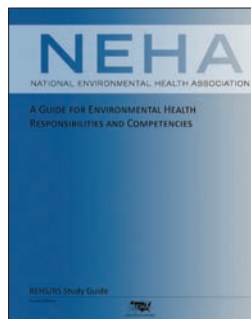
RESOURCE CORNER

Resource Corner highlights different resources the National Environmental Health Association (NEHA) has available to meet your education and training needs. These resources provide you with information and knowledge to advance your professional development. Visit NEHA's online Bookstore for additional information about these and many other pertinent resources!



REHS/RS Study Guide (4th Edition)

National Environmental Health Association (2014)



The Registered Environmental Health Specialist/Registered Sanitarian (REHS/RS) credential is the National Environmental Health Association's (NEHA) premier credential. This study guide provides a tool for individuals to prepare for the REHS/RS exam and has been revised and updated to reflect changes and advancements in technologies and theories in the environmental health

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308 pages / Paperback

Member: \$149 / Nonmember: \$179

Certified Professional–Food Safety Manual (3rd Edition)

National Environmental Health Association (2014)



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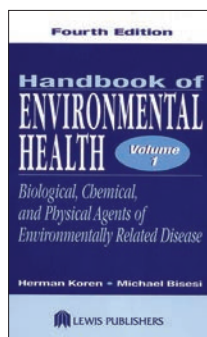
illness, HACCP plans and active managerial control, cleaning and sanitizing, conducting facility plan reviews, pest control, risk-based inspections, sampling food for laboratory analysis, food defense, responding to food emergencies and foodborne illness outbreaks, and legal aspects of food safety.

358 pages / Spiral-bound paperback

Member: \$179 / Nonmember: \$209

Handbook of Environmental Health, Volume 1: Biological, Chemical, and Physical Agents of Environmentally Related Disease (4th Edition)

Herman Koren and Michael Bisesi (2003)



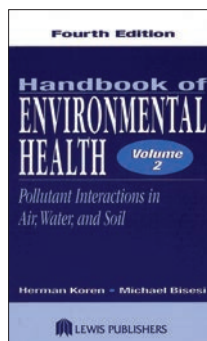
A must for the reference library of anyone in the environmental health profession, this book focuses on factors that are generally associated with the internal environment. It was written by experts in the field and copublished with NEHA. A variety of environmental issues are covered such as food safety, food technology, insect and rodent control, indoor air quality, hospital environment, home environment, injury control, pesticides, industrial hygiene, instrumentation, and much more. Environmental issues, energy, practical microbiology and chemistry, risk assessment, emerging infectious diseases, laws, toxicology, epidemiology, human physiology, and the effects of the environment on humans are also covered. Study reference for NEHA's REHS/RS credential exam.

790 pages / Hardback

Member: \$215 / Nonmember: \$245

Handbook of Environmental Health, Volume 2: Pollutant Interactions With Air, Water, and Soil (4th Edition)

Herman Koren and Michael Bisesi (2003)



A must for the reference library of anyone in the environmental health profession, this book focuses on factors that are generally associated with the outdoor environment. It was written by experts in the field and copublished with NEHA. A variety of environmental issues are covered such as toxic air pollutants and air quality control; risk assessment; solid and hazardous waste problems and controls; safe drinking water problems and standards; onsite and public sewage problems and controls; plumbing hazards; air, water, and solid waste programs; technology transfer; GIS and mapping; bioterrorism and security; disaster emergency health programs; ocean dumping; and much more. Study reference for NEHA's REHS/RS credential exam.

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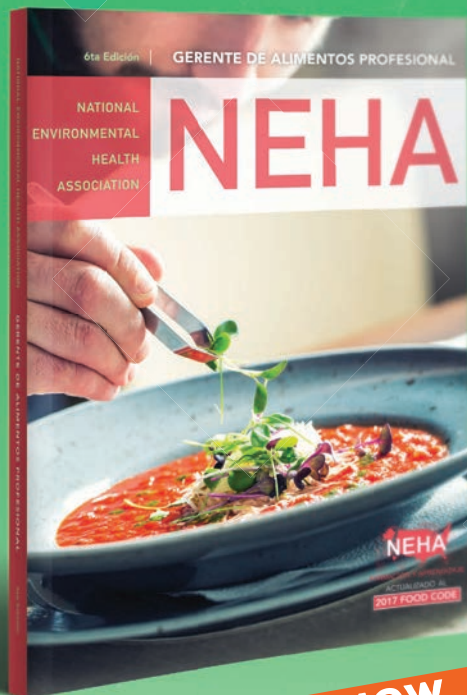


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EH CALENDAR

Editor's Note: Due to the coronavirus disease 2019 (COVID-19) pandemic, many conferences and events are being canceled as shelter-in-place orders are announced and social distancing is advised. As cancellations are occurring rapidly, the status of the conferences listed below might not be correct. Attendees are encouraged to check the websites for each conference listing for the latest information. Any cancellations that occurred prior to time of press have been noted below. Furthermore, the National Environmental Health Association (NEHA) is actively monitoring current developments related to the COVID-19 pandemic and potential impacts to the 2020 Annual Educational Conference (AEC) & Exhibition. At time of press, the 2020 AEC is still scheduled. Any changes to the status of the 2020 AEC will be communicated immediately. The same considerations are being taken by NSF Health and NEHA in regard to the Legionella Conference 2020.

UPCOMING NATIONAL ENVIRONMENTAL HEALTH ASSOCIATION (NEHA) CONFERENCES

July 13–16, 2020: NEHA 2020 Annual Educational Conference & Exhibition, New York City, NY, www.neha.org/aec
 July 12–15, 2021: NEHA 2021 Annual Educational Conference & Exhibition, Spokane, WA

NEHA AFFILIATE AND REGIONAL LISTINGS

Colorado

September 15–18, 2020: Annual Education Conference, Colorado Environmental Health Association, Pueblo, CO, www.cehaweb.com

Florida

August 2–8, 2020: 72nd Annual Education Meeting, Florida Environmental Health Association, Jensen Beach, FL, www.feha.org/2020AEM

Georgia

CANCELED: May 27–29, 2020: Annual Education Conference, Georgia Environmental Health Association, Lake Lanier Islands, GA, www.geha-online.org

Illinois

November 2–3, 2020: Annual Educational Conference, Illinois Environmental Health Association, Utica, IL, <http://iehaonline.org>

Indiana

September 21–23, 2020: 70th Annual Fall Educational Conference, Indiana Environmental Health Association, Lawrenceburg, IN, www.iehaind.org/Conference

Iowa

October 14–15, 2020: Fall Conference, Iowa Environmental Health Association, Des Moines, IA, www.ieha.net/FallConference2020

Jamaica

October 25–30, 2020: One Health, One Global Environment Conference, Jamaica Association of Public Health Inspectors and the Americas Region of the International Federation of Environmental Health, Montego Bay, Jamaica, www.onehealthconference.com

Michigan

September 14–16, 2020: Annual Education Conference, Michigan Environmental Health Association, Traverse City, MI, www.meha.net/AEC

Minnesota

May 14–15, 2020: Spring Conference, Minnesota Environmental Health Association, Walker, MN, www.mehaonline.org

North Carolina

September 16–18, 2020: Fall Educational Conference, North Carolina Public Health Association, Wilmington, NC, <https://ncpha.memberclicks.net>

Texas

October 26–30, 2020: 65th Annual Education Conference, Texas Environmental Health Association, Austin, TX, www.myteha.org

Utah

CANCELED: May 6–8, 2020: Spring Conference, Utah Environmental Health Association, Kanab, UT, www.ueha.org/events.html

Wisconsin

September 23–25, 2020: Educational Conference, Wisconsin Environmental Health Association, Eau Claire, WI, <https://weha.net>

TOPICAL LISTINGS

Water Quality

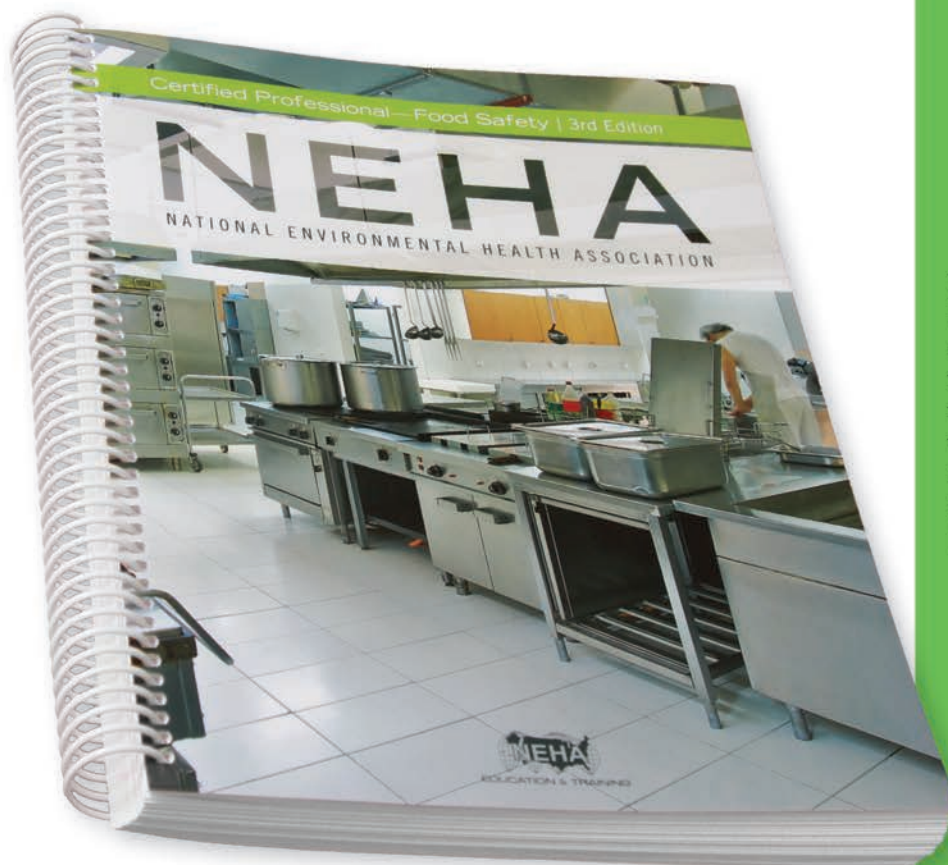
August 19–21, 2020: Legionella Conference 2020, NSF Health Sciences and NEHA, Chicago, IL, www.legionellaconference.org



Did You Know?

You can post your upcoming events, such as conferences and webinars, on NEHA's Community Calendar at www.neha.org/news-events/community-calendar. If you need to reschedule or cancel a posted event, please e-mail webmaster@neha.org so we can update your listing.

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- Food defense
- Responding to food emergencies and foodborne illness outbreaks
- Conducting facility plan reviews
- Legal aspects of food safety



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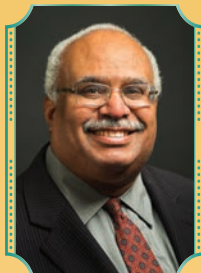
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FEATURED SPEAKERS



Keynote Address

Climate Change: A Public Health Approach

Georges C. Benjamin, MD
Executive Director,
American Public Health Association



Closing Session

Is it Too Late?

Reverend Gerald L. Durley, MS, MDiv, PhD
Chair of the Board,
Interfaith Power and Light



Grand Session Kickoff

Artificial Intelligence and Environmental Health: Bringing New Tools to Field Work

John Howard, MPH, MBA, LLM, JD, MD
Director,
National Institute for Occupational
Safety and Health,
Centers for Disease Control and Prevention

COMPLETE SPEAKER DETAILS

neha.org/aec/speakers

EDUCATIONAL SESSIONS HIGHLIGHTS

Hurricane Disaster Relief

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IN MEMORIAM

Sheila Davidson Pressley

The National Environmental Health Association (NEHA) was saddened to learn that Sheila Davidson Pressley, DrPH, CPH, DAAS, REHS, HHS, passed away on January 24, 2020. Dr. Pressley was the dean of the College of Health Sciences at Eastern Kentucky University (EKU). She was born on May 2, 1967, in Asheville, North Carolina. She attended Western Carolina University for her undergraduate education and earned graduate degrees from Tufts University and the University of Kentucky. The University of Kentucky honored her in 2017 with the Lyman T. Johnson Torch of Excellence Award.

Dr. Pressley worked in environmental health for more than 20 years in the public and private sectors and academia. She enjoyed working with undergraduate students as her mentors and college professors did with her. She joined EKU in 2004. She became the first African American to chair the EKU Faculty Senate from 2012–2014. She also served on various other committees and councils. Dr. Pressley was named dean of the College of Health Sciences in 2017.

Dr. Pressley was an active member of NEHA and the American Academy of Sanitarians (AAS). She became a diplomate of AAS in 2008. She joined NEHA in 2005 and volunteered her time and talent through various ways. She was cochair of the hazardous materials and toxic substances technical section from 2007–2011, technical advisor for environmental justice from 2011–2013, a peer reviewer for the *Journal of Environmental Health*, and cochair of the NEHA Sick, Bereavement, and Memorial Committee in 2019. Dr. Pressley was honored with the NEHA Past Presidents Award in 2015.

The following quotes from fellow colleagues and friends highlight her dedication to environmental health through her tireless work, personal interactions, and dedication to students.

“Sheila was a most persuasive and delightful person, full of enthusiasm and verve for the education of students. I enjoyed her interest in providing real world discussions of how these students could find their way into the environmental health profession,” James J. Balsamo, Jr., NEHA past-president and professor.

“A decided bright light with such passion for environmental health. Her smile brightened every room. We honor her and her contributions to environmental health,” Dr. Bryan Brooks, professor.

“Dr. Pressley’s exuberance and commitment to environmental health created a nexus between theory and practice that transcended two generations. Her character, vision, leadership, and participation as a role model and mentor will influence generations to come,” Brian Collins, NEHA past-president.

“Dr. Pressley will be always remembered as a beautiful human being, a great friend, and a first-class professional,” Dr. Amer El-Ahraf, NEHA past-president and professor.

“I reflect on what might have been different in my life if I had not met Dr. Pressley. I learned as much from her as many have learned from me. She had a way of making me feel better about almost everything,” Dr. Larry W. Figgs, division chief.

“Sheila became one of EKU’s most popular and creative faculty. She was very good at recruiting students as well as working on



Dr. Sheila Davidson Pressley accepting the National Environmental Health Association's Past Presidents Award at the 2015 Annual Educational Conference & Exhibition in Orlando, Florida. Photo courtesy of Joe Deats Photography.

making her classes interesting and enjoyable. Sheila was a very hard worker and a super friend. She was a gift to us for a short time and will be deeply missed,” Dr. Carolyn Harvey, NEHA past-president and professor.

“Dr. Pressley was a dedicated friend; devoted mom and wife; committed and multitalented professional; caring teacher, professor, dean, and mentor; visionary and forward thinking leader; epitome of the consummate environmental health professional; and a star gone too soon,” COL Wendell A. Moore.

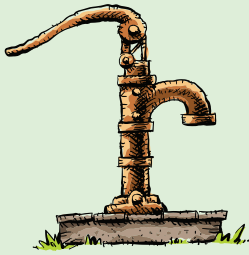
“I could write a book on the many accomplishments, pleasing personality, and sharp leadership characteristics of Dr. Pressley. She was a true leader that would light up the room. She was not a stranger to anyone and kept a smile on her face that warmed our hearts,” Dr. Priscilla Oliver, NEHA president.

“Sheila was always looking for ways to help environmental health students. She would organize special sessions at the NEHA AEC to help students find jobs, mentor the students on taking the REHS/RS exam, and provide one-on-one mentoring opportunities,” Vince Radke, NEHA past-president.

“Sheila was funny, kind, caring, supportive, and sisterly. I will always cherish our sweet friendship,” Dana Reed Wise, bureau chief.

NEHA extends its deepest sympathies to Dr. Pressley’s family, friends, and colleagues. Her contributions to the profession will be long lasting due her passion and dedication to the students she taught and mentored, as well as the relationships she cultivated. She will be greatly missed. 🙏

Editor’s Note: We thank everyone who provided quotes and information regarding the life of Dr. Pressley. If you would like to share information about the passing of an environmental health professional to be mentioned in a future In Memoriam, please contact Kristen Ruby-Cisneros at kruby@neha.org. The *Journal* will publish the In Memoriam section twice a year in the June and December issues, or in other issues as dictated by time and page space considerations.



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NEHA NEWS

NEHA's COVID-19 Response and Resources

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

On March 11, 2020, the World Health Organization (WHO) declared coronavirus disease 2019 (COVID-19) a pandemic. At the time of writing (March 31, 2020), the Centers for Disease Control and Prevention (CDC) reports 163,539 cases (both confirmed and presumptive positive) of COVID-19 in the U.S. with 2,860 total deaths. Shelter-in-place orders have been issued statewide in 33 states as of March 31, 2020. Globally, WHO reports 754,948 confirmed cases and 36,571 confirmed deaths, with over 203 countries, areas, or territories affected. These reported numbers probably do not represent how many people are actually sick or have died; however, they do provide us with a somber picture of the impact and spread of this pandemic. COVID-19 has changed the landscape of our world and has impacted all of our lives. In these uncertain times, one thing that is certain is that the importance of environmental public health has been thrust into the spotlight.

The National Environmental Health Association (NEHA) is closely monitoring developments from the COVID-19 pandemic and is working to provide members and stakeholders with access to critical information and updates. Across the U.S. and around the globe, environmental health professionals are on the frontlines of preventive public health services delivery and we are committed to supporting the environmental health workforce to effectively and safely do their jobs.

In regard to NEHA's Annual Educational Conference (AEC) & Exhibition, a news release was issued on March 6, 2020, that stated we are actively monitoring current developments related to COVID-19 and the potential impacts to the 2020 AEC in New York City, New York, July 13–16. At the present, we are not planning to cancel the AEC and are moving forward with the July conference as scheduled. We will continue to make attendee safety and well-being a priority as we plan the AEC and any changes to the AEC status will be communicated to the NEHA community immediately. For the latest AEC updates, please visit www.neha.org/aec.

On March 16, 2020, the NEHA office transitioned to a 100% telework schedule to protect the health and safety of our employees and communities. We are working hard from our homes to ensure that normal operations within the organization are carried out and that we meet the needs and requests of our members, partners, and stakeholders. "Ebola, H1N1, H5N1, MERS, SARS, and COVID-19 have one characteristic in common, they are rooted in environmental health. This is a teachable moment, one our association is committed to. In the meantime, we encourage our constituencies to surveil and adhere to CDC recommendations, as we do," stated NEHA Executive Director Dr. David Dyjack.

Contact information for critical services such as credentialing, member services, books and sales, finance, the AEC, and administration can be found at www.neha.org/news-events/latest-news/neha-transitions-teleworking-response-covid-19-pandemic. You can also find a staff listing on page 46. The decision for staff to

return to the Denver office will be based upon city and state directives, as well as guidance from CDC and WHO.

NEHA has created a COVID-19 resources page for environmental health professions at www.neha.org/covid-19. Information about COVID-19 was first posted on January 30, 2020. That posted page included several links to additional information and resources, as well as a video of NEHA Executive Director Dr. David Dyjack and Program and Partnership Development Director Jesse Bliss discussing the COVID-19 outbreak (www.neha.org/news-events/latest-news/neha-actively-monitoring-coronavirus-disease-2019-outbreak). Since that time, we have worked diligently to provide a more comprehensive resources page. The current resources page provides links organized in the following categories: Pandemic Situation Reports; About the Disease; Guidance for Work, Schools, & Homes; COVID-19 & Food Safety; and Related *Journal of Environmental Health* Articles.

Original COVID-19 content from NEHA is also being produced or considered. For example, we recently posted two guidance documents on COVID-19 and food safety for food establishments and food safety regulators. These documents will be updated as new information comes to light and can be accessed on our COVID-19 resources page at www.neha.org/covid-19. We plan to produce weekly podcasts that highlight various environmental health disciplines, such as retail food safety, recreational water, international partner activities, early childhood education facilities, etc., through a COVID-19 lens. Grant opportunities are being pursued. We also conducted a rapid needs assessment of the environmental health profession on March 25, 2020, and a summary of the survey has been produced and is posted at www.neha.org/covid-19.

A vacuum for obtaining continuing education has been created with social distancing, shelter-in-place orders, and local conferences and events being canceled. In response to this need, NEHA is offering free access to online trainings to all environmental health professionals regardless of membership status starting on March 30, 2020. The online trainings include webinars, partner courses, and NEHA's E-Learning videos of sessions from the 2017–2019 AECs. By completing these videos, webinars, and courses, environmental health professionals can earn continuing education contact hours toward their NEHA credentials. At this time, open access will be available for 90 days. Information about the online training offerings and how to access them can be found at www.neha.org/elearning.

As changes are occurring daily, our association decisions, plans for resources, and operations can change. Please bookmark www.neha.org/covid-19 and check it often for updates. We strive to provide you with the most relevant and up-to-date information and resources so you can do your jobs effectively and safely. From all at NEHA, we thank those working in our communities and across the globe to protect the health and safety of the public and the environment. As we know—and now is the time to show the whole world—environmental health matters!

NEHA Staff Profile

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 one NEHA staff member. Contact information for all NEHA staff can be found on page 46.



Kim Koenig

I came to NEHA in May 2019 having worked in instructional design and training delivery for 11 years. Prior to joining the Entrepreneurial Zone team at NEHA, I worked for the University of Colorado Health Authority, University of Denver, and a variety of health and professional organizations as a curriculum developer, analyst, and principal trainer.

Much of my work as an instructional designer involves working with domain experts to create curriculum for professional, technical, and academic projects or programs of study. Collaborating with subject matter experts is personally enriching because I learn so much with every project. At NEHA, I've had the privilege of

working with members who are some of the most competent subject matter experts I've ever worked with.

I love to learn and it's a wonderful byproduct of the work I do. Along the way I've been a subject matter expert myself, becoming a certified analyst for multiple clinical enterprise applications, collaborating on system development while developing training programs as well.

I enjoy coordinating stakeholder input and pulling together the narrative of a course and, ultimately, crafting tools that help people learn and understand. Instructional design is dynamic and creative, too. Keeping up with technology and creating across many different modes keeps me energized. And I need it—my husband and I are very busy keeping up with our four fantastically unique kids, three geriatric dogs, and our horse, which has me happily running at both ends.

Since joining NEHA, I've been developing training components and am currently working on the Centers for Disease Control and Prevention Hurricane Supplemental projects focused on the U.S. Virgin Islands. I look forward to working with the rest of the Entrepreneurial Zone team to upgrade NEHA's catalog of training products and to optimize the effectiveness of education, certificate, and credential offerings. 🐾

DirectTalk

continued from page 54

anticipate the release of a funding opportunity to support us in this exciting and long overlooked component of our programmatic portfolio—telling our professional story.

We've also reengineered our annual conference to provide affiliate leadership with training on association management, which we feel is a wonderful opportunity to share stories of success and failure and to learn from each other. Our *Journal* is also planning to provide affiliates with space in this publication to directly share affiliate developments, opportunities, and challenges with the profession writ-large.

While we are sensitive to affiliate needs, we have been blessed by affiliate contributions to the overall professional enterprise. Our Business and Industry Affiliate (BIA) has sponsored and presented several national webinars over the last 18 months. These webinars have received accolades for their content and delivery, and attendance has been impressive. Recent BIA webinars have included the following titles: Power of Partnerships:



The Texas Environmental Health Association in action. Photo courtesy of David Dyjack.

Strengthening Agency and Industry Relationships; Boil Water What?!? When Good Water Goes Bad; and Coming Clean About Norovirus: How to Dodge the Spread. We acknowledge that industry is frequently a leader in adopting new practices and technologies and we collectively benefit when the private and governmental sectors collaborate.

The Uniformed Services Environmental Health Association (USEHA) is also an important and foundational professional constitu-

ency. They plan to host their annual USEHA Educational Program Day at the NEHA 2020 Annual Educational Conference (AEC) & Exhibition in New York City, providing a full day of environmental health presentations given by their uniformed services members. We encourage all AEC attendees to join them at the USEHA Educational Program Day. USEHA also plans to offer a scholarship to a uniformed services member to attend the NEHA 2020 AEC. I am proud of our members in uniform.

The three sisters showcase the wisdom of our Native American forefathers. This system is a classic case of how agrosystems, ecosystems, and diets are more productive and healthier when careful thought and consideration are invested into the management system that supports them. We honor the Native Americans who identified this approach. We humbly borrow from their ideas and are committed to ensuring our affiliates remain vibrant and viable as we nurture the future of the profession. 🐾

Dave

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► **DirectTalk** MUSINGS FROM THE 10TH FLOOR

David Dyjack, DrPH, CIH

Three Sisters

*Local agencies,
public and private,
are hotbeds
of innovation.*

Planting corn, beans, and squash together, reverently referred to as the “three sisters,” originated with the Haudenosaunee, also known as the Iroquois. The Haudenosaunee, who occupy the regions around the Great Lakes in the Northeastern United States and Canada, historically planted all three seeds together, often in an elevated mound. This approach assisted with drainage and avoided water logging of the plant roots, which was important in a region that historically received abundant rainfall.

The sisters also dish up a wholesome, nutritious meal. Corn is a source of carbohydrates. Dried beans are rich in protein and provide amino acids. Squash is an important source of vitamins and minerals absent from corn and beans. These crops are also important because they are amenable to drying and long-term storage. While these traits are perhaps less important today than in years gone by, these characteristics were critically important in the past and led to their significance as major cultivated foods.

Then, there is the benefit the plants provide to each other. Corn provides a substrate for the beans to climb on. Beans provide nitrogen to fertilize the soil while also stabilizing the corn during inclement weather. Beans are nitrogen-fixers, which means they secure nitrogen from the air and convert it into forms that can be absorbed by plant roots. The large squash leaves shade the ground, which helps retain soil moisture and prevents undesirable weeds. In short, the three sisters are the foundation of a stable and sustainable dietary community.

The National Environmental Health Association (NEHA) has its own version of the three sisters. In our case, the three are our individual members, our affiliates, and the third leg of the stool, our national association (i.e., NEHA). Our affiliates—state, uniformed, and business and industry—are vital to the profession. Frankly, all three sisters are essential to a thriving professional community.

Why? Environmental health is profoundly local by its nature. From a governmental perspective, many of our states are home rule (i.e., local jurisdictions fund, lead, and manage their affairs at the local level). For our private sector members, I have learned anecdotally that many grocery, restaurant, and healthcare chains defer to local codes and professional sensibilities in the way they conduct their affairs. This system is what our forefathers envisioned, locals managing local issues in a manner that makes sense to them. We also observe that local agencies, public and private, are hotbeds of innovation. It’s where the action is.

There are about 40 state, regional, and sector-specific affiliates associated with us and each is independently operated and man-

aged. By policy, they have no financial ties to NEHA, the mother ship. We recently surveyed the affiliates to characterize their operational state and to identify how NEHA could be most helpful to them. We had a response rate of 75% (30/40). There were some surprising findings.

First, 90% of the respondents reported their individual affiliate was either stable or growing in membership, with almost 40% suggesting they are currently in member growth mode. This discovery was delightful. Having said that, almost one third suggested that recruiting and retaining members and securing the assistance of volunteers are recalcitrant challenges.

We then inquired about the value NEHA represents to them. The top affiliate response was capacity building—face-to-face training and e-learning. We took these responses to heart and have an internal team working diligently to ensure our e-learning is valuable, easy to access, and easy to report for continuing education purposes.

We also learned that advocacy resources were important. In consideration, we are doubling our efforts to ensure we have caliber government affairs support and stories of impact that affiliates might find useful in sharing the message about the importance of the profession. This spring our government affairs activities will pivot to the local level to ensure we provide timely responses to affiliate needs. And yes, we will continue to be active in Washington, DC. We also anticipate a growing footprint in the environmental health storytelling arena. As I write this column, we

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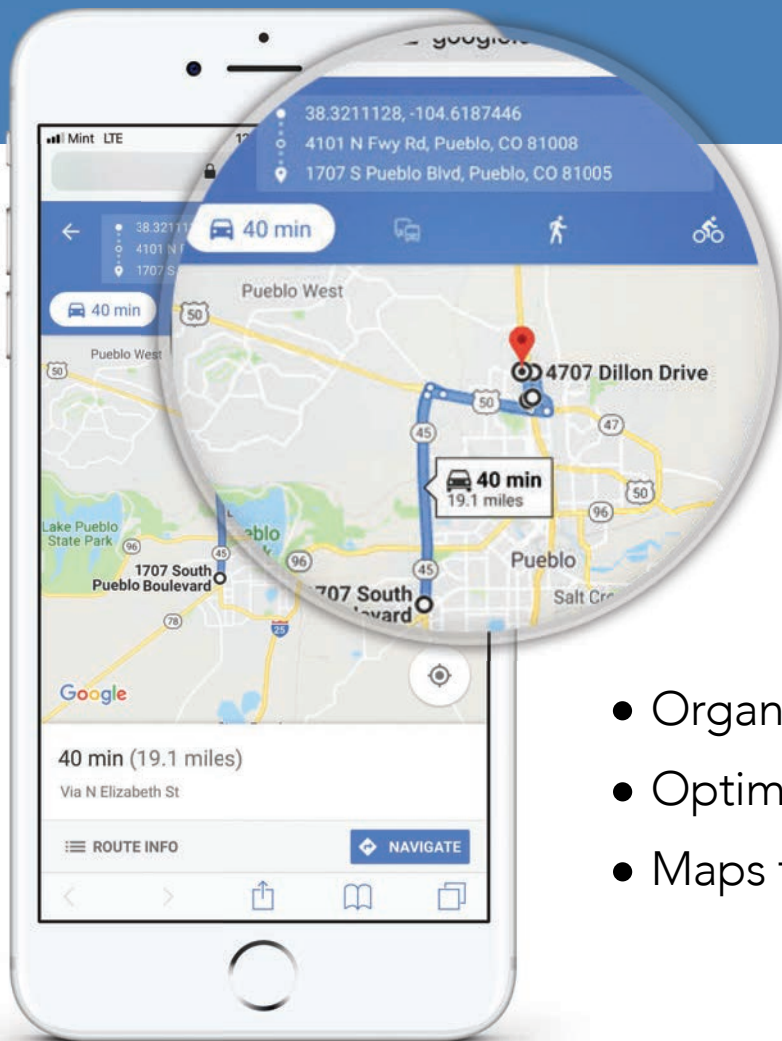
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