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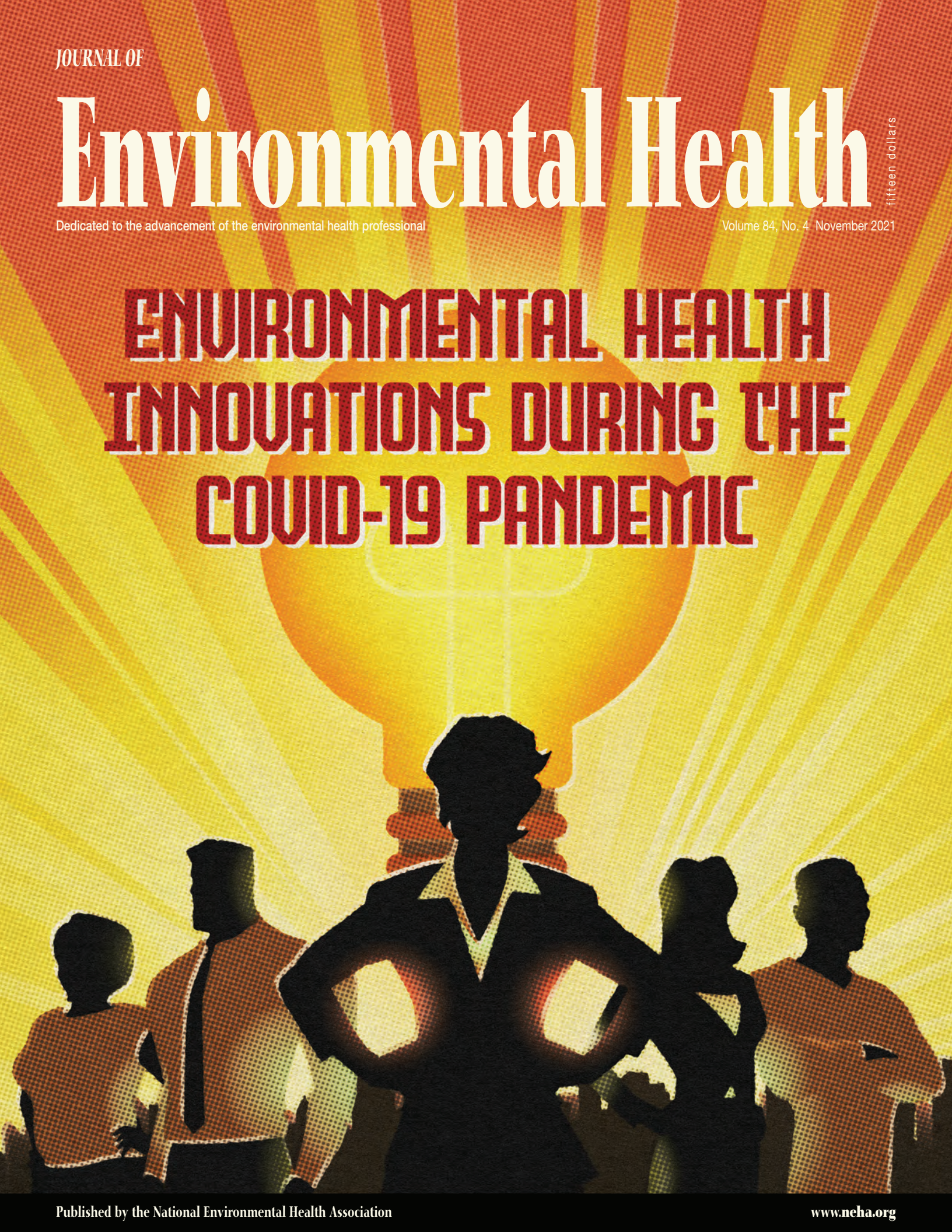

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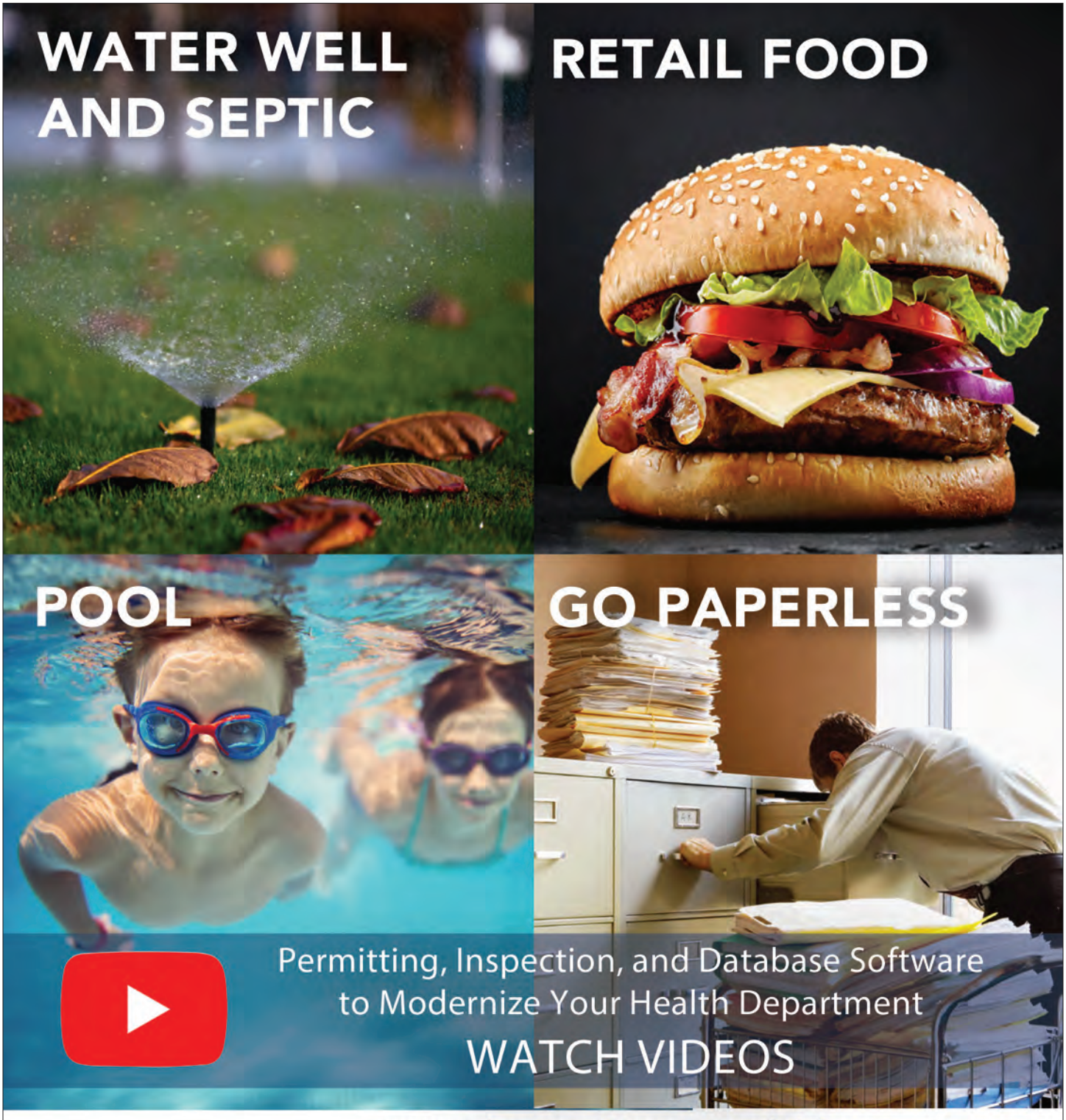

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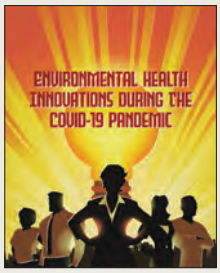

Throughout the COVID-19 pandemic, environmental health professionals have worked tirelessly to promote the health and well-being of their communities. The National Environmental Health Association (NEHA), in partnership with the Centers for Disease Control and Prevention's National Center for Environmental Health and the Agency for Toxic Substances and Disease Registry, sought to recognize some of the innovative programs, activities, or strategies that were developed by state, tribal, local, and territorial health departments to deliver essential environmental health services during the pandemic. This partnership led to the development of the NEHA Environmental Health Innovation Awards. This month's cover highlights a feature story, "Environmental Health Innovations During the COVID-19 Pandemic," that shares the stories of these award winners and their innovative programs.

See page 32.

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PRESIDENT'S MESSAGE

Roy Kroeger, REHS

Environmental Health Has More to Do!

If you have followed my columns each month, you may recall that I mentioned in my first column about reaching out to environmental health programs that we do not think of every day. We all understand that environmental health exists at the intersection of the environment and human health. The climate in which we live affects our health in profound ways. Environmental health professionals are working hard every day to prevent disease and poor health through food safety, water quality, air quality, and hazardous materials program implementation.

Our environment, however, is so much more than just these few but significant programs. I want to talk about environmental health issues beyond those that we think of every day. Healthy community design, sustainability, climate change, and public health preparedness are significant environmental health concerns that rarely rise to the top of our to-do list. Yet, each of these is contributing to declining health conditions in our country.

Of the four programs mentioned, public health preparedness receives the most financial support from government agencies. Following the 9/11 attack, President George W. Bush pledged that the country would improve public health's response. In early 2002, that administration approved nearly $1 billion to strengthen state and local public health departments. That money has been reduced drastically since 2002 but still exceeds expenditure for most environmental health-related programs.

With the recent hurricane that hit Louisiana and then traveled through the eastern U.S., federal, state, and local health departments responded more collaboratively than they have in the past. The improved response was due to training and resources that have evolved since 9/11 and Hurricane Katrina. Hurricane Ida had much stronger winds than Katrina and the rain continued throughout the country, but preparedness helped prevent a disaster similar to Katrina. Preparedness funding has been cut significantly since 9/11. Less funding equates to a decrease in training and resources for the future. Hopefully we have learned that being prepared is worth every dollar spent on it.

I want to talk about environmental health issues beyond those that we think of every day.

Climate change is the next environmental health concern that I believe needs more attention. I do not want to start arguing the politics of whether this problem is man-made or not. The real issue is that the climate has changed and environmental health has a role in protecting public health. Vectors, disease, storms, heat waves, drought, fires, floods, and even aquifer depletion affect human health. Higher summertime and lower wintertime temperatures lead to an increase in exposure deaths. These deaths are more common in low-income and impoverished populations with increased exposure and less ability to protect themselves from temperature extremes. Most of us are also aware that climate change has allowed vectors to bring new diseases into our country and has expanded the range of existing conditions further inland and to the north.

Environmental health professionals are working in many ways to improve health regarding climate change. Some areas of interest include reducing greenhouse gases released to the environment and improving water conservation in drier climates. Professionals have worked to minimize the vectors that carry disease. They continually prepare to respond to natural disasters. Environmental health is there to mitigate exposure to sewage in flooding events and provide public information about smoke caused by wildfires.

Sustainability, natural resources, water quantity, and solar, wind, and hydroelectric power are all areas where environmental health can improve health. Many of these programs work to reduce climate change. Additional programs can improve health with the use of technology and research. Many parts of the central U.S. are depleting aquifers faster than they can be recharged and sustainable practices can reduce water use and improve agricultural processes. The transportation of fossils fuels has become more polarized than the extraction ever was; sustainable policies can decrease fossil fuel consumption and reduce the need to transfer as much energy across the country. Reuse and recycling have become more complex and expensive than ever. The improper disposal of prescription drugs pollutes water supplies. Failure to renovate homes to make

them more energy efficient is wasting valuable natural resources. All of these examples are sustainable practices that environmental health professionals are part of.

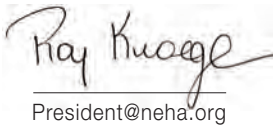
Building healthy communities is the last program that I want to mention in this column. It is also one of my favorites. As a former runner and current bicyclist, I often review new subdivision plans with connectivity in mind. Can I walk or bicycle from point A to point B and beyond? Unfortunately, the answer is usually no! In a perfect environment, everyone would have access to everything they need within their neighborhood. Work, groceries, entertainment, and recreation would all be located within walking or biking distance. Instead, we have become a society where most people want everything around them to be the same as what is around others. This desire has led to cookie-cutter subdivisions where residents have to drive for everything they want or need—driving your kids to their friend's house or school, driving to work, driving to the store, and driving almost anywhere else we want to be.

As a consequence, our society has become heavier and much less healthy than our ancestors. Our country has made great strides to improve sanitary conditions and advance the technology and knowledge in healthcare. For nearly a century, people in the U.S. have seen their life expectancy increase each year. In 2014 that life expectancy started to decrease slowly. And now, even prior to COVID-19, heart disease and obesity have started to make those numbers fall more quickly. Good community design will improve health and increase the safety of walkers, runners, and bicyclists. All the while, we are improving air quality through decreased traffic and improving people's mental well-being.

None of these programs is sexy or easy, and most of them are expensive. And there is no readily available funding method to pay for most of them. Many communities are already cash-strapped and do not want to increase taxes to pay for these critical services.

So, how can environmental health make a difference? Changes are not going to happen overnight but they need to start somewhere. People need to be educated and those interested need to be provided with the tools to make a difference. The National Environmental Health Association (NEHA) cannot pay for these programs but we can build a trained cadre of professionals who want to make a difference. We can work with our federal partners at the U.S. Environmental Protection Agency and the Centers for Disease Control and Prevention to build tools to help the dedicated professionals who want to make a difference. NEHA can provide training through our Annual Educational Conference & Exhibition, online training, and webinars.

Working to include more of these critical environmental health professionals in our association will help NEHA grow and at the same time, expose current members to environmental health programs that are important to everyone's future.



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Built Environment Attributes and Preparedness for Potential Gun Violence at Secondary Schools

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Abstract **Characterizing built or physical environment risk factors for gun violence in and around K-12 schools is an emerging, complex children's environmental health need. We used data on New Jersey high schools on gun violence-related preventive practices and school (building and facility) environmental controls in place in fall 2019. We assimilated publicly available secondary data from state education agencies, school websites, and Google Maps to identify aspects of high school indoor and outdoor built environments, including fields, gymnasiums, auditoriums, and athletic fields and types of seating. We analyzed statewide data and stratified by county, region, and urban/nonurban locale. Results identified deficient environmental aspects of schools; however, if addressed, then more effective responses to active shooter scenarios could occur. These deficits included unmonitored entrances, security systems with missing cameras, hidden stairwells, and dense foliage around school buildings. Our research was also relevant to the scope of practice and services highlighted by the recent Understanding the Needs, Challenges, Opportunities, Vision, and Emerging Roles in Environmental Health (UNCOVER EH) initiative. Future research can help inform local emergency preparedness, response efforts, and school priorities for design, operations, and maintenance.**

Introduction

Firearms present public health issues at schools. During 1994–2018, gun-related injuries accounted for 70% of fatalities in school-associated youth homicides or violent deaths (Holland et al., 2019; National Center for Education Statistics, 2021); most incidents occurred in secondary or high schools and were motivated by gang-related activity or other interpersonal disputes with White male perpetrators (Holland et al., 2019; Katsiyannis et al., 2018; Vossekuil et al., 2004). At U.S. high schools during 2014–2018, 0.5–0.8% of surveyed students annually reported carrying a handgun and 50% of surveyed high schools experienced ≥1 student carrying a gun (Docherty et al., 2020). In addition, psychological injuries can be sustained after direct experiences with school-based shootings (Rowhani-Rahbar et al., 2019).

The New Jersey (NJ) Safe Schools Program reviews safety and health plans once every 5 years for the NJ Department of Education that pertain to environmental health and workplace safety regulations for high school career/technical/vocational programs for students between the ages 14–21 in hazardous settings. The goal of the plan is to reduce injury and illness as well as increase safety practices among school administrators, teachers, staff, and students. To date, examined plans

TABLE **1**

Participant Response Summary for Questions 4 and 16 Regarding School Built Environment Features

Level of Concern/ Worry of a Mass Shooting at School	Aspect of the School Built Environment That Most Exacerbates the Potential for a School Emergency on School Property					
	Unmonitored Entrances	Lack of Security Systems	Hidden Stairwells	Dense Foliage Around the School	Total	% of Total
Worried	47	14	16	8	85	58.6
Not worried	32	10	9	6	57	39.3
Unsure/I do not know	2	1	0	0	3	2.1
Total	81	25	25	14	145	100

pertained to fire, evacuation, and lockdown drills; however, there has not been a specific focus on built or physical environment features of high school campuses.

There is a growing need to identify aspects of built or physical environment features in and around K-12 schools that can serve as either barriers or facilitators to responding effectively in an active shooter scenario. Built environment refers to man-made structures, features, and facilities including specific rooms, type of seating, landscaping, and stands and fences around sports fields. Some of these structures, both indoors and outdoors, are used for large and crowded gatherings (i.e., gymnasiums, auditoriums, sports fields). These areas can be targets for violent attacks. Campus indoor and outdoor environmental factors in high schools can be incorporated into school safety, emergency preparedness, and response efforts specific to preventing gun violence, such as planning for and conducting lockdown drills and active shooter drills.

One study has suggested some U.S. elementary schools were more likely to lock exits after mass school shootings such as Columbine, Colorado, in 1999, but little to no evidence exists about precautions being implemented for outdoor gathering areas (Curran et al., 2020). Fields near roads or parking lots at high schools could also make the area more dangerous for those on the fields or in the bleachers. If an altercation occurs on the roads or in a parking lot during normal school hours, or during or immediately before or after a school event, a gunshot could potentially harm people on and around the fields or bleachers. This potential for harm includes any stray gunshots not necessarily intended to harm bystanders. Permanent concrete seating with no gaps in between levels could be an effective barrier to prevent stray gunshots from reaching spectators and players. Permanent seating in an auditorium might also be a more effective barrier than removable seating. Prior literature reviews examined attempts to prevent school-based shootings (Jonson, 2017; Jonson et al., 2020), the role of the social and physical school environment in reducing school-based violence (Johnson, 2009), and the influence of crimes or delinquency on- and off-campus with intensified security, policing, and punishment protocols (Hirschfield, 2018) in the aftermath of mass shootings at schools in the last two decades.

To our knowledge, our study is the first to examine a) available data pertaining to built environment characteristics both inside and outside high school campuses and b) the perception of effectiveness of gun violence-related controls. This study focused on high schools in NJ. We describe selected findings from a statewide online survey conducted in the 2019–2020 school year about school built environment features and possible controls to restrict or potentially prevent the presence of guns and subsequent violence (Campbell et al., 2021; Shendell et al., 2021).

Methods

Our study survey was approved by the Rutgers University Institutional Review Board. Participants were eligible if they completed the NJ Safe Schools Program trainings required of school-sponsored work-based learning (formerly structured learning) experiences during prior school years (2014–2019) and had provided their email address. Details of how this cross-sectional survey design was implemented can be found in Campbell et al. (2021) and Shendell et al. (2021). Two questions (#4 and #16) from this survey will be summarized in this article:

- How worried are you about the potential for a mass shooting event at your school? Answer options were very worried, moderately worried, not really worried, and unknown/do not know.
- In your opinion, which aspect of the school built environment most exacerbates the potential for a school emergency on your school's property? Answer options were unmonitored entrances, lack of security systems (e.g., no video cameras, security officers, or entry metal detectors), hidden stairwells, and dense foliage around school.

We identified public high schools in NJ, including those with attached middle and/or elementary schools. Addresses for these schools were identified and verified using Google Maps, and campuses were examined via photos (i.e., satellite images) available online. For each high school, we noted the following facilities: outdoor football, track, soccer, baseball or softball stadiums and/or fields; outdoor tennis courts; and outdoor swimming pools. Through review of data available via Google Maps (photos dated 2020), we also determined if any of these outdoor sports and recreation facilities were near parking lots and/or adjacent to public roads.

To determine indoor built environments, we used and searched Google Images to establish if the school had a gymnasium and/or auditorium, and if so, if permanent or nonpermanent

TABLE **2**

Identified Indoor Built Environment Features at Assessed Secondary and High Schools Related to Occupancy by Larger Groups of People Across New Jersey by Region and County

Region Designation I	Region Designation II	County	Presence of a Gymnasium or Multipurpose Room With Seating				If Yes				Presence of a Theater or Auditorium With Seating				If Yes	
			Yes		No		Wooden Retractable Seating		Plastic or Metal Temporary Retractable Seating		Yes		No		Seating Is Permanent[a]	
			#	%	#	%	#	%	#	%	#	%	#	%	#	%
North New Jersey (n = 11 counties)	North New Jersey (n = 7 counties)	Bergen	38	72	15	28	26	68	12	32	37	68	17	32	33	89
		Essex	22	51	21	49	9	41	13	59	26	60	17	40	24	92
		Hudson	19	76	6	24	3	16	16	84	12	48	13	52	12	100
		Morris	20	74	7	26	3	15	17	85	20	74	7	26	20	100
		Passaic	13	46	15	54	2	15	11	85	13	46	15	54	12	92
		Sussex	8	67	4	33	3	37	5	63	6	50	6	50	6	100
		Warren	6	86	1	14	2	33	4	67	6	86	1	14	6	100
	Central New Jersey (n = 7 counties)	Hunterdon	4	80	1	20	0	0	4	100	3	60	2	40	3	100
		Middlesex	20	56	16	44	6	30	14	70	26	72	10	28	24	92
		Somerset	11	79	3	21	4	36	7	64	10	71	4	29	10	100
		Union	18	49	19	51	4	22	14	78	19	51	18	49	19	100
South New Jersey (n = 10 counties)		Monmouth	22	59	15	41	4	18	18	82	16	43	21	57	13	81
		Ocean	15	63	9	37	13	87	2	13	15	63	9	37	15	100
		Mercer	13	76	4	24	5	38	8	62	11	65	6	35	11	100
	South New Jersey (n = 7 counties)	Atlantic	10	83	2	17	9	90	1	10	7	58	5	42	7	100
		Burlington	13	62	8	38	4	31	9	69	19	90	2	10	18	95
		Camden	15	71	6	29	8	53	6	43	13	62	8	38	12	93
		Cape May	4	80	1	20	1	25	3	75	3	60	2	40	3	100
		Cumberland	2	25	6	75	0	0	2	100	2	25	6	75	2	100
		Gloucester	15	83	3	17	3	20	12	80	13	72	5	28	15	100
		Salem	5	56	4	44	0	0	5	100	2	22	7	78	2	100
Overall statewide study sample			293	63.8	166	37.0	109	37.2	183	62.5	279	60.6	181	39.4	267	95.7

Note. N = 460. One location only had a theater or auditorium on site.

[a] Versus not permanent or unknown.

seating was present, as well as if the bleachers had wooden, plastic, or metal retractable seating. For further investigation of indoor and outdoor built/physical environments, we searched school websites for images or videos. Search terms used to find gymnasiums were "school gym" or "school basketball." Search terms used to find auditoriums were "school auditorium" or "school theater." For the study data analyses presented in this article, 460 high schools were identified.

Using a study data dictionary, Microsoft Excel was used to enter either yes or no (1 = yes, 0 = no) and dummy variable coding for categorical variables. Once we had identified the high schools, we conducted a Google Maps search to identify if there were outdoor fields on campus (1 = yes, 0 = no). Next, we identified types of fields present and marked 1 for yes and 0 for no for each type of field and noted the type of seating present (permanent or nonpermanent). This process was repeated for the indoor microenvironments. If there was a gymnasium or auditorium present, then we proceeded to note the type of seating present (permanent or nonpermanent, retractable, and if made of metal, plastic, or wood).

Data were analyzed on a statewide level as well as stratified by county, urbanicity (urban versus nonurban counties), and region of NJ (North and South, 10–11 counties each; North, South, and Central, 7 counties each).

TABLE **3**

Identified Outdoor On-Campus Built Environment Features at Secondary and High Schools Related to Occupancy by Larger Groups of People Across New Jersey by Region and County

Region Designation I	Region Designation II	County	Presence of a Stadium and Any Other Ball Field(s) or Court(s) on Campus				If Yes															
			Yes		No		Presence of a Stadium With Field With Seating [a]		Presence of Adjacent or Nearby Baseball Field(s) [b]		Presence of Adjacent or Nearby Softball Field(s) [b]		Presence of Adjacent or Nearby Tennis Courts [b]		Presence of Other Adjacent or Nearby Field(s) [b]		Presence of Adjacent or Nearby Swimming Pool [b]		Field(s) Are Near Parking Lot(s) [b]		Field(s) Are Near Adjacent Road(s) [b]	
			#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%
North New Jersey (n = 11 counties)	North New Jersey (n = 7 counties)	Bergen	45	85	8	15	36	80	35	78	29	64	24	53	27	60	0	0	29	64	22	49
		Essex	17	40	26	60	14	82	12	71	11	65	10	59	12	71	2	12	5	29	4	24
		Hudson	7	28	18	72	6	86	4	57	1	14	1	14	3	43	0	0	0	0	2	29
		Morris	21	81	5	19	19	90	15	71	17	81	12	57	20	95	0	0	16	76	3	14
		Passaic	9	32	19	68	8	89	6	67	4	44	4	44	6	67	0	0	6	67	4	44
		Sussex	9	75	3	25	9	100	7	78	9	100	9	100	9	100	0	0	5	56	2	22
		Warren	6	86	1	14	4	67	6	100	6	100	3	50	6	100	2	33	4	67	2	33
	Central New Jersey (n = 7 counties)	Hunterdon	5	100	0	0	4	80	5	100	4	80	3	60	5	100	0	0	1	20	2	40
		Middlesex	25	68	12	32	16	64	22	88	17	68	13	52	23	92	1	4	10	40	9	36
		Somerset	11	79	3	21	10	91	6	55	8	73	4	36	10	91	0	0	9	82	3	27
		Union	17	45	21	55	8	47	7	41	15	88	6	35	9	53	1	6	7	41	7	41
South New Jersey (n = 10 counties)		Monmouth	25	71	10	29	23	92	24	96	23	92	19	76	24	96	0	0	17	68	9	36
		Ocean	16	67	8	33	15	94	15	94	15	94	13	81	15	94	0	0	13	81	7	44
		Mercer	11	69	5	21	11	100	10	91	9	82	7	64	9	82	1	9	9	82	4	36
	South New Jersey (n = 7 counties)	Atlantic	11	92	1	8	10	91	10	91	11	100	9	82	10	91	0	0	7	64	6	55
		Burlington	19	86	3	14	19	100	15	79	14	74	11	58	16	84	0	0	11	58	5	26
		Camden	16	76	5	24	15	94	14	88	12	75	13	81	14	88	0	0	5	31	6	38
		Cape May	4	80	1	20	2	50	3	75	2	50	2	50	3	75	0	0	2	50	3	75
		Cumberland	4	57	3	43	2	50	4	100	3	75	3	75	4	100	0	0	1	25	3	75
		Gloucester	17	94	1	6	15	88	17	100	17	100	13	76	17	100	1	6	7	41	4	24
		Salem	6	67	3	33	5	83	3	50	5	83	4	67	5	83	0	0	4	67	2	33
Overall statewide study sample			301	65.9	156	34.1	251	83.4	240	79.7	232	77.1	183	60.8	247	82.1	8	2.7	168	55.8	109	36.2

Note. N = 460. Three locations did not have a stadium or any ball field(s) for games.

[a] Includes fields for football, lacrosse, soccer, track and field, etc.

[b] With limited seating and/or standing room.

Maps were created in ArcView GIS after geocoding of addresses of schools/districts for the respondents (n = 139) in our statewide online survey study and the 460 identified high schools with information available online about the campus site (school websites or Google Maps). We obtained the NJ county shape file in ArcView GIS and then summarized the number of schools per county with the addresses of the schools. We used EJScreen to map the demographic index (U.S. Environmental Protection Agency, 2021), which averages the two demographic indicators—Percent Minority and Percent Low-Income—and multiplies by the population of the block group. These data were aggregated from block group to 21 NJ counties for consistent units of analysis. NJ State Police data reported for 2019 were cleaned, managed, and aggregated in Microsoft Excel and then mapped for the 21 NJ counties.

Results

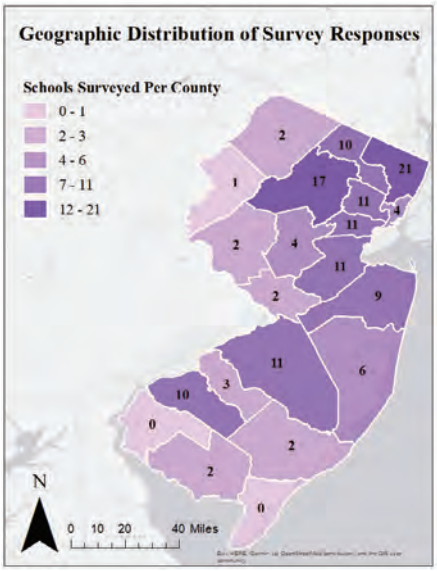
Survey Results

Of 151 total survey respondents, 145 responded to both questions. Of the respondents, 59% indicated they were worried about a potential mass shooting at their high school and 39% indicated they were not worried. Of respondents who were worried about mass shootings, 32% indicated unmonitored entrances and exits were

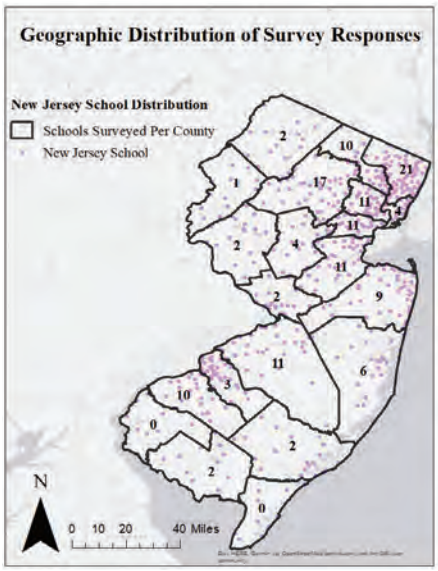
FIGURE **1**

Map of Geographic Distribution of Survey Responses by County (A) and for Schools Assessed (B) in New Jersey

A



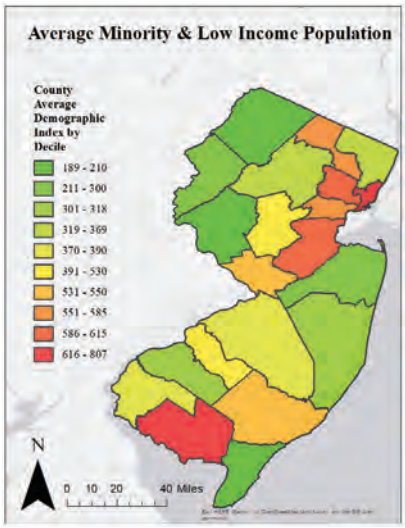
B



Note. For A and B, $n = 139$ for survey response and $n = 21$ for county. For B, each public high school assessed ($n = 460$) for built/physical environment features are represented by individual points on the map.

FIGURE **2**

Decile of Average Demographic Index by County in New Jersey in 2019



Note. Census block group values were averaged to the county level, which show the average number of people who are low income, minority, or both. The Demographic Index was created by the U.S. Environmental Protection Agency's EJScreen by averaging two demographic indicators—Percent Minority and Percent Low-Income—and multiplying by the population of the block group. Data were obtained in 2019 from EJScreen.

aspects of the built environment exacerbating the potential for a school emergency. Overall, whether or not the participant was worried about a school mass shooting, more than one half (56%) of survey respondents believed unmonitored entrances at high schools are an issue to be addressed. Among survey respondents who were worried or not worried about the possibility of a mass shooting on school property, respondents additionally indicated a lack of security systems (17%), hidden stairwells (17%), and dense foliage around the school (10%) as additional aspects of the built environment to be addressed (Table 1).

Indoor Environment Features

Our initial analysis found 64% of high schools have a known gymnasium or multipurpose room with permanent seating; 37% of those with seating have permanent wooden retractable seating, while 63% had plastic or metal temporary retractable seating (with 1% not certain). Also, 61% of high schools had known auditoriums and 96% had permanent seating (verses nonpermanent seating or unknown seating configurations and types). Monmouth County high schools had the lowest percentage of auditoriums with permanent seating at 81%.

When stratified by urban counties (n = 10) versus nonurban counties (n = 11), we found there was almost no difference in the number of high schools with a gymnasium or multipurpose room with seating (65% and 67%, respectively). There was, however, a difference in the type of seating. Urban high schools had a higher quantity of wooden seating (39%) versus nonurban high schools (26%), and nonurban schools more often had plastic or metal temporary retractable seating (74%) versus urban schools (61%). The presence of an auditorium with seating in urban versus nonurban schools was similar (60% versus 58%, respectively), as was permanent seating (96% versus 98%, respectively). Table 2 provides a summary of these indoor environment features.

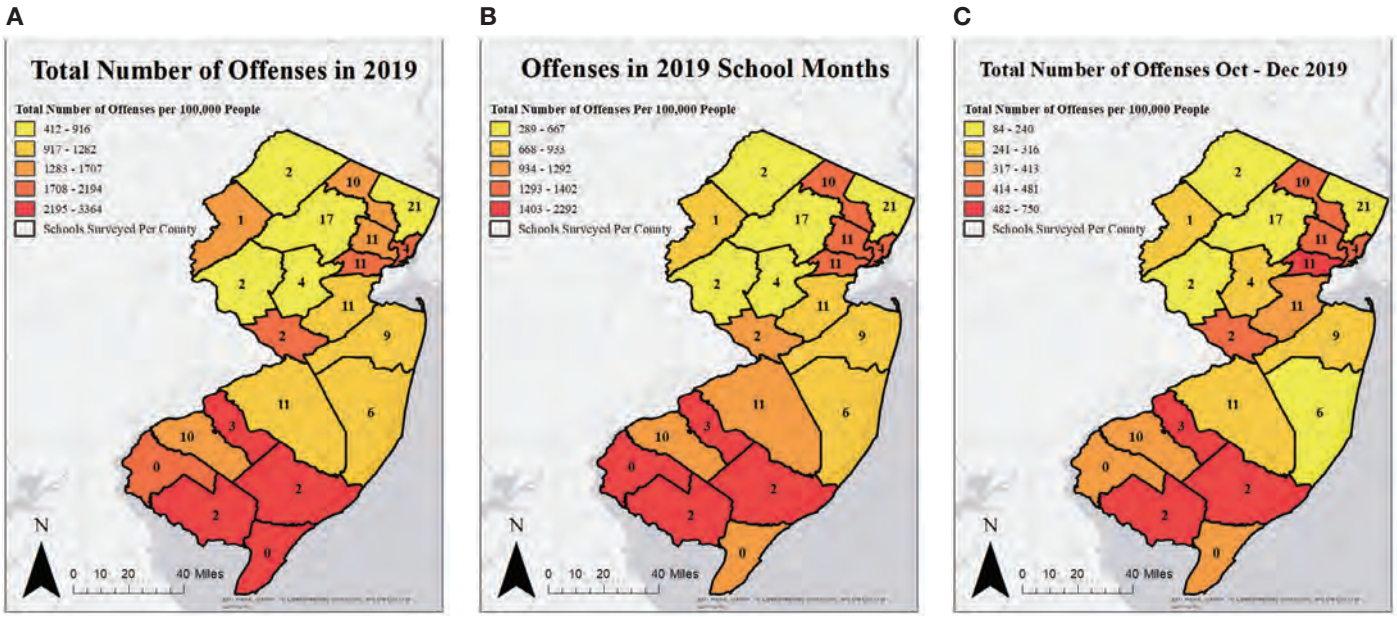
Outdoor Environment Features

Approximately 2 out of 3 (66%) of NJ high schools have a stadium or other type of sports fields or courts present on campus. Specifically, 80% have baseball fields, 77% have softball fields, 61% have tennis courts, 82% have other fields (e.g., soccer/multipurpose), and 3% have outdoor swimming pools. Of the high schools, 83% have a field with permanent seating, 56% have at least one field near a parking lot, and 36% have at least one facility on campus directly adjacent to a public road. Atlantic, Bergen, Burlington, Mercer, Monmouth, Morris, Ocean, Passaic, Salem, Somerset, Sussex, and Warren counties had more than 50% of their schools with fields near parking lots. Somerset County had 82% of their school's fields near parking lots. Atlantic, Bergen, Cape May, Cumberland, Hunterdon, Ocean, Passaic, and Union counties had >40% of their fields adjacent to roads; both Cape May and Cumberland counties had 75% of their fields adjacent to roads.

When stratified by urban or nonurban counties, we found 62% of high schools in urban areas have a sports field/court/stadium on campus versus 78% in nonurban ar-

FIGURE **3**

Total Number of Offenses per 100,000 Population by County in New Jersey in 2019



Note. $n = 21$ for county. A) Total number of offenses in 2019; B) Total number of offenses in the 1st, 2nd, and 4th quarters of 2019 (i.e., months that represent the school year); C) Total number of offenses in the 4th quarter of 2019. Total number of surveyed schools in each New Jersey county is labeled in each map. Offenses include murder, rape, robbery, assault, burglary, larceny, and auto theft. Data were obtained by quarterly reports from the New Jersey State Police's Current Crime Data via its Uniform Crime Reporting (www.njsp.org/ucr/current-crime-data1.shtml).

eas. There is, however, not a large difference in the percentage of high schools with the presence of a stadium with a field on campus (if there is any type of field present on campus). Of urban high schools, 49% have fields near parking lots and 37% have fields near public roads, compared with nonurban high schools with 56% of fields near parking lots and 40% of fields near public roads. Table 3 provides a summary of these outdoor environment features.

Geolocation

Figure 1A shows the geographic distribution of survey responses (n = 139) by county. Most survey respondents were from Bergen and Morris counties, with the fewest survey respondents (no responses) received from Cape May and Salem counties. Figure 1B shows the geolocations of high schools in NJ (n = 460). Specific parts of NJ, such as the northeastern counties and the southwestern counties, had more survey respondents. Figure 2 indicates the average minority and low-income populations by county by the average demographic index by decile who are low income, minority, or both. Cumberland and Hudson counties have the highest demographic index, whereas Hunterdon and Sussex counties have the lowest index.

Figure 3A suggests more offenses per 100,000 people overall in Atlantic, Camden, Cape May, and Cumberland counties, compared with fewer offenses per 100,000 people in Bergen, Hunterdon, Morris, Somerset, and Sussex counties in 2019. Figure 3B refers to the 1st, 2nd, and 4th quarters of 2019, which represent when school was in session (i.e., second half of 2018–2019 school year and first half of 2019–2020 school year). Overall, data were similar between the three quarters of 2019 (Figure 3B) and the full 2019 year (Figure 3A), except for a slight increase of offenses in Mercer and Salem counties. Figure 3C indicates the number of offenses solely in the 4th quarter (October to December, which was the fall semester of the 2019–2020 school year). These data suggest how, with the exception of Union County, offenses per 100,000 people were either similar to or lower than the whole year of 2019 (Figure 3A) or the three school-year quarters of 2019 (Figure 3B).

In summary, Figures 1–3 provided community-level context for teachers working in NJ high schools when they answered our statewide online survey on gun violence.

There does not seem to be an association or correlation between the average demographic index by decile, number of schools per county, or offense rate in a county on any factors regarding indoor or outdoor built environments. This finding is in part because in this study, 12 NJ counties had >50% of schools with fields near parking lots, 8 counties had >40% of schools with fields near public roads, and most schools tend to have gymnasiums and auditoriums with permanent seating.

Discussion

Among indoor environmental concerns, respondents were worried about the unmonitored entrances of the schools. While this concern is legitimate, congregations of people and unsafe built environments can also increase risk for violence during active shooter events.

We found great variability regarding the indoor built environment among high schools

in different NJ counties (Tables 1 and 2). The overall average of counties with high schools with auditoriums was 61%, with Salem County having the lowest at 22% and Warren County having the highest at 86%. When separated by region, the average percentage of high schools with auditoriums was 61% in North and Central Jersey and 56% in South Jersey. We found most schools have permanent seating indoors. This type of seating can allow for temporary hiding places before evacuation of the building area through the nearest well-marked exit or when advised by law enforcement (Federal Emergency Management Agency, 2018).

Overall, 64% of high schools have a gymnasium with permanent seating. When stratified by regions, the range of the percentage of high schools with a gymnasium with permanent seating was similar (66–68%), with Cumberland County having the lowest percentage at 25% and Atlantic County having the highest at 83%. There was little difference in the percentage of high schools with a gymnasium when stratified by urban versus nonurban.

Like indoor built environments, there is also great variability in outdoor built environments (Table 3). South Jersey had the highest percentage of high schools by region with fields (79%), whereas North Jersey had the lowest percentage (61%). South Jersey also had the lowest percentage of high schools with fields near parking lots with an average of 48%, while Central Jersey had the highest percentage at 59%. South Jersey, however, had 46% of their high schools with fields adjacent to roads, while North Jersey had only 31%. South Jersey had the highest percentage of high schools near roads, but the least near parking lots, which suggested no correlation between if a NJ high school is near a road or a parking lot.

In relation to the high rate of offenses in South Jersey, making exterior adjustments at schools near roadways and with fields could provide additional safety measures during mass gatherings (e.g., sporting events, school assemblies). Permanent seating could be safer than temporary seating outdoors because generally there are not gaps in the seating; therefore, gunshots from adjacent parking areas or roads cannot enter the stadium or field through the gaps and potentially hit spectators. Physical or landscaping barriers could also provide potential lifesaving protection from nearby gun violence.

There are more high schools in nonurban areas of NJ with more fields near parking lots and public roads and these schools typically are located farther from emergency response services compared with high schools in urban areas. The nonurban schools could have a more holistic approach to gun violence prevention, including regular checks and maintenance on doors and entrances/exits, management of landscaping, and education for teachers and students on best practices during an active shooter event.

For example, Cape May in South Jersey, a nonurban county, has a total of 5 high schools (4 with the presence of a field), and, overall, 75% of high schools have fields adjacent to public roads. Bergen in North Jersey, an urban county, has 53 high schools (45 with the presence of fields) and almost one half (49%) of the high schools are adjacent to roads. The number of high schools per county does not affect the placement of the fields. Thus, for any of these schools, built and physical environment attributes are relevant and important to consider in planning for potential emergencies, including gun violence.

For outdoor environments such as fields or seating, which were not examined in the NJ Safe Schools Program survey, most respondents were worried about the unmonitored entrances of the schools from these outdoor areas. Unmonitored entrances and exits are parts of the constructed physical environment where improvements can be made to support future school planning for natural disasters as well as other emergencies such as gun violence (Limbos & Casteel, 2008). Future studies can explore if outdoor open fields are also a concern, as most fields are unmonitored by school security.

One multidisciplinary approach related to built/physical and natural environments and their role in promoting positive behaviors and reducing crime, including violence with guns and other weapons, is crime prevention through environmental design (CPTED) (Carter & Carter, 2001; Centers for Disease Control and Prevention [CDC], 2021a; The International Crime Prevention Through Environmental Design Association, n.d.; Lamoreaux & Sulkowski, 2020; Vagi et al., 2018). See Online Supplemental Information Part I for more information (www.neha.org/jeh/supplemental).

In the social-ecological model, physical, mental, and social support includes personal and societal factors contributing to the development of an individual's security and well-being (Bronfenbrenner, 1979; CDC, 2021b). See Online Supplemental Information Part II with Supplemental Figure S1 (www.neha.org/jeh/supplemental).

This research is within the scope of environmental health by nature of the practices and services highlighted by the recent Understanding the Needs, Challenges, Opportunities, Vision, and Emerging Roles in Environmental Health (UNCOVER EH) initiative. Specifically, for example, among the most common program areas in which environmental health professionals work, according to UNCOVER EH, schools ranked fourth (46%) and emergency preparedness and response ranked third (47%). Emergencies include natural disasters due to extreme weather events as well as emerging environmental health, public health and safety issues, plus concerns facing communities such as gun violence and various intentional and unintentional injuries. Moreover, day care and early child development facilities ranked 10th (34%). Environmental health professionals assess built and physical environments, indoor air quality, injuries, etc. (Brooks et al., 2019; CDC, 2019; Gerding et al., 2019, 2020).

Study Limitations

First, information about school gymnasiums and auditoriums was taken from photos on the internet. Therefore, it is possible that multipurpose spaces do exist in the school but were not accounted for in this study's secondary analysis portion. Second, we did not examine off-campus city/town or county fields potentially available for use to NJ high schools. Third, any updates to indoor facilities or outdoor fields on campus not provided on websites or through Google Maps might have occurred after the data collection phase of this study. Finally, due to the unit of analysis (county), the modifiable areal unit problem could limit our ability to see variation in offenses and the demographic index. Due to the general lack of systematic data collection on built environments and building quality of high schools in the U.S. and elsewhere, however, this study used a methodology that could be replicated elsewhere to address a gap in research.

Study Strengths

First, there was the ability to explore and categorize indoor and outdoor built/physical

environments of every public high school in NJ in the context of our statewide survey on gun and other weapons-related violence. Second, mapping enhanced our understanding of the density, demographics, and baseline community crime levels around schools. Third, this study collected perceptions directly from a statewide sample of education professionals at NJ high schools who supervise students as well as other staff.

Conclusion

To our knowledge, this study is the first to examine available data on public secondary or senior high school built environment features both indoors and outdoors in relation to preventive practices and environmental area controls in place or perceived as needed to potentially address active school shooter scenarios. This study highlights the importance of the school building and campus site during an active shooter event and suggests specific places for public health intervention to increase school safety. This study also warrants more research, including for primary and elementary schools as well as for middle schools and junior high schools.

At present, for environmental and public health professionals working with schools, our initial results suggest some future actions. First, post a pop-up text box with pertinent safety information on school websites on the day prior to an event involving bigger gatherings. Keep this text up through the end of such gatherings—whether indoors or outdoors and at any time of the day or week. Such risk communication informs people that entrances and connecting stairwells are secured (e.g., no one takes bags into auditoriums or sporting events areas without school staff searching belongings or checking with a metal detector wand, etc.). Second, protective structures or barriers (but not including dense vegetation) between roads/parking lots and school fields could further protect people on outdoor fields from potential altercations in these adjacent outdoor areas.

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AEHAP
ASSOCIATION OF ENVIRONMENTAL HEALTH ACADEMIC PROGRAMS

STUDENT OPPORTUNITY

2022 AEHAP STUDENT RESEARCH COMPETITION

Environmental health students enrolled in a National Environmental Health Science and Protection Accreditation Council-accredited program at an AEHAP member school are eligible. Undergraduate and graduate students are encouraged to enter. Four winners will be selected.

Award winners will receive **$1,000** and up to **$1,500 in travel expenses** to make a 20-minute platform presentation with poster at the NEHA 2022 Annual Educational Conference & Exhibition.

All entrants will also be welcome to present at the AEHAP 2022 Student Symposium.

Submission period will open January 10, 2022.

Deadline to submit is February 18, 2022.

Submit entries to Jamie Hisel at jamie.hisel@eku.edu.

For more information and research guidelines, visit www.aehap.org/srcandnsf.html.

AEHAP gratefully acknowledges the volunteer time and efforts of program faculty members who serve as judges and advisors for this competition.

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STUDENT RESEARCH INTERNSHIP

2022 STUDENT RESEARCH INTERNSHIP SPONSORED BY NSF INTERNATIONAL

NSF International is again working with AEHAP to provide a 2022 student research internship opportunity. Undergraduate students from an active AEHAP school with a National Environmental Health Science and Protection Accreditation Council-accredited program are eligible to apply.

The winner will be awarded $3,500 and travel/registration reimbursement to attend the NEHA 2022 Annual Educational Conference & Exhibition.

Project Description

The winner will spend 8–10 weeks working on a research project identified by NSF International. This year's project will focus on state standards and regulations for onsite wastewater and sewage systems.

Application deadline: December 10, 2021

Submit applications to Jamie Hisel at jamie.hisel@eku.edu.

For more information and application submission guidelines, visit www.aehap.org/srcandnsf.html.

Isolation of Antimicrobial-Resistant Enterobacteriaceae and Nonfermenting Bacteria From Livestock-Associated Ambient Particulate Matter

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Abstract **The issue of antimicrobial resistance, particularly among Gram-negative enteric bacteria, in agricultural settings has been documented in literature and continues to be a growing public health concern. Among the Enterobacteriaceae family, the presence of extended spectrum beta-lactamase (ESBL)-producing and carbapenem-resistant Enterobacteriaceae (CRE) are especially concerning because of the impact they have on healthcare worldwide. We employed a novel approach by constructing and placing adhesive air strips in a stockyard in Madison County, Kentucky. Samples were placed in enteric enrichment (EE) broth after collection and incubated for 24 hr. Samples that turned yellow due to fermentation were subsequently inoculated on ESBL and CRE screening media. We transferred colonies that grew on both plates onto MacConkey and sheep blood agar to use for further testing. We recovered 8 of the 10 placed air strips. Of the EE broth tubes, 7 of the 16 turned yellow, indicative of enteric bacteria. Of the 7 positive tubes, 5 isolates grew on ESBL and CRE screening media with only 1 isolate displaying pigmentation indicative of a resistant organism. We were able to isolate resistant enteric bacteria from particulate matter in an agricultural setting using our novel sampling approach.**

Introduction

The emergence of antibiotic-resistant microorganisms in animal and human medicine can be linked to increased consumption and misuse of antibiotics (Chapin et al., 2005; Gandolfi et al., 2011; van den Bogaard et al., 2001). Veterinarians and physicians prescribe antibiotics for therapy and mitigation of bacterial infections (van den Bogaard et al., 2001). Beyond medical therapy, livestock managers can choose one of two management strategies for administering antibiotics to their herds: 1) nontherapeutic use for promoting growth and efficiently feeding herds or 2) prophylactic use to preemptively address potential bacterial infections (Chapin et al., 2005). Antibiotic use in animal husbandry or livestock operations is estimated to be >20 million pounds per year in the U.S. (McEachran et al., 2015).

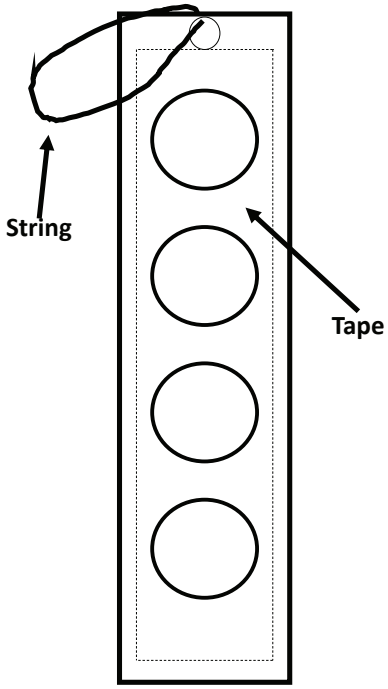
Research suggests that approximately 60–80% of antibiotic use among livestock in the U.S. is classified as nontherapeutic and is used to facilitate larger herd sizes on industrial farms (Dignard & Leibler, 2019). Larger herd sizes emanate from a growing national population and subsequent demands for livestock (Arfken et al., 2015). Increased demands led to a shift in the agricultural industry from a pasture-based approach to a confinement and concentration system (Gibbs et al., 2006). The amplification of nontherapeutic and prophylactic antibiotic use was sparked by the need of livestock managers to nurture animal growth and prevent zoonotic disease spread (Arfken et al., 2015).

Antibiotics can be incompletely metabolized during ingestion and thus not absorbed into the gut of the animal (McEachran et al., 2015). As a result, animal feces can contain unaltered antibiotics and subsequent metabolites. Upon entering the environment, feces can move beyond feed and livestock yards through rain runoff, use as a soil conditioner on agricultural fields, and/or airborne distribution (Arfken et al., 2015; Chapin et al., 2005; McEachran et al., 2015). Livestock yards temporarily house animals as they await transfer to their ultimate destination. During housing, the animals produce high volumes of urine and excrement in their holding areas. The urine and excrement dries and is ground up by the movement of the animals in the holding areas. The resulting dust, potentially containing antibiotic-resistant bacteria, is then aerosolized and easily becomes airborne (McEachran et al., 2015).

Aerosolization of livestock particulates can lead to occupational and environmental exposure. Arguably, livestock yard workers and individuals living near livestock yards face increased exposure to particulate matter containing antibiotic-resistant bacteria derived from livestock excrement (Arfken et al., 2015; Gibbs et al., 2006). Studies have utilized multistage cascade impactors (Gandolfi et al., 2011; Gibbs et al., 2006); digital, high-volume whole-air samplers (McEachran

FIGURE **1**

Paper Air Strips Constructed for Study



et al., 2015); and vacuum pumps (Arfken et al., 2015; Chapin et al., 2005) to collect particulate matter samples in an effort to isolate antibiotic-resistant bacteria derived from livestock yards and feeding lots.

Results from these studies can be useful in better understanding worker- and community-level exposures to antibiotic-resistant bacteria from livestock yards and feeding lots. Gibbs et al. (2006) isolated antibiotic-resistant bacteria (i.e., *Staphylococcus aureus*) from air samples taken within and 150 m downwind from a swine-confined feeding operation. In another study, microbial communities containing antibiotic-resistant genes and antibiotics were isolated from airborne particulate matter collected downwind and upwind from 10 cattle feed yards in the Southern U.S. (McEachran et al., 2015). Chapin et al. (2005) isolated multidrug-resistant bacteria (i.e., *Enterococcus*, coagulase-negative staphylococci, and viridans group streptococci) from a concentrated swine feeding operation in the mid-Atlantic region of the U.S.

TABLE **1**

Summary of Samples Yielding a Yellow Color in Enteric Enrichment (EE) Broth That Are Suggestive of Fermenting Enteric Bacteria

Sample #	Growth on ESBL Screening Media	Growth on CRE Screening Media	Growth on MacConkey Agar	Oxidase Test	API Identification
3	Colorless	Tan	Colorless	Positive	Unidentified nonfermenter
4	Colorless	Tan	Colorless	Positive	*Pseudomonas* spp.
5	Colorless	Tan	Colorless	Positive	*Pseudomonas* spp.
6	–	Blue-gray	Colorless	Positive	*P. aeruginosa*
7A	–	–	–	–	–
7B	Magenta with dark pink center	Tan	Strong pink	Negative	*E. coli*

Note. Sample 7A did not produce growth when it was subcultured to screening media and therefore was not investigated further. ESBL = extended spectrum beta-lactamase; CRE = carbapenem-resistant Enterobacteriaceae; API = analytical profile index.

As noted, research indicates that antibiotic-resistant bacteria can be isolated from particulate matter originating in livestock yards and feeding lots. To date, however, studies examining particulate matter for antibiotic-resistant bacteria used only active air sampling devices to collect air samples. The aim of our study was to isolate antibiotic-resistant bacteria from particulate matter collected at a livestock yard located in a rural Midwestern town in the U.S. using a passive air sampling technique (i.e., air strips).

Methods

To sample airborne particulate matter for potential drug-resistant Gram-negative enteric bacteria, 10 adhesive paper strips were constructed, sterilized, and suspended in the air at set distances throughout a local county stockyard (Figure 1). After 48 hr of exposure, each strip was aseptically collected and cut into two pieces. Each piece was placed into a tube of enteric enrichment (EE) broth for incubation, following modified and previously used procedures (Gazin et al., 2012; Zurfluh et al., 2013).

After approximately 24 hr of incubation at 36 °C, the broth tubes that turned yellow (indicative of fermentation) were vortexed and subcultured to HardyCHROM ESBL and ChromID Carba (carbapenemase-producing Enterobacteriaceae [CRE]) screening media following established recommendations for screening of antimicrobial resistance (Gazin et al., 2012). Broth tubes that stayed green were not evaluated further. Screening media were incubated for 24 hr at 36° C, after which any unique colony observed was subcultured to sheep blood and MacConkey agars and incubated for 24 hr at 36 °C. After incubation, gram stains and oxidase tests were performed on colonies from the sheep blood agar plates, while the MacConkey agar plates were observed for lactose fermentation. Identification and antimicrobial susceptibility testing were attempted using growth from the sheep blood agar plates.

Oxidase positive and negative isolates were tested on the analytical profile index (API) 20 NE and API 20E systems, respectively, following manufacturer's specifications. Antimicrobial susceptibility testing was performed on all isolates against 12 antimicrobial disks, using the Kirby-Bauer disk diffusion susceptibility test protocol (Hudzicki, 2009). After incubation of the Mueller-Hinton agar plates, zones of inhibition were measured in mm and the measurements for each disk were categorized

as resistant, susceptible, or intermediate based on Clinical and Laboratory Standards Institute guidelines (2015, 2016). ESBL and carbapenemase production were confirmed, when necessary, using Etest ESBL and ertapenem test strips as indicated.

Results

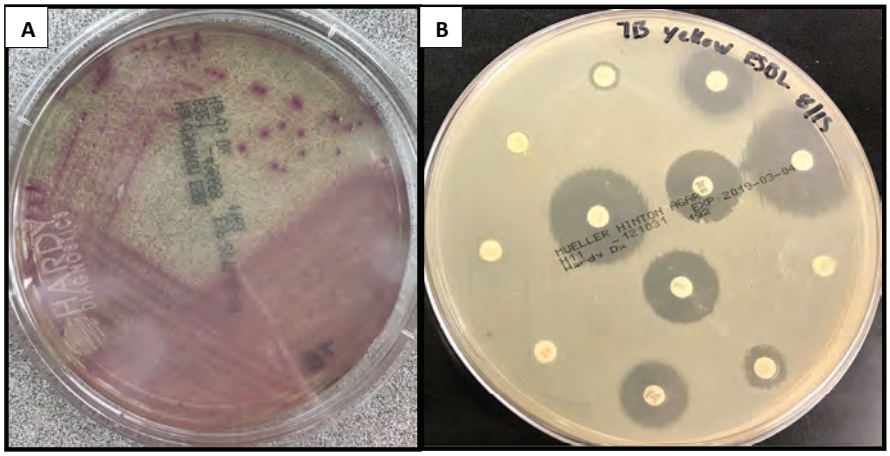
Of the original 10 adhesive strips hung throughout the stockyard, 8 were recovered after 48 hr of exposure, yielding 16 total samples that we incubated in EE broth. Following 24 hr of incubation, 6 of the 16 EE broth samples turned yellow, indicating fermentation (Table 1). Following subculture of these 6 broth samples, 4 yielded growth of a single isolate on the ESBL-screening medium, while 5 demonstrated growth on the CRE-screening medium. Among the 4 isolates that grew on the ESBL-screening medium, 1 demonstrated dark pink pigmentation indicative of ESBL-producing *E. coli* (Figure 2A), while 1 isolate exhibited blue-gray pigmentation suggestive of CRE (Table 1). One broth sample (7A) did not yield growth on either medium and therefore was not investigated further.

The probable ESBL-producing isolate from sample 7B exhibited dark pink growth on MacConkey agar due to lactose fermentation (Table 1). Additionally, the lactose-fermenting isolate tested oxidase negative, further indicating it was a probable *E. coli* strain. All other isolates were nonlactose fermenters, producing colorless colonies on MacConkey agar and were oxidase positive, suggesting that they were not members of the Enterobacteriaceae family. This result likely indicates that more than one organism was isolated from the corresponding paper strip and grew in the EE broth tubes.

We attempted identification and antimicrobial susceptibility testing on all isolates from the yellow EE broth tubes (Table 1). The lactose-fermenting, oxidase-negative isolate from sample 7B that we identified as exhibiting probable ESBL-production was identified as *E. coli* (98% confidence). The oxidase-positive isolate from sample 6 that displayed pigmentation suggestive of CRE on CHROMID Carba agar was identified as *P. aeruginosa* (95% confidence). Of the three remaining isolates, two were identified as probable *Pseudomonas* species, while one could be identified only as a nonfermenter.

FIGURE **2**

Image of Subculture Plates



Note. A is the isolate from sample 7B, exhibiting pigmentation suggestive of extended spectrum beta-lactamase (ESBL)-producing *E. coli*, that is growing on HardyCHROM ESBL medium. B is the antimicrobial disk diffusion test of the isolate from A, showing multidrug resistance. ESBL-production was confirmed with Etest ESBL strips.

Antimicrobial disk zone diameters for each isolate are shown in Table 2. The isolate identified as *E. coli* displayed a multidrug resistant susceptibility pattern (Figure 2B), including resistance to ampicillin, cephalothin, cefotaxime, chloramphenicol, streptomycin, and tetracycline (Table 2). Additionally, this isolate produced phantom and deformation zones against Etest ESBL strips and gave a cefotaxime/cefotaxime + clavulanate MIC ratio of ≥512 (Stürenburg et al., 2004), which confirmed ESBL production. The *P. aeruginosa* isolate from sample 6 displayed a pattern typical of innate resistance to multiple antimicrobials. There are no approved zone diameter interpretive categories for other *Pseudomonas* spp. or for many other nonfermenters, so zone diameters are provided only for the isolates that could not be identified conclusively (Table 2). Despite not having documented interpretive categories, however, zone diameters of approximately 6 mm likely would indicate tolerance/resistance at the test concentration, as no inhibition is observed. Ciprofloxacin and gentamicin were the most effective antimicrobials at inhibiting isolate growth at the concentrations tested, while nearly all isolates displayed tolerance or resistance to ampicillin, amoxicillin-clavulanic acid, cephalothin, nalidixic acid, and trimethoprim/sulfamethoxazole (Table 2).

Discussion

As a proof-of-concept study, our approach remained limited in practice and, subsequently, in outcome. We focused on the recovery of Gram-negative bacteria specifically in the Enterobacteriaceae family due to their ubiquity and medical importance, using enteric broth tubes that detect fermentation metabolites indicated by a color change. The majority of bacteria isolated and identified, however, were nonfermenters, indicating that the broth tubes contained a mixture of fermenting and nonfermenting bacteria that were recovered from the paper air strips. It is also possible that the broth tubes that did not change color yet demonstrated growth (via turbidity) could have grown fermenting bacteria, albeit at lower numbers relative to nonfermentative growth. Additionally, the screening media used may not have supported the growth of all ESBL- and carbapenem-producing enterics (Gazin et al., 2012).

We identified recovered bacteria using the API system, even though automated biochemical analyzers typically provide enhanced quality control with reproducibility, have robust databases, are less labor-intensive, and are able to measure minimum inhibitory concentrations of antimicrobials in addition to determining qualitative resistance (Donay et al., 2004; O'Hara et al., 1993). Because

TABLE **2**

Summary of Zone Diameters and Interpretive Categories of Isolates From Table 1

Sample # and Isolate	Antimicrobial Disks (Concentrations)											
	AM (10)	AMC (20/10)	CF (30)	CTX (30)	C (30)	CIP (5)	ETP (10)	GM (10)	NA (30)	S (10)	SXT (1.25/23.75)	TE (30)
3: Unidentified nonfermenter[a]	6	14	6	23	14	40	13	35	8	19	7	22
4: *Pseudomonas* spp.[b]	6	7	6	23	14	40	25	40	6	33	6	22
5: *Pseudomonas* spp.[b]	6	9	6	21	N/A	27	23	25	7	12	6	25
6: *P. aeruginosa*[c]	6 IR	6 IR	6 IR	20	9 IR	35 S	22	18 S	6	10	6 IR	11 IR
7B: *E. coli*	6 R	19 S	6 R	11 R	6 R	33 S	29 S	21 S	22 S	9 R	22 S	6 R

Note. Zone diameters are in mm and antimicrobial disk concentrations are in µg. AM = ampicillin; AMC = amoxicillin-clavulanic acid; CF = cephalothin; CTX = cefotaxime; C = chloramphenicol; CIP = ciprofloxacin; ETP = ertapenem; GM = gentamicin; NA = nalidixic acid; S = streptomycin; SXT = trimethoprim/sulfamethoxazole; TE = tetracycline; N/A = not available due to inability to measure zone of inhibition; IR = innate resistance; S = susceptible; R = resistant.

[a] This isolate could not be identified and therefore interpretive categories could not be determined.

[b] The Clinical and Laboratory Standards Institute (CLSI) does not provide interpretive categories from zone diameter measurements for *Pseudomonas* spp. that are not *P. aeruginosa*.

[c] Of the antimicrobials tested, CLSI provides interpretive categories for ciprofloxacin and gentamicin only. The antimicrobials to which *P. aeruginosa* is innately resistant to are labeled as IR.

we were interested solely in the recovery of viable bacteria, we did not perform any molecular methodologies. Molecular analyses, however, can supplement the information obtained from biochemical methods by detecting the presence of resistance genes and can potentially identify the full spectrum of recoverable bacteria.

Conclusion

We were able to recover and isolate viable antimicrobial-resistant bacteria from a passive air sampling method in an agricultural environment. Subsequent studies should use both biochemical and molecular approaches for more detailed analyses, and also sample ambient air and agricultural workers in parallel to better assess occupational and environmental exposure risks.

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2022

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INTERNATIONAL PERSPECTIVES

Sustainable Brownfields Redevelopment in the European Union: An Overview of Policy and Funding Frameworks

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Abstract **This first article in a series of three on land reuse highlights sustainable brownfields redevelopment in Europe. Sustainability is a key European concept. Europe's densely populated urban areas are facing specific challenges that include urban sprawl and environmental pollution. Redeveloping brownfields, or reusing the abandoned built landscape, can positively impact the economic, social, and environmental health security of cities. Many European Union (EU) cities benefit from policy and financial assistance in renovating their urban areas. This article reviews the EU's policy and funding frameworks that support sustainable brownfields redevelopment. Brownfield site problems are common to many countries in Europe and around the world, and this article aims to share knowledge and resources that support the transformation of these abandoned or underused areas into public or private uses.**

Introduction

Where we live affects our health. Environmental risks are linked to 22% of the global disease burden and 23% of deaths worldwide (Prüss-Ustün et al., 2016). In Europe, environmental stressors are responsible for 15–20% of deaths in 53 countries (Landrigan et al., 2018). The densely populated European Union (EU) is not spared the negative impacts of environmental contamination. Approximately 70% of the EU population lives in urban or suburban areas (Publications Office of the European Union, 2016) that are challenged by urban sprawl; scattered development; urban dispersion; soil sealing (i.e., the capping of soil with impermeable materials such as asphalt roads, parking lots, and buildings) (Colsaet et al., 2018); and air, soil, and water pollution. These challenges threaten the sustainable development process and impact economic, social, and environmental health security.

These problems may be exacerbated in the future as the population living in EU urban areas is expected to increase to over 80% by 2050 (Publications Office of the European Union, 2016). Millions of new urban residents will need housing, employment, and infrastructure that will limit available open spaces. In this context, the issues of safe land reuse, remediation, and productive use of underused, derelict, and contaminated lands—commonly known as brownfields—become more important than ever.

While the U.S. defines brownfields as "real property, the expansion, redevelopment, or reuse of which may be complicated by the presence of a hazardous substance, pollutant, or contaminant" (U.S. Environmental Protection Agency, 2021), in Europe there is no common definition of brownfields. The concept, however, is generally associated with land contamination (Cobârzan, 2007; Grimski & Ferber, 2001).

Brownfields rehabilitation in Europe presents valuable opportunities for private investments and for limiting the practices of land taking and urban sprawl, making cities safer, healthier, and more attractive economically (European Commission, 2012). European urban development is part of the sustainable development mechanism and can improve the environment through brownfields reuse and reduction of air, water, and soil pollution (European Commission, 2016a). In recent decades, many EU cities successfully reused abandoned sites; for example, the regeneration of industrial and military brownfields occurred through support from the European Regional Development Fund/Cohesion Fund (European Court of Auditors, 2012). Concurrently, investments in green spaces fields (i.e., greenfields, which are undeveloped lands that are left "natural" in the urban landscape) and brownfields rehabilitation are seen as new development opportunities (European Commission, 2016b; Morar et al., 2019).

There are no EU standards to define contaminated sites and associated environmental health risks. This lack of standards is further complicated in that no single methodology defines site-specific remediation standards (European Environment Agency, 2017). Brownfields remediation, however, is a 2014–2020 EU priority that is incorporated in several policies, such as the 2030 Sustainable Development Goals and Agenda (European Commission, 2016a). EU policies take into account the direct and indirect impact of land use, including the use of undeveloped

TABLE **1**

The European Union 2014–2020 Funding Frameworks That Support Brownfields Redevelopment

Funding Mechanism	Overall Budget	General Objectives
Cohesion Fund	€74.8 billion	Reduce economic and social disparities and promote sustainable development by financing projects in the fields of environment and trans-European networks
European Regional Development Fund (ERDF)	€278 billion	Strengthen the economic and social cohesion in the European Union (EU) by correcting imbalances among its regions through: • Convergence • Regional competitiveness and employment • Territorial cooperation (cross-border, transnational, interregional)
Urban Innovative Actions	€372 million ERDF budget	Facilitate pilot projects for sustainable urban development
URBACT III	€96.3 million • €74.3 million, ERDF budget • €5.5 million, national contributions • €16.5, local contributions	Find new and sustainable pragmatic solutions for cities integrated with economic, social, and environmental urban topics
LIFE Programme	€3.4 billion	Instrument of funding for the environment and climate action
European Investment Bank	€243 billion capital base	Develop sustainable public–private investment, research, and innovation projects in line with EU environment objectives
URBIS	–	Provide an investment advisory platform
Horizon 2020	€80 billion	Identify new solutions for societal challenges to drive innovation-led sustainable growth

land and natural areas through urban sprawl and energy production.

With few exceptions (e.g., mining activities), the expansion and use of undeveloped land generally is connected with soil sealing. Limiting soil sealing can occur by reducing the rate at which greenfield sites, agricultural land, and natural areas are turned into infrastructure or settlement areas, or by reusing previously developed land such as brownfields (European Commission, 2012). Often, potentially contaminated sites are located close to city centers, offering attractive opportunities for investors. These sites can be redeveloped through planning, financial support, and administrative and governmental procedures.

Methods

Our initial literature exploration highlighted previous networking and research projects focused on brownfields redevelopment in Europe; these projects (BROWNTRANS, HOMBRE, CLARINET, CABERNET, COBRAMAN, COMMON FORUM, TIMBRE, NICOLE, RESCUE, and REVIT) highlighted the progress and successes of brownfields redevelopment plans. The information, however, might be either outdated or too general, which motivated our recent, more expansive literature review.

Using keywords of "sustainable development," "urban development," "brownfields policies," "green infrastructure," "environmental contamination," "sustainable brownfields redevelopment," "public benefits + brownfields redevelopment," "brownfields + economic development," and "brownfields funding" in PubMed, Toxline, Scopus, and Web of Science databases, we built a shared library of globally published literature related to brownfields. We then framed a series of proposed publications and research activities based on our literature search results.

This article presents key aspects of our literature review and analysis regarding the European landscape of brownfields redevelopment via policy and funding frameworks. This effort is a first step toward fostering an understanding among academia, the public sector, and local private development interests of EU involvement in brownfields redevelopment.

Results and Discussion

The high level of economic development, social cohesion, support for democratic societies, and commitment to sustainable development in the EU is designed for preserving the environment based on the choices we make today (European Commission, 2016a). Several policies and an extensive funding framework (Table 1) that promote and support sustainable brownfields redevelopment in Europe are described below.

The European Union Policy Framework Related to Brownfields

European Union 2030 Agenda for Sustainable Development and Sustainable Development Goals

The European Union 2030 Agenda for Sustainable Development and Sustainable Development Goals (2030 Agenda) includes sustainable development goals in the European policy framework and current European Commission priorities based on the three pillars of sustainable development: society, environment, and the economy (European Commission, 2016a). The 2030 Agenda a) calls for reducing negative impacts of urban activities and chemicals that are hazardous to human health and the environment and b) includes environmentally sound chemical management plans, reduction and recycling of waste, and more efficient use of water and energy. It also supports brownfields redevelopment by making cities and human settlements inclusive, safe, resilient, and sustainable; protecting, restoring, and promoting sustainable use of terrestrial ecosystems; and halting and reversing land degradation.

7th Environment Action Programme

The 7th Environment Action Programme (7th EAP) adopted by the European Parliament and the European Council of the Euro-

pean Union (Decision No. 1386/2013/EU) set forth objectives to be achieved by 2020 in its publication *Living Well, Within the Limits of Our Planet*, which incorporated a broad range of environmental and ecological concerns related to the protection of air, land, and water, while promoting sustainable economies and development (European Commission, 2014; European Environment Agency, 2013). The 7th EAP 2050 EU vision emphasizes prosperity and a healthy environment based on an innovative economy focused on minimal waste, sustainable management of natural resources, biodiversity protection, and low-carbon growth to achieve a "safe and sustainable global society" (European Environment Agency, 2013).

The 7th EAP focused on conservation of natural resources and the environment, reduction of environmental health risk, and establishment of sustainable cities—all of which align with brownfields issues. In the EU, water pollution, air pollution, and chemicals are among the public's top environmental concerns (data.europa.eu, n.d.). Reducing environmental exposures to contaminated sites such as brownfields can protect the health of affected populations. With a projection of 80% of the population living in urban or suburban areas by 2050 (European Environment Agency, 2013), environmental problems and pressure on green or natural areas could intensify. Cities will likely need to integrate urban sustainability mechanisms with innovative solutions to address environmental challenges (European Commission, 2011). The 7th EAP's focus on sustainable cities can promote brownfields redevelopments as opportunities for sustainable redevelopment.

European Environmental Directives: Waste, Water, and Air Quality Legislation

The European Waste Framework Directive states that soil contaminated by fuels leaking from underground tanks should be regarded as waste (European Commission, 2018a). This directive addresses water pollution and promotes discovery and monitoring of environmental contamination. Similarly, the European Air Quality Directive (European Commission, n.d.-a) focuses on air quality impacts of specific contaminants from both natural and industrial sources in ambient air via the 2008 Air Quality Directive and the Fourth Daughter Air Quality Directive.

Coupled with broader policy intiatives, the existing environmental directives can support cleanup and redevelopment of brownfields (e.g., the Waste Framework Directive can address petroleum contamination, a common contaminant in brownfields). The European Water Framework (European Commission, 2000) and Air Quality Directives can address water and air contamination associated with brownfields such as from plume migration, runoff, and air emissions.

Urban Agenda for the European Union

The Urban Agenda for the EU supports cooperation among EU member states, cities, the European Commission and other stakeholders; it aims to stimulate growth, liveability, and innovation in EU cities and to identify and successfully tackle social challenges. This agenda promotes the "better" agenda: better regulation, better funding, and better knowledge related to policy making and implementation. The Urban Agenda priority themes relevant to brownfields redevelopment are the sustainable use of land; sound and strategic urban planning; limiting greenfield consumption; and urban regeneration, including social, economic, environmental, spatial, and cultural aspects (European Commission, 2017).

Soil Thematic Strategy

Adopted in 2006, the Soil Thematic Strategy proposed protection of soils in the EU. While the European Commission withdrew a proposal in favor of a Soil Framework Directive, the strategy included an official report that explained why a high level of soil protection is needed; a proposed directive to protect EU soils; and an impact assessment of economic, social, and environmental impacts of different options to be considered in the preparation of the final strategy (European Commission, n.d.-b). The strategy promotes minimizing additional land acquisition and limiting, mitigating, or compensating soil sealing, calling for efficient use and restoration of previously acquired land (Colsaet et al., 2018), which can prevent development of green areas and aligns with the reuse of already built abandoned areas (i.e., brownfields).

European Union Biodiversity Strategy for 2030

The EU Biodiversity Strategy for 2030 presents a long-term plan for protecting nature and reversing degradation of ecosystems. The strategy was conceived to build societal resilience to future threats, such as climate change, forest fires, food insecurity, or disease outbreaks. This strategy identifies specific objectives to be completed by 2030, including a larger network of protected areas on land and sea, a Nature Restoration Plan to sustainably manage degraded ecosystems, measures for transformative change, and measures to track a global biodiversity framework (European Commission, n.d.-c).

The EU Biodiversity Strategy for 2030 advances the European Green Deal to make Europe climate neutral by 2050 by supporting green technology, sustainable industry and transport, and pollution reduction (European Commission, n.d.-d). The strategy can promote healthy and sustainable communities through brownfields reuse focused on protecting and creating green space, restoring watersheds, reducing the urban heat island effect, protecting the night sky and wildlife, and turning blighted and abandoned spaces into community assets.

Green Infrastructure Strategy

The Green Infrastructure Strategy promotes cost-effective alternatives to traditional "grey" infrastructure (the built environment) and offers many other benefits to EU residents and to biodiversity. This strategy describes green infrastructure as a "strategically planned network of natural and seminatural areas with other environmental features designed and managed to deliver a wide range of ecosystem services." Green infrastructure incorporates a network of green and blue (water) spaces to improve environmental conditions and health and quality of life. It also supports a green economy, creates job opportunities, and enhances biodiversity, particularly in the EU's heavily populated urban areas. Green infrastructure can result in healthier communities through cleaner air, improved water quality, and a greater sense of community (European Commission, 2013).

Turning grey infrastructure into green infrastructure through brownfields reuse is a natural solution to local planning problems. Green infrastructure can avoid building new infrastructure by a) reusing sites such as brownfields and b) incorporating natural spaces to provide less expensive and more sustainable solutions.

The European Union Funding Framework for Brownfields

The "polluter pays principle," which expects polluters to bear the costs of remediation or cleanup, applies to all EU funding and overall redevelopment mechanisms (European Commission, n.d.-e). It is not strictly enforced, though, and local municipalities and other development entities often must rely on alternative sources to fund brownfields redevelopment. Across the EU, solutions to this problem have included insurance policies, financial provisions, and bonds, but the liquidation of a property leaves no provision for cleanup, or alternately, the provisions are ignored by the liquidator due to insolvency and the predominance of company law. "Ultimately, lengthy legal battles may still result in the taxpayer covering the expense—in direct contradiction of the polluter pays principle" (European Union Network for the Implementation and Enforcement of Environmental Law, 2020).

Fortunately, although brownfields redevelopment often is funded by local sources or private investment, the EU also has a complex framework of funding to support regional, cross-border, and multicity (or member state) redevelopment projects. The primary funding mechanisms are the Cohesion Fund and the European Regional Development Fund (ERDF). There are also supplementary funding mechanisms that support sustainable development and environmental restoration projects. The following provides an overview of the EU funding framework, which is summarized in Table 1.

Cohesion Fund

In its 2014–2020 Financial Framework, the European Commission improved funding opportunities for member states as part of the Cohesion Policy for environmentally oriented public goods and services (European Parliament, 2013). This policy outlines growth and development through clustering (i.e., actions focused on competitiveness), internal urban cohesion (i.e., redeveloping brownfield sites, preserving and developing the cultural heritage), or promotion of a more balanced, polycentric development (i.e., creating networking opportunities for urban areas and linking the physical infrastructure with communities) (European Council, 2006).

To reduce economic and social disparities, the Cohesion Fund dedicated €74.8 billion to EU member states with a gross national income per inhabitant <90% of the EU average. The fund's financial investments focus on preserving and protecting the environment by revitalizating cities and decontaminating and regenerating brownfield sites (European Parliament, 2013). The Cohesion Policy and Cohesion Fund have indirect effects on the environment and sustainability. As most communities already have infrastructure in place and no additional land is needed, a growing economy could lead to land use changes as well as national, regional, and local policies could encourage brownfields redevelopment. The post-2020 Cohesion Policy continues to support cleanup or reuse of brownfields; this issue will be reflected in the Operational Programmes (i.e., member states' plans to implement EU funding during the program period) (European Commission, n.d.-f).

European Regional Development Fund

ERDF can allocate €278 billion to the European Structural and Investment Funds of 2014–2020 so that cities can receive funding for "taking action to improve the urban environment, to revitalise cities, regenerate, and decontaminate brownfield sites (including conversion areas)" (Investment Priority 6, Point e; EUR-Lex Access to European Union Law, 2013). The ERDF funding directly mentions brownfields redevelopment (European Commission, 2021a).

Urban Innovative Actions

Urban Innovative Actions (UIA, n.d.) is based on Article 8 of ERDF and has a total budget of €372 million for 2014–2020; it makes direct funding contributions to support innovative approaches to sustainable land use and land use planning (i.e., remediation, restoration, and prevention of brownfields). The UIA indirectly contributes to sustainability through inclusive urban regeneration and sustainable urban development projects (i.e., improving quality of life, health, well-being, and upstream urban and regional planning).

URBACT III 2014–2020

URBACT III 2014–2020 is an ERDF project to help Europe's cities develop new, sustainable, and pragmatic solutions that integrate economic, social, and environmental factors. URBACT focuses on the intersection of the urban physical economy with themes of environment, governance, inclusion, and economy. The environment theme, for example, concentrates on ecosystems (air, water, soil quality, pollution), climate change, urban sustainability and resilience, and linkages to economic challenges and social impacts of environmental interventions (URBACT, n.d.).

LIFE Programme

In the 2014–2020 funding period, the LIFE Programme (L'Instrument Financier Pour l'Environnement) allocated €3.4 billion to cofinance projects in the environmental sector, particularly in the areas of air, chemicals, green and circular economy, waste, water, soil, and the urban environment. Funded projects will implement technologies and solutions that are ready for implementation in close-to-market conditions, at industrial or commercial scale, and during the project period. In 2020 there was €450 million available in the categories of environment, nature, and climate action (European Commission, 2021b).

European Investment Bank

The European Investment Bank (EIB, 2017) is the bank of the EU and provides funding for sustainable public–private investment, research, and innovation projects in line with EU environmental objectives (European Council, 2012). EIB provides an infrastructure for large investments (e.g., brownfields redevelopment) focused on remediation of contaminated urban and industrial sites and renovation of housing and high energy-efficiency buildings.

URBIS

URBIS, part of the European Investment Advisory Hub, is an urban investment advisory platform that assists urban authorities to facilitate, accelerate, and unlock urban investment projects, programs, and platforms, which also include brownfield redevelopment projects (European Investment Advisory Hub, 2021).

Horizon 2020

Horizon 2020 is the largest EU research and innovation program, with €80 billion of funding available over 7 years (2014–2020). The program focuses on supporting excellent science and industrial leadership and tackling societal challenges in innovative ways (Horizon 2020 Programme, 2020).

FIGURE **1**

Red Barracks Brownfields Redevelopment in Oradea, Romania

Note. Left and center images are before redevelopment and right image is after redevelopment. Photos courtesy of Cezar Morar (2016 and 2020).

Case Examples

The EU policies and funding efforts that support brownfields redevelopment have assisted scores of sustainable redevelopment projects throughout Europe. Many projects repurposed and regenerated brownfields, which fueled local community revitalization efforts on a broad scale.

Policy Benefit Case Study: Brownfields Regeneration in Oradea, Bihor County, Romania

The city of Oradea is in northwestern Romania, close to the border with Hungary. Between 1896 and 1912, large Austro-Hungarian military complexes composed of educational institutions, barracks, and other military facilities were built close to the city's historical center (Borcea & Gorun, 2007). Postsocialist demilitarization in the 1990s, followed by the accession to the North Atlantic Treaty Organization (NATO, 2004) and to the European Union (2007) led to the abandonment, decay, or underuse of many military areas, resulting in deteriorated urban spaces that made no contribution to the local economy. To spur local development efforts, ownership of the majority of former military brownfields was transfered from central authories (i.e., Ministry of Defence) to local public authorities in the early 2000s. The proximity to national roads makes the available sites attractive for potential investors (Local Council of Oradea, 2011).

In 2016, Oradea redeveloped several military brownfields, including the Red Barracks. Closed since 1990, these barracks consisted of a large number of abandoned military facilities including bases, arsenals, depots, storage, and tank training areas that left behind soil contaminated with hazardous waste. Based on its 83 hectares size, existing infrastructure, and other amenities, the site was remediated and redeveloped into an industrial park as an alternative to the potential use of a greenfield (Figure 1). The site regeneration was sustainably planned, avoided urban sprawl, and reversed land degradation. The city financed the redevelopment using funds from local public authorities and private investment.

The city integrated both local and EU policies in this large-scale redevelopment, including the City of Oradea Strategy for Sustainable Development 2015–2020, the EU 2030 Agenda on Sustainable Development, and the EU Urban Agenda. Fiscal facilities (i.e., tax exemption) are offered to companies within the industrial park (Local Council of Oradea, 2011; Morar et al., 2019).

Funding Benefits: Examples From Greece, Latvia, and Belgium

The city of Aigio in western Greece used ERDF funding of €2,296,258 to rebuild its seafront. Extensive renovation of the 2-km seafront was undertaken, resulting in an accessible recreational area that improved existing green spaces and quality of life for city residents. The investment fell under Investment Priority 6e, "Taking action to improve the urban environment, to revitalize cities, regenerate and decontaminate brownfield sites (including conversion areas), reduce air pollution, and promote noise-reduction measures," and Specific Objective 6.e.1, "Support for integrated urban development" (European Commission, 2019a).

In Riga, Latvia, €54,000,000 in ERDF funding was used in five urban regeneration projects: three were completed and two are in process. The funding was awarded to develop cultural assets and revitalize neglected areas. The goal was to create urban spaces that are attractive to residents, tourists, and investors. One project converted an old former factory into a cultural palace called VEF Cultural Palace, which has become a highlight of cultural life (European Commission, 2018b, 2019b).

Finally, in the Saint-Leonard district of Liège, Belgium, a former coal mining area with several brownfields was cleaned up and redeveloped to complement the city's 1995 urban renewal initiative to build public and green spaces, public housing, and create a business incubator. The city used €963,800 in ERDF funding to clean up two adjoining brownfields and redevelop them into a business park that was integrated into the urban landscape. Early businesses included a furniture designer and a heating company that produced heating pumps and solar panels (European Commission, 2010).

Conclusion

Approximately 30% of the EU's territory is spatially fragmented, affecting the connectivity and health of ecosystems and the ability to provide services and appropriate habitats. Despite improvements, water quality, air pollution, unsustainable land use, and soil degradation are still issues. Residents are still

exposed to hazardous substances, potentially compromising their health and well-being. Policies and funding that support sustainable and remediated environments (e.g., the EU 2030 Agenda for Sustainable Development and Sustainable Development Goals, the ERDF suite of funding opportunities, and the LIFE Programme funding) are promising opportunities to address these concerns. These opportunities can potentially reduce the loss of ecosystem services associated with future development or restore struggling ecosystems by improving air, water, and soil quality—ultimately improving overall environmental, economic, and community health.

While the EU does not have a formal definition for brownfields, we have highlighted the strong system of policy and funding frameworks that work synergistically to support brownfields redevelopment across the region. By including brownfields remediation in their sustainability goals, many EU countries have preserved green spaces while meeting the needs of private and public companies through the creation of multiuse spaces that are fully integrated into the socioeconomic and cultural landscapes. Continued integration of sustainability and development goals, via remediation of brownfields and preservation of green spaces, will continue to improve public health and help heal our cities. These EU successes can highlight best land reuse practices that can be globally modeled.

Editor's Note: This review article is the first in a series of three that examine brownfields redevelopment as a subset of overall land use and reuse practices in Europe and the U.S. These articles are a result of a collaboration within the North American–European Land Reuse Working Group, a subgroup of the Brownfields & Reuse Opportunity Working Network (www.atsdr.cdc.gov/sites/brownfields/stakeholders.html). This first article presents the landscape of EU policy and funding frameworks to promote sustainable brownfields redevelopment. The second article examines brownfields redevelopment in the U.S. via regulatory, public health, and sustainability lenses. The third article is a descriptive and visual analysis of brownfields in Europe and the U.S. The working group aims to share and highlight best practices to promote healthy and sustainable redevelopment globally.

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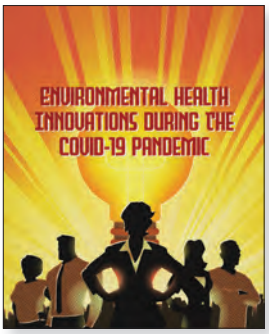
Did You Know?

We will host our first Giving Tuesday campaign on November 30. With a goal of raising $10,000 for the NEHA/AAS Scholarship Fund, please consider a donation to support students and the future of environmental health. Learn about our Giving Tuesday campaign at www.neha.org/giving-tuesday.

FEATURE STORY



Environmental Health Innovations During the COVID-19 Pandemic

Gina Bare, RN
Alyssa Wooden, MHS
Jesse C. Bliss, MPH
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National Environmental Health Association

Throughout the COVID-19 pandemic, environmental health professionals have worked tirelessly to protect the health and well-being of their communities. A COVID-19 environmental health workforce needs assessment conducted by the National Environmental Health Association (NEHA, 2020) in July and August 2020 found that all sectors of the workforce—local, state, federal, tribal, and territorial health departments as well as the private sector—were actively involved in the COVID-19 response. According to the report, environmental health department staff took on numerous responsibilities outside their typical scope of work, including contact tracing, emergency communications, logistics, infection prevention roles, and administrative duties. Many employees, however, reported a lack of adequate guidance, training, supplies, and staff to fulfill these responsibilities and faced difficulties managing their workload as a result. For example, 13% of assessment respondents said that their departments had paused conducting regular inspections. Workers also cited problems working from home and a lack of work–life balance as additional challenges. They also reported feeling extremely stressed, overworked, and burnt out (NEHA, 2020).

Nevertheless, environmental health professionals in local health departments and environmental health programs across the nation quickly adapted to these unprecedented circumstances. Many came up with innovative approaches or entirely new approaches for addressing challenges impacting environmental health services delivery as well as helping support effective response and recovery efforts. NEHA, in partnership with the Centers for Disease Control and Prevention's (CDC) National Center for Environmental Health (NCEH) and the Agency for Toxic Substances and Disease Registry (ATSDR), sought to recognize some of the innovative programs, activities, or strategies that were developed by state, tribal, local, and territorial health departments to deliver essential environmental health services during the pandemic. This partnership led to the development of the NEHA Environmental Health Innovation Awards that served to recognize and award environmental health programs with both monetary awards and workforce development resources. Four different levels of awards were given: Gold, Silver, Bronze, and Honorable Mention.

Innovation award submissions were solicited for approximately one month starting the second week of April 2021. The submissions received were related to a variety of different environmental health services such as implementing virtual facility inspection programs, creating safe business reopening procedures, and developing a novel testing method for COVID-19 in wastewater, to name a few. Submissions were evaluated based on how well their innovation addressed health equity, enhanced workforce capacity, reached new populations, and employed cross-sector partnerships with other agencies and organizations, among other criteria. Ultimately, one Gold, two Silver, three Bronze, and five Honorable Mention Award winners were selected.

During Part 3 of the NEHA 2021 Annual Educational Conference & Exhibition Three-Part Virtual Series on July 15, 2021, Dr. Patrick Breysse, director of CDC's NCEH and ATSDR, hosted a panel discussion featuring three of the Innovation Award winners. "Even amidst the stress and uncertainty of the pandemic, environmental health professionals across the nation have found innovative and creative methods to ensure essential environmental health functions continue," Breysse stated during his opening remarks. "The purpose of these awards is to both celebrate the success of these resilient environmental health heroes, as well as to share their innovations with the broader public health community."

Gold Award Winner

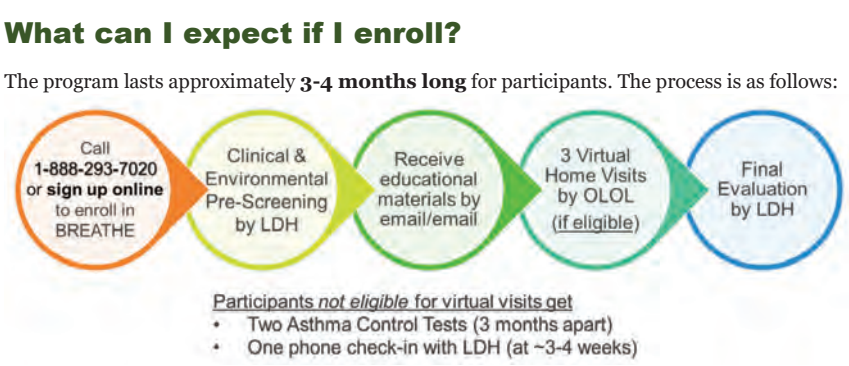
Louisiana Department of Health: Virtual Asthma Home Visit Program

In January 2020, the Louisiana Department of Health (LDH) began to develop the Bringing Respiratory Health Equity for Asthmatics Through Healthier Environments (BREATHE) initiative to provide asthma services and resources to patients (Figure 1). During the COVID-19 pandemic, LDH conducted virtual home visits for asthmatics and partnered with COVID-19 contact tracers to receive referrals of COVID-19 patients affected by asthma.

Although BREATHE launched during a period of uncertainty and shifting priorities, Dr. Arundhati Bakshi, program monitor for the environmental epidemiology and toxicology section at LDH, felt that the pandemic highlighted existing health disparities and emphasized the need for an asthma program. "Asthma is a condition that often affects African Americans, low-income populations, and people who do not have access to healthy housing," Bakshi said. "COVID-19 shone a spotlight on the fact that there are all these

FIGURE **1**

Excerpt From a Flyer Promoting Enrollment in the BREATHE Initiative Offered by the Louisiana Department of Health



Note. BREATHE = Bringing Respiratory Health Equity for Asthmatics Through Healthier Environments. Figure courtesy of Arundhati Bakshi, Louisiana Department of Health.

health disparities out there that were affecting COVID-19 outcomes, but really, it's a much bigger problem that's been going on for a long time."

BREATHE relies on partnerships with the Green and Healthy Homes Initiative, a national nonprofit organization that provides LDH with technical assistance and expertise, as well as Our Lady of the Lake Children's Hospital (OLOLCH) that refers patients to the program. OLOLCH already had experience providing telehealth services before the pandemic, so BREATHE was able to quickly pivot from an in-person home visiting program to a virtual program. Bakshi noted that telehealth services are often more convenient for patients who may have limited time to schedule healthcare appointments in person. LDH also works with 24-hr translation services to conduct virtual visits in the language with which the patients are most comfortable.

The virtual home visits are focused mainly on asthma and healthy homes education, and allow LDH staff to assess homes for health hazards that can exacerbate asthma. "We have a pretty extensive questionnaire that we take people through and we encourage them to show us things they're concerned about," Bakshi explained. "A lot of times people will say, 'There's this black spot on the wall. Is it mold? Can you help me with that?'"

Before BREATHE launched, there was no statewide asthma program that brought together managed care organizations, Medicaid services, LDH, and private and community groups. Bakshi hopes that this new program will help people better manage their own asthma and in the long term, reduce emergency department visits due to asthma. So far, she feels participants appreciate the materials and resources BREATHE has provided.

"Several people told us that their asthma was a lot worse after they had COVID-19. So we developed materials that tell people what they can do after COVID-19 to bring their asthma down to the baseline," Bakshi stated. When BREATHE representatives conducted follow-up visits with these individuals, they all reported that their asthma had returned to where it was pre-COVID-19.

LDH found that communities most heavily affected by COVID-19 are also those with the highest burden of asthma. Based on that finding, LDH intentionally targeted BREATHE interventions within those communities. Recognizing that asthma is exacerbated by indoor and outdoor environmental concerns, LDH staff seek to provide additional services, such as HEPA air purifiers, to address these issues.

One challenge that LDH has faced is establishing asthma as a priority amid so many other public health issues. "People don't always recognize the impact of asthma, especially the long-term impact of asthma when you're talking about children," Bakshi explained. "Those missed school days and the missed workdays for the parent all add up and it really affects their quality of life."

Bakshi stressed the importance of forming partnerships and collaborating with other organizations, which she feels have been invaluable to the success of the BREATHE initiative. She also hopes that BREATHE will eventually no longer have to rely on grants, although she wishes LDH had started laying the groundwork for the program's long-term sustainability earlier on. "We always knew that it would have to start with grants and show that the program works before people are willing to put their own money into it. We're just now starting to build those stepping-stones to get ourselves up to that point where we are a sustainable source of asthma services," Bakshi said.

Silver Award Winners

Public Health—Seattle & King County: Homeless Shelter Indoor Air Quality

After receiving American Rescue Plan congressional relief funding, Public Health—Seattle & King County (PHSKC) undertook a massive effort to distribute nearly 3,000 HEPA air cleaners to homeless service providers across the county. Throughout the COVID-19 pandemic, PHSKC staff had been following the latest research on airborne SARS-CoV-2 transmission, so when they learned they had received the funding they applied for, they quickly mobilized to procure the HEPA filters. They initially decided to focus on facilities serving homeless populations as many of these facilities are located in older buildings that lack proper ventilation. PHSKC staff traveled to homeless shelters and met with providers to discuss their ventilation needs. They then worked to coordinate transportation and installation of the HEPA units.

PHSKC used an equity tool to determine which homeless shelter sites were at highest risk of COVID-19 transmission and provided filters to the most vulnerable sites first. A staff member would first visit the site to determine how many filters were needed in the space, then arrange transport with the warehouses where the filters were stored. PHSKC partnered with Amazon, who provided transportation services between warehouses and shelter sites. For smaller sites that required fewer units, PHSKC staff members were able

to transport the filters themselves. After the filters were installed, staff followed up with providers to ensure the filters were functioning correctly and provided additional site visits or phone consultations as needed (Figure 2). They continue to hold a weekly call with providers to share new information and address any concerns.

Marta Lema, homelessness response coordinator for PHSKC, described the impact that this project has had on the community. "We've heard from so many providers the benefits that the air purifiers have provided for their spaces and for their clients, just in terms of even psychologically being able to feel a little safer in this space," she said. "We've also heard stories of people feeling that their asthma symptoms have really gone down."

Shirlee Tan, toxicologist for the Environmental Health Division at PHSKC, added that her team has begun monitoring air quality at some of the sites. While they are still collecting and analyzing data to assess the long-term impact of the units on air quality, initial data have shown that particulate matter decreased up to 70% in some spaces.

Lema explained how this project allowed PHSKC to provide increased education and support to homeless service providers and address a portion of the population often neglected by public health services. "We don't have health standards for our homeless service sites so it was really important that we had public health support available to meet with folks in person and answer all of their questions," she stated. "And the fact that we were able to team up and bring in clinical expertise along with environmental health expertise was really a huge advantage to homeless service sites."

Leah Helms, supervisor for the solid waste, rodent, and disease programs at PHSKC, hopes to use this project to expand other homeless services throughout the county. Recently, PHSKC held a training program for homeless service providers to educate them on indoor air quality. "We're looking at creating training resources for our homeless service providers that they can access on a more regular basis, so not only COVID-19 response but also infection control and prevention," she stated.

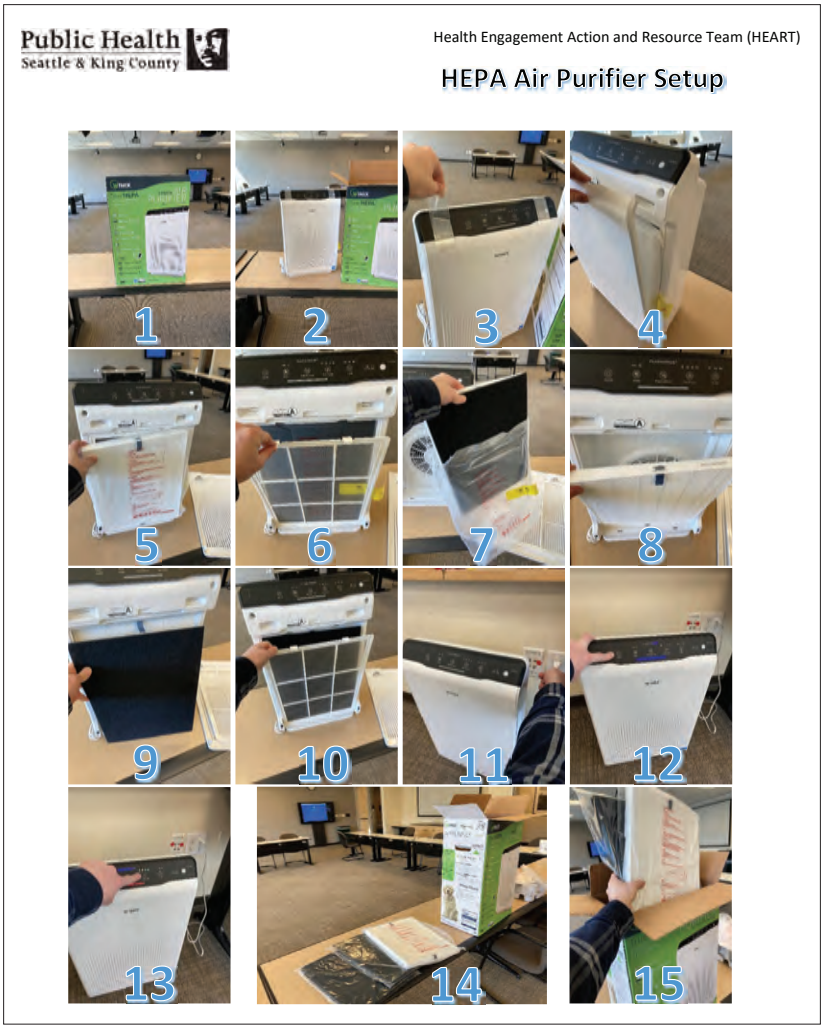
PHSKC staff found it challenging to create guidance for homeless service providers as well as their own team members on how to use the air filters, especially as it required communicating technical and scientific subject matter. Tan stressed the importance of developing education and outreach tools ahead of time since most people don't have prior knowledge around HVAC and air filtration systems or why indoor air quality is important.

Another challenge was coordinating the logistics of distribution, including finding warehouse space and arranging transportation with Amazon and PHSKC staff. Gursharn Bedi, administrator for the Health, Engagement, Action, and Resource Team at PHSKC, developed a system to track deliveries and ensure that filters were distributed correctly.

In the future, PHSKC hopes to provide filters to schools, childcare facilities, restaurants, and other indoor spaces. This work will also inform their response to wildfire smoke and other extreme weather events, especially in terms of providing air filters for emergency shelters. "Having a structure around how you're going to triage requests is really important," Tan said. "Right now, we're expecting a lot of questions and inquiries as offices and schools reopen because air is one of the

FIGURE **2**

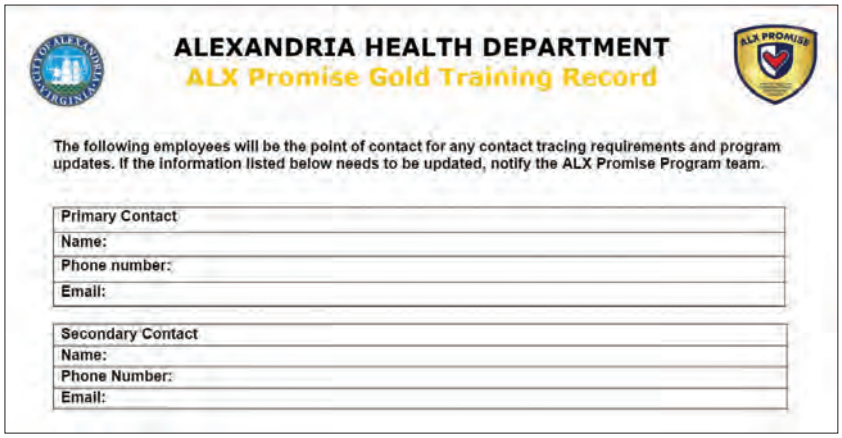
HEPA Air Purifier Setup Instructions



Note. Public Health—Seattle & King County (PHSKC) created a number of resources, such as this flyer demonstrating how to set up a HEPA air purifier, to be distributed to homeless service providers along with the HEPA units. Figure courtesy of Shirlee Tan, PHSKC.

FIGURE **3**

Example of the ALX Promise Gold Training Record



ALEXANDRIA HEALTH DEPARTMENT

ALX Promise Gold Training Record

The following employees will be the point of contact for any contact tracing requirements and program updates. If the information listed below needs to be updated, notify the ALX Promise Program team.

Primary Contact
Name:
Phone number:
Email:

Secondary Contact
Name:
Phone Number:
Email:

Note. Businesses participating in ALX Promise Gold offered by the Alexandria Health Department are required to provide contact information for COVID-19 contact tracers. Figure courtesy of Rachel Stradling, Alexandria Health Department.

interventions where you can still have some control around COVID-19 transmission when vaccination status is unknown and you have mixed groups of vulnerable people. I think it's going to be even more important as we move into this next phase of the pandemic."

South Carolina Department of Health and Environmental Control: Food Service Facility Inspections and Lead Risk Assessment

Like many state and local health departments, the South Carolina Department of Health and Environmental Control (DHEC) pivoted to virtual activities when stay-at-home orders were first issued at the beginning of the COVID-19 pandemic. DHEC developed a way to provide lead risk assessments in private homes while minimizing in-person contact.

Mary Ramirez, training coordinator at DHEC, explained how the state's lead inspection program quickly pivoted to a virtual format. Assessors conducted lead risk assessments by phone and completed virtual home walk-throughs using FaceTime, Microsoft Teams, and Zoom. Inspectors were also able to collect water samples and conduct in-person visits while complying with restrictions. "The lead program said, 'Hey, there's nothing that says the water sample has to be collected by a certified assessor. Can we not mail those out to folks with instructions on how to make the sample collections?'" Ramirez stated. "So, we moved on to that and then as things progressed, we started to work with folks to say, 'Hey, if you can leave your home for this period of time, we can come and we can do your assessment while you're out of the house.'"

Children with elevated lead levels tend to be from lower-income families and live in poor quality housing. As such, DHEC took extra care to ensure that these populations continued to receive lead assessment services throughout the pandemic. "Rural areas really struggle a lot more than the urban ones because there are plenty of areas without any cell phone reception in South Carolina. So, learning how to do video conferencing with families that don't even have internet was a huge learning curve for us," Ramirez said.

Virtual inspections significantly reduced transportation time and costs throughout the state as inspectors no longer had to travel to homes or food service facilities in person. This change allowed DHEC employees to have longer, more meaningful conversations with clients.

According to Ramirez, it was initially difficult for DHEC to adapt to social distancing regulations. Developing written guidance that both staff and community members could understand took longer than anticipated and lead inspectors faced delays in educating families about the new protocol and scheduling inspections for when families were out of the home.

The department plans to continue developing new innovations, such as making changes to their email and data management system, as well as a mobile application for those that don't have access to a computer. They are also focusing on providing more education and resources to rural communities. Finally, Ramirez stressed the importance of collaboration and seeking advice from partner agencies when developing and implementing new programs.

Bronze Award Winners

Virginia Department of Health (Alexandria): ALX Promise Program

When the tourism industry in Alexandria, Virginia, came to an abrupt halt due to the COVID-19 pandemic, the Alexandria Health Department (AHD) started developing a way to help businesses reopen and reassure the community that they were taking all possible safety precautions. This development led to the ALX Promise program, which requires participating businesses to comply with executive orders and other COVID-19-related standards set by AHD. In exchange, businesses receive a decal they can display in their window and are recognized on the Visit Alexandria website.

Rachel Stradling, environmental health manager for AHD, explained that when the ALX Promise program was first launched, it was mainly focused on complying with state-issued executive orders (e.g., requiring all staff to wear masks). The program also included cleaning and social distancing measures as well as training provided by AHD. As executive orders were lifted, the program was relaunched as ALX Promise Gold, which is aimed at helping businesses transition out of the pandemic (Figure 3). "The program is 100% focused on encouraging vaccinations and reporting cases," Stradling stated. "We're requiring businesses to give staff paid time off to get vaccinated or tested, and to allow employees time during work to book a vaccination appointment."

According to Stradling, the program has had an enormous impact on the Alexandria community, even helping to prevent some

businesses from closing altogether. It also created networks between businesses and allowed them to share resources with each other. "One of the high points for me was when there was a shortage of hand sanitizer and other items. The ALX Promise participants grouped together and said, 'Well, right now, there's some at BJ's, there's some at Costco,'" she said. "There was this lovely collaboration at the start because all of the businesses were in it together."

To get the word out about the program, AHD sent an email blast with information about ALX Promise to every business in its database and promoted the program through online publications and television news channels. Larger businesses were easy to contact and usually quick to participate; however, smaller, less tech-savvy businesses were more difficult to reach. AHD also found that these businesses tended to be in ethnically diverse communities with higher numbers of COVID-19 cases. "In the communities where outbreaks were much higher, we actually sent volunteers to go door-to-door and encourage participation," Stradling explained. "We then reviewed our data and were able to actually provide a direct correlation between the businesses coming on board and cases going down, which was fantastic."

The ALX Promise program has received numerous recognitions for innovation, as well as overwhelmingly positive feedback from Alexandria's business community. Stradling noted that the businesses advocated heavily for the new ALX Promise Gold program. "It was actually our businesses that said, 'Hey, we want to do something as we transition out. Can we have a new program so that we can encourage the community to understand that we're not just literally ripping off the face masks then going back to normal? That we're taking it seriously,'" she said.

For Stradling, one of the biggest challenges when implementing the ALX Promise program was getting the window decals printed and distributed to the hundreds of businesses who signed up to participate. With the ALX Promise Gold program, AHD made sure to print decals and training materials before the launch of the program. They also have a full-time staff member dedicated to the program. Stradling also stressed the importance of promoting the program as a good news story—especially during such a stressful, confusing time—to restore faith within the community. "It's so important for our community to really believe and trust in our businesses," she said. "There was a lot of talk about businesses putting profit before safety and I think this type of program really shows that our businesses do care and they do the right thing."

FIGURE **4**

Example of a Component From the Oral Culture Learning Classes

Note. Presentations from the Oral Culture Learning classes from Boulder County Public Health include visual components that teach participants proper handwashing technique. Figure courtesy of Shawna Johnson, Boulder County Public Health.

Boulder County Public Health: Oral Culture Train-the-Trainer Program

Before the COVID-19 pandemic, the Food Safety Program within Boulder County Public Health (BCPH) adopted an Oral Culture Learning Program that largely replaced BCPH's traditional text-based presentations with interactive, image-based classes. The original goal of the program was to address disparities in food safety exam scores between English- and Spanish-speaking restaurant staff. During the COVID-19 pandemic, when in-person trainings were paused, the program then began developing an Oral Culture Train-the-Trainer Program that restaurant managers could use to train new staff themselves rather than attend an on-site class taught by BCPH inspectors.

Prior to the pandemic, the Oral Culture Learning classes would take place in the restaurants rather than in BCPH offices. The presentations were offered in English, Spanish, and Mandarin, and included a Food and Drug Administration video, a case study of a foodborne illness outbreak, and an interactive demonstrations (Figure 4). "It's not just us talking, it's making them think and then give us an answer. And obviously if they don't know the answer, we are there to explain it to them," stated Rosa Stillwell, an environmental health specialist with BCPH. "We take them to the kitchen and start opening refrigerators. We pull out an item and I'll say, 'Is this potentially hazardous or not?' And they have to answer. That way they learn more."

In addition to improved exam scores, BCPH has received positive feedback from restaurants. Participants reported that the Oral Culture Learning classes are much more interesting than the old classroom-style train-

Photo 1. During virtual inspections, childcare providers test the strength of their sanitizing solution using test strips. Photo courtesy of Amy Gammel, Colorado Department of Public Health and Environment.

ing and that they are learning more relevant information, which BCPH believes will have a significant impact on restaurants' approach to food safety. Shawna Johnson, food safety lead at BCPH, noted that the new train-the-trainer program also helps reduce disparities and eliminate barriers, especially among Spanish-speaking and lower-literacy restaurant staff.

Stillwell and Johnson added that they have received feedback on the Oral Culture Train-the-Trainer Program from other inspectors and plan to launch a pilot program at a limited number of restaurant facilities, as well as a school district, so they can gather additional data and make any necessary changes. Johnson also hopes that this model can be adapted for other jurisdictions and situations in the future.

Oneida Nation of Wisconsin: Safe Business Certification

The Oneida Nation in Wisconsin has used its status as a sovereign tribe throughout the COVID-19 pandemic to implement laws and regulations in the best interests of the community. One of these regulations required businesses to have an approved safety plan in place before they were permitted to reopen. Oneida Nation Sanitarian Vanessa Miller and Community Public Health Officer Michelle Myers helped each business create a plan to reopen while keeping public health a priority.

Miller and Myers created an electronic form that businesses could use to submit their plans. Once the plan was approved, the business would need to sign a form attesting that they would follow the practices outlined in the plan and a safe reopening certificate was sent to the business electronically. "We really laid it out in a way where businesses were seeing a benefit to this plan because now they have something they can put on their wall to show their customers that they can have confidence in dining there and shopping there—that they are a safer business," Miller stated.

As an Indigenous population, the Oneida Nation experiences considerable health disparities and is at disproportionately high risk for many diseases and illnesses. Miller and Myers felt it was important to use their sovereign status to create rules and regulations that best served their community, regardless of what other jurisdictions were doing. "I do believe that there is often a misconception that tribal sovereignty is used to, for lack of a better term, get out of something or take the easy way out," Miller said. "I think Oneida and so many other nations have shown that it is the opposite. It is because we know that by having things be locally controlled by our own government and our own public health teams that we can best address the unique set of needs that exist here."

The program has gotten positive feedback from other jurisdictions that Oneida Nation has collaborated with, as well as from the businesses. "We definitely have heard from external nontribal community members that they just felt so much safer in tribally owned and operated businesses. A quote that really stuck out to me is, 'Oh my gosh, Oneida is doing so much more,'" Miller stated. "So that was a win-win to our businesses because they were then seeing that positive word of mouth directly impacts their business."

To explain to businesses why creating a reopening plan is important, Miller and Myers stressed the need for safety measures to protect the elders of the tribe, as well as to preserve their language and way of life for future generations. "You really need people to be personally invested in efforts like this one," Miller commented. "You can't just tell them what to do and expect there to be this widespread behavior change. So, we've definitely learned to listen to the community and see what is important to them and make sure that is directly tied into why this effort is important."

Miller and Myers have documented everything they learned throughout the process so they can be prepared in the event of a future public health emergency. Their team has also learned how to rapidly communicate and collaborate with businesses and other organizations. "We always had good relationships and they are much better because we are connecting and meeting with each other much more often. We're utilizing technology to do some of that collaboration," Myers said.

Honorable Mention

Colorado Department of Public Health and Environment: Virtual Childcare Inspection Program

During the first few months of the pandemic, childcare facilities in Colorado remained closed and health departments paused on-site inspections. When facilities began to reopen in June 2020, the Colorado Department of Public Health and Environment (CDPHE) started conducting virtual inspections. CDPHE emailed each childcare provider to let them know they were due for an inspection and that it would be conducted virtually. The emails included a list of required documents and materials needed to complete the inspection, such as test strips and a thermometer (Photo 1).

CDPHE varied the format of the inspection based on what worked best for each provider and worked with local health departments to meet the specific needs of providers. Ultimately, conducting virtual inspections resulted in significant travel time and cost savings, and although it could be challenging

to conduct inspections at facilities with poor internet connection, feedback from providers on the new virtual format has been overwhelmingly positive.

Bucks County Department of Corrections: Environmental Health Controls During COVID-19

The Department of Corrections in Bucks County, Pennsylvania, took steps to combat COVID-19 in January 2020, months before it was declared a national emergency. As the county correctional facility was largely unable to enforce social distancing or masking, Forensic Sanitarian Dr. Robert Powitz implemented procedures for screening, isolation of anyone who exhibited symptoms, improved ventilation, and increased sanitation.

Facility staff used infrared thermometers to screen everyone coming into the jail and tested anyone suspected of having COVID-19. Positive cases were quarantined in designated cells with ventilation systems providing negative airflow. The correctional facility also created additional medical examination rooms with increased lighting and handwashing stations. Although the facility recorded a small number of COVID-19 cases, it did not experience a major outbreak during the pandemic. Powitz believes the facility's success is largely due to preventative work and procedures implemented early on.

Wisconsin Department of Health Services: Remote Lead Risk Assessment Staff Training

In September 2020, the Lead and Asbestos Accreditation Unit within the Wisconsin Department of Health Services (DHS) began offering virtual refresher courses over Zoom for lead paint risk assessor certifications. DHS also recorded the sessions so that assessors could receive certification even if they aren't able to attend a live training. The virtual classes were found to be much more convenient for attendees, allowing them to have more one-on-one time with instructors and giving assessors from different regions a chance to share ideas and techniques with each other.

The DHS team made sure to have all materials prepared in advance and tried to include a variety of engaging, interactive activities to keep participants occupied throughout the 8-hr session, such as a model of a house that assessors could look at and determine where samples should be taken. Although DHS staff plan to hold in-person courses again in the future, they believe most assessors will continue to attend virtual sessions. They also hope to incorporate breakout rooms so that participants can interact with each other in smaller groups.

Photo 2. University of Wisconsin–Eau Claire students wore hazmat suits to take composite wastewater samples. Photo courtesy of Crispin Pierce, University of Wisconsin–Eau Claire.

University of Wisconsin–Eau Claire: Wastewater Sampling Program

In February 2021, University of Wisconsin–Eau Claire Professor Dr. Crispin Pierce and his team began taking 24-hr composite wastewater samples from the local wastewater treatment plant, as well as from dormitories and other university buildings, to monitor for COVID-19 outbreaks in the community (Photo 2). Wastewater samples provide an additional form of COVID-19 surveillance that can be used alongside other prevention measures such as testing and quarantining.

Wastewater sampling allows health professionals to perform an initial screening to narrow down a population of concern (e.g., a specific floor of a dormitory). It can also help reach members of the community that might not have access to other COVID-19 services. The team is also working to construct a mathematical model that illustrates how soon the community can expect to see an outbreak after detecting COVID-19 RNA in wastewater. So far, Pierce has found that different towns and cities in Wisconsin seem to differ in terms of when they see RNA peaks in wastewater versus peaks in COVID-19 cases.

Santa Clara County Department of Environmental Health: Virtual Plan Review Program

Prior to the onset of the COVID-19 pandemic, the Santa Clara County Department of Environmental Health (DEH) required that plan reviews for food facilities and construction projects be submitted to inspectors in person. When DEH staff began working from home, they developed a way for these projects to be submitted electroni-

cally using existing software. DEH inspectors also worked to ensure that the system was accessible to those with limited English proficiency and those without access to the internet, using the Government Alliance on Race and Equity Toolkit to help implement the program equitably.

The digital submittal process saves applicants time and money as they no longer have to print out physical copies of blueprints. This system has also increased overall efficiency at DEH and has prevented any delays in the business approval process throughout the pandemic. Although there were a few instances where their software would slow down or crash, overall inspectors are satisfied with how well the system has worked for them.

Conclusion

Despite the challenges, setbacks, and losses that environmental health professionals experienced over the course of the pandemic, creativity and innovation has flourished. State, local, tribal, and territorial health departments developed programs and initiatives that allowed staff to continue to provide services and in many cases, will improve their efficiency going forward. Many departments plan to continue implementing these programs even as the world returns to normal and will use them to prepare for future public health emergencies. Tools and resources provided by the award winners, including presentations, flyers, templates, and guides used to implement these innovations, can be found on the NEHA website at www.neha.org/eh-innovation-award.

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Email: gbare@neha.org.

Reference

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BUILDING CAPACITY

Darryl Booth, MBA

Build Capacity With Digital Delivery

Editor's Note: A need exists within environmental health agencies to increase their capacity to perform in an environment of diminishing resources. With limited resources and increasing demands, we need to seek new approaches to the business of environmental health. Acutely aware of these challenges, the National Environmental Health Association (NEHA) has initiated a partnership with Accela called Building Capacity—a joint effort to educate, reinforce, and build upon successes within the profession using technology to improve efficiency and extend the impact of environmental health agencies.

The *Journal* is pleased to publish this column that will provide readers with insight into the Building Capacity initiative, as well as be a conduit for fostering the capacity building of environmental health agencies across the country. The conclusions of this column are those of the author(s) and do not necessarily represent the views of NEHA.

Darryl Booth is the general manager of environmental health at Accela and has been monitoring regulatory and data tracking needs of agencies across the U.S. for over 20 years. He serves as technical advisor to NEHA's data and technology section.

Have you noticed that most of your recent credit card transactions reflect a new, more modern process?

COVID-19 concerns (e.g., sharing that gross ballpoint pen to sign receipts) plus long overdue security enhancements combined to institute new routines when paying for that family outing. We tend to now tap (not swipe), avoiding grubby hands, skipping signatures, and forgoing paper receipts. According to a Federal Reserve payment study, there were over 40 billion general purpose credit card transactions in 2018—that is up to 40 billion signature scribbles and tiny paper receipts. We can count that waste reduction among the benefits. I know my wallet feels slimmer without those useless copies, and store owners can celebrate, too. Did you know store owners were compelled to keep merchant copy receipts for 18 months in case somebody disputed a charge?

For the Love of Paper

There are those among us (both regulators and industry) who still embrace the paper. They may give lip service to going paperless but when the time comes, it is difficult to remove paper from the equation despite its costs and limitations.

As a baseline, let's consider the benefits of digital delivery. For this section, we can imagine a Food Establishment Inspection Report (Figure 1) as described in Annex 7 of the Food and Drug Administration (FDA) model *Food Code* (U.S. Department of Health and Human Services [HHS], 2017).

When we think about digital delivery, we envision:

1. A report instantly delivered via secure email or text as an attachment or hyperlink (a clicked hyperlink can constitute delivery).
2. A professionally designed report in a secure format (e.g., PDF) that is searchable and easily stored, forwarded, and annotated (could still be printed for those who want it).
3. The removed cost, logistics, and the waste of consumables related to paper, ink, toner, and batteries.
4. How to avoid overloading inspectors with equipment and support for printers.

This list presumes a computerized inspection. For districts still using paper-based inspections, moving to a digital format is obviously a prerequisite.

Challenges: Real and Perceived

Naturally, you may encounter an "it's always been this way" mentality. This hurdle can be arduous to overcome since inspectors and operators each harbor their own predispositions. Changing minds without a higher authority can be difficult.

Those predispositions might include a perception that the record is only official when it contains the operator's ink-on-paper to be stored on file for many years.

Wet Versus Electronic Signatures

When a person uses a pen to sign their name, acknowledging receipt of an inspection report or any other document, they have endorsed it with a wet ink signature. Statutes have been

FIGURE **1**

Food Establishment Inspection Report From the Food and Drug Administration Model *Food Code*

FORM 3-A

Food Establishment Inspection Report Page ____ of ____

As Governed by State Code Section	No. of Risk Factor/Intervention Violations		Date
	No. of Repeat Risk Factor/Intervention Violations		Time In
	Score *(optional)*		Time Out

Establishment	Address	City/State	Zip Code	Telephone

License/Permit #	Permit Holder	Purpose of Inspection	Est. Type	Risk Category

FOODBORNE ILLNESS RISK FACTORS AND PUBLIC HEALTH INTERVENTIONS

Circle designated compliance status (IN, OUT, N/O, N/A) for each numbered item. Mark "X" in appropriate box for COS and R.
IN=in compliance **OUT**=not in compliance **N/O**=not observed **N/A**=not applicable **COS**=corrected on-site during inspection **R**=repeat violation

	Compliance Status		COS	R
	Supervision			
1	IN OUT	Person in charge present, demonstrates knowledge, and performs duties		
	Employee Health			
2	IN OUT	Management awareness; policy present		
3	IN OUT	Proper use of reporting, restriction & exclusion		
	Good Hygienic Practices			
4	IN OUT N/O	Proper eating, tasting, drinking, or tobacco use		
5	IN OUT N/O	No discharge from eyes, nose, and mouth		
	Preventing Contamination by Hands			
6	IN OUT N/O	Hands clean and properly washed		
7	IN OUT N/A N/O	No bare hand contact with ready-to-eat foods or approved alternate method properly followed		
8	IN OUT	Adequate handwashing facilities supplied & accessible		
	Approved Source			
9	IN OUT	Food obtained from approved source		
10	IN OUT N/A N/O	Food received at proper temperature		
11	IN OUT	Food in good condition, safe, and unadulterated		
12	IN OUT N/A N/O	Required records available: shellstock tags, parasite destruction		
	Protection from Contamination			
13	IN OUT N/A	Food separated and protected		
14	IN OUT N/A	Food-contact surfaces: cleaned & sanitized		
15	IN OUT	Proper disposition of returned, previously served, reconditioned, and unsafe food		

	Compliance Status		COS	R
	Potentially Hazardous Food (TCS food)			
16	IN OUT N/A N/O	Proper cooking time and temperatures		
17	IN OUT N/A N/O	Proper reheating procedures for hot holding		
18	IN OUT N/A N/O	Proper cooling time and temperatures		
19	IN OUT N/A N/O	Proper hot holding temperatures		
20	IN OUT N/A	Proper cold holding temperatures		
21	IN OUT N/A N/O	Proper date marking and disposition		
22	IN OUT N/A N/O	Time as a public health control: procedures & records		
	Consumer Advisory			
23	IN OUT N/A	Consumer advisory provided for raw or undercooked foods		
	Highly Susceptible Populations			
24	IN OUT N/A	Pasteurized foods used; prohibited foods not offered		
	Chemical			
25	IN OUT N/A	Food additives: approved and properly used		
26	IN OUT	Toxic substances properly identified, stored, used		
	Conformance with Approved Procedures			
27	IN OUT N/A	Compliance with variance, specialized process, and HACCP plan		

Risk factors are food preparation practices and employees behaviors most commonly reported to the Centers for Disease Control and Prevention as contributing factors in foodborne illness outbreaks.
Public health interventions are control measures to prevent foodborne illness or injury.

GOOD RETAIL PRACTICES

Good Retail Practices are preventative measures to control the introduction of pathogens, chemicals, and physical objects into foods.
Mark "X" in box if numbered item is **not** in compliance. Mark "X" in appropriate box for COS and/or R. **COS**=corrected on-site during inspection **R**=repeat violation

			COS	R
		Safe Food and Water		
28		Pasteurized eggs used where required		
29		Water and ice from approved source		
30		Variance obtained for specialized processing methods		
		Food Temperature Control		
31		Proper cooling methods used; adequate equipment for temperature control		
32		Plant food properly cooked for hot holding		
33		Approved thawing methods used		
34		Thermometers provided and accurate		
		Food Identification		
35		Food properly labeled; original container		
		Prevention of Food Contamination		
36		Insects, rodents, and animals not present		
37		Contamination prevented during food preparation, storage & display		
38		Personal cleanliness		
39		Wiping cloths: properly used and stored		
40		Washing fruits and vegetables		

			COS	R
		Proper Use of Utensils		
41		In-use utensils: properly stored		
42		Utensils, equipment and linens: properly stored, dried, handled		
43		Single-use/single-service articles: properly stored, used		
44		Gloves used properly		
		Utensils, Equipment and Vending		
45		Food and nonfood-contact surfaces cleanable, properly designed, constructed, and used		
46		Warewashing facilities: installed, maintained, used; test strips		
47		Nonfood-contact surfaces clean		
		Physical Facilities		
48		Hot and cold water available; adequate pressure		
49		Plumbing installed; proper backflow devices		
50		Sewage and waste water properly disposed		
51		Toilet facilities: properly constructed, supplied, cleaned		
52		Garbage/refuse properly disposed; facilities maintained		
53		Physical facilities installed, maintained, and clean		
54		Adequate ventilation and lighting; designated areas use		

Person in Charge (Signature) **Date:**

Inspector (Signature) **Follow-up:** YES NO (Circle one) **Follow-up Date:**

enacted in the U.S. and Canada that a) allow e-signatures and electronic records to have the same legal effect as physical (i.e., wet ink) signatures and records and b) ensure that a contract is not made invalid solely because it exists only in an electronic form.

There are some exceptions where a document still warrants a wet signature. Examples include property title instruments, investment securities, wills, powers of attorney, family law matters (e.g., adoption, divorce), and others of this ilk.

Ordinances That Specify Physical Delivery

It still occurs, however, that an inspector cites local or state ordinances as the basis for keeping with the physical (paper) delivery.

There is a challenge here. Primarily, it's not practical to study all of the applicable codes across 2,500 health departments. If this issue is suspected, you'll have to call upon local resources. Through your health department's legal counsel (e.g., county counsel), the question can be researched and interpreted. An opinion letter on file should allow for revised procedures. Refreshing the ordinance or embracing the FDA *Food Code* is another way to go.

The *Food Code*

The FDA *Food Code* is agnostic on the matter. As stated in Annex 5 of the *Food* Code:

> The inspection form is the official document utilized by a regulatory agency for documentation of compliance of the food establishment with regulatory requirements. The goal of the inspection form is to clearly, concisely, and fairly present the compliance status of the food establishment and to convey compliance information to the permit holder or person in charge at the conclusion of the inspection. (HHS, 2017, p. 620)

At the conclusion of an inspection event, the ideals above can be met by reviewing a shared screen or by transmitting a provisional report for review prior to the final.

Conclusion

The remaining questions and policies surrounding this topic are worthy of a healthy debate. Putting aside the cost savings and other benefits, is the physical hand off of a paper food facility inspection report measurably superior in achieving compliance and protecting the public's health?

Perhaps soon enough we will have superior technology. Perhaps we will transmit the report to the operator's smart device where they can wave their hand across the holographic images of facility violations, zooming in and around, à la *Minority Report*. Until that date, we can avail ourselves of the technology that is out there and that is already well understood by most folks—or at least easily demonstrated.

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Reference

U.S. Department of Health and Human Services, Public Health Service, Food and Drug Administration. (2017). Food Code: *2017 recommendations of the United States Public Health Service, Food and Drug Administration*. https://www.fda.gov/media/110822/download

DIRECT FROM CDC ENVIRONMENTAL HEALTH SERVICES

Bite, Snack, Meal: A Content Strategy to Get Your Message Across and Keep Audiences Engaged

Jena A. Losch, MPH

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

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

Jena Losch is a health communicator within the National Environmental Public Health Tracking Program in the Division of Environmental Health Science and Practice at CDC.

As environmental health professionals, we constantly strive to provide clear, plain language information to our audiences. Our goal is to provide relevant, easy-to-understand information so they can learn something new, remember important information, and possibly take some sort of action. Our audiences are hungry for information and we must deliver them content that satisfies their hunger.

Everyone has, however, different appetites:

- Some people only want a little **bite**—they are looking for high-level information.
- Some want more of a **snack**—maybe they took a bite and they are intrigued to learn more.
- Some want a whole **meal**—they are hungry for all the details.

You can use a bite, snack, meal approach (Figure 1) to help lead your audience through your content, giving them the perfect portion to meet their information needs. Let's look at the bite, snack, and meal a little more closely.

The Bite

A bite should take less than 30 seconds to digest. Bites should include only one main message and a call to action or way for people to get more information. Some examples of a bite are a billboard, social media message, or a public service announcement. When creating bites, you're looking to capture someone's attention. Bites are written in plain language, designed for a general audience, and should have enough information for people with larger appetites (and your target audience) to look for further information.

The Snack

A snack should take less than 5 minutes to digest. Some examples of snacks include an infographic, a visual abstract, a data visualization such as a map or chart (Figure 2), or a short video. Since snacks take a little longer to consume, they should be designed for your targeted or interested audience but should still be written in plain language. Snacks can include multiple messages and should also include the bottom line or a call to action.

The Meal

A meal takes more than 5 minutes to digest. These can be full websites, data tools, reports, or research articles. Meals can have more technical, complex content. They typically include lots of supporting information and are designed for a highly targeted, possibly technical, audience.

Putting It All Together: Designing a Digestible Webpage

Webpages and websites are some of the most common ways of delivering environmental and public health information. A webpage can usually be an entire meal but it should be laid out in a way that makes information easy to digest (Figure 3). You can achieve this type of website by putting the bottom line at the top of the page and adding descriptive headers (bite) so people can quickly scan the page to find the information they need. Add a data visualization or infographic (snack) that helps convey the information in a different way. Try to limit your webpages to a few major key points and add links to other webpages for more information to help guide people through your content.

Develop Your Content Kitchen

To feed your audience's appetites for information, you should serve your content mostly as bites and snacks, using multiple formats to align with different media or communication platforms. The content should cater to the health literacy level, interest level, and learning styles of your audience. When promoting a new data tool, website, or article (meal),

FIGURE **1**

The Bite, Snack, Meal Approach

Note. Lead your audiences through your content using a bite, snack, meal approach.

you can develop an email campaign (snack), a sample data visualizations (snack), an infographic or video that highlights different features (snack), and a variety of social media messages (bite). When creating your bites, snacks, and meals, the key thing to remember is to keep your main message or bottom line consistent. Happy cooking!

Resources

Data Visualizations

The Centers for Disease Control and Prevention's National Environmental Public Health Tracking Network (www.cdc.gov/ephtracking) has tools to help you create data visualizations for your bites, snacks, or meals.

- Data Explorer: Create custom maps, charts, and tables on over 500 environmental and health data measures on the Data Explorer. Use the Data Visualization Embed feature to get a custom HTML code to embed any visualization into your webpage.
- API: If you are a developer or have an application, you can use the Tracking Network's application program interface (API) to import publicly available data on the Data Explorer into your own application.

Social Media and Infographics

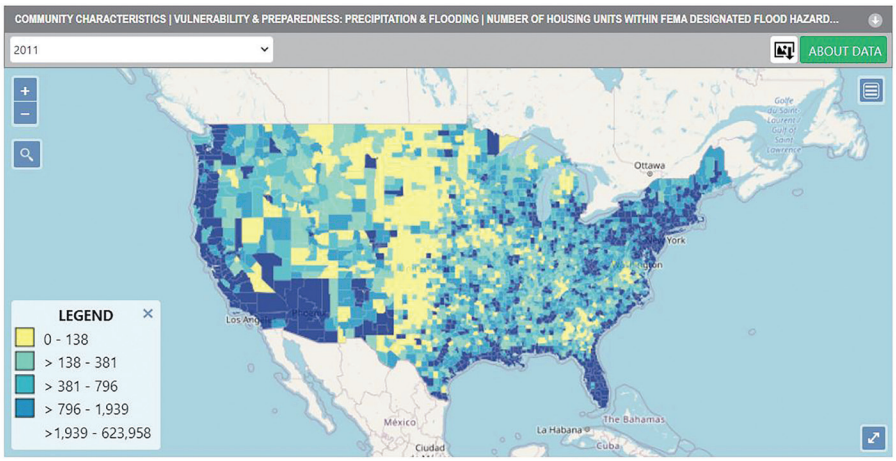
There are many other free or low-cost tools, such as Canva (www.canva.com) and Piktochart (www.piktochart.com), that you can use to create bites and snacks like social media content and infographics.

Visual Abstracts

A resource for developing visual abstracts for journal articles and other research is the Visual Abstract Open Source Primer (www.surgeryredesign.com/resources).

FIGURE **2**

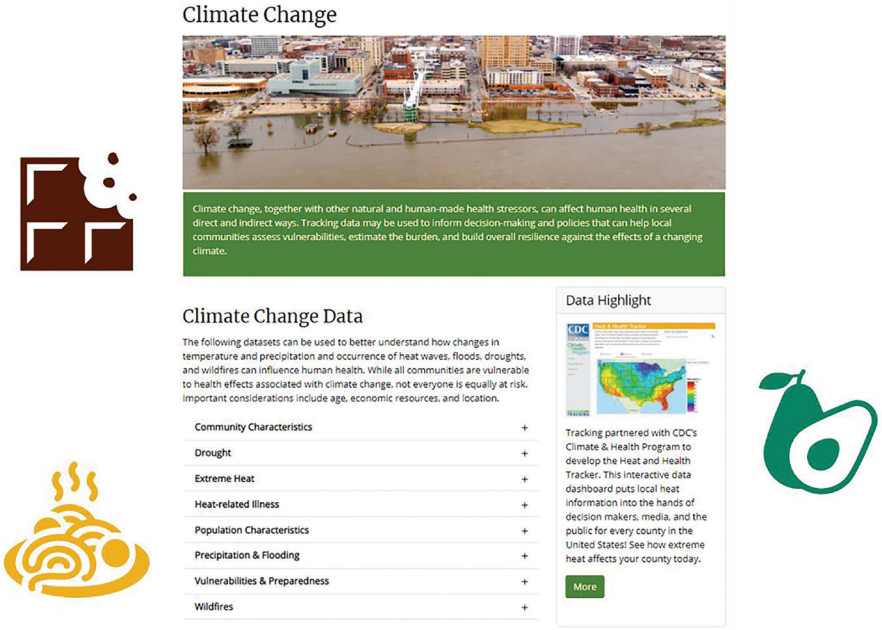
Example of a Snack



Note. You can create custom maps, charts, and tables to embed in your webpages using the Data Visualization Embed feature on the Environmental Public Health Tracking Network Data Explorer from the Centers for Disease Control and Prevention (https://ephtracking.cdc.gov/DataExplorer).

FIGURE **3**

Example of a Website Using the Bite, Snack, Meal Approach



Note. Formatting your websites using a bite, snack, meal approach can help people find relevant information quickly and stay engaged.

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EH CALENDAR

UPCOMING NATIONAL ENVIRONMENTAL HEALTH ASSOCIATION (NEHA) CONFERENCE

June 28–July 1, 2022: NEHA 2022 Annual Educational Conference & Exhibition—Now a Hybrid Event, Spokane, WA, https://www.neha.org/aec

NEHA AFFILIATE AND REGIONAL LISTINGS

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

Iowa
May 3–4, 2022: **Public Health Conference of Iowa**, Iowa Environmental Health and Public Health Associations, Ames, IA, https://www.ieha.net/PHCI2022

Michigan
March 22–24, 2022: **2022 Annual Education Conference**, Michigan Environmental Health Association, Traverse City, MI, https://www.meha.net/AEC

New Mexico
December 7–8, 2021: **NMEHA Annual Conference (Virtual)**, New Mexico Environmental Health Association, http://www.nmeha.org

North Carolina
April 27–29, 2022: **NCPHA Fall Educational Conference (Rescheduled)**, North Carolina Public Health Association, Asheville, NC, https://ncpha.memberclicks.net

Did You Know?

You can share your event with the environmental health community by posting it on NEHA's Community Calendar at www.neha.org/news-events/community-calendar. Posting is free and a great way to bring attention to your event. You can also find listings for upcoming events from NEHA and other organizations.

DAVIS CALVIN WAGNER SANITARIAN AWARD

The American Academy of Sanitarians (AAS) announces the annual Davis Calvin Wagner Sanitarian Award. The award will be presented by AAS during the National Environmental Health Association (NEHA) 2022 Annual Educational Conference & Exhibition. The award consists of an individual plaque and a perpetual plaque that is displayed in the NEHA office.

Nominations for this award are open to all AAS diplomates who:

1. Exhibit resourcefulness and dedication in promoting the improvement of the public's health through the application of environmental and public health practices.
2. Demonstrate professionalism, administrative and technical skills, and competence in applying such skills to raise the level of environmental health.
3. Continue to improve through involvement in continuing education type programs to keep abreast of new developments in environmental and public health.
4. Are of such excellence to merit AAS recognition.

NOMINATIONS MUST BE RECEIVED BY APRIL 15, 2022.

Nomination packages should be emailed to Dr. Robert W. Powitz at powitz@sanitarian.com. Files should be in Word or PDF format.

For more information about the nomination, eligibility, and evaluation process, as well as previous recipients of the award, please visit www.sanitarians.org/awards.

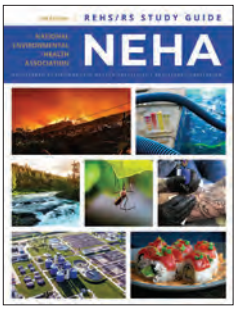
RESOURCE CORNER

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 the NEHA online Bookstore for additional information about these and many other pertinent resources!

NEHA BOOKSTORE
www.neha.org/store

REHS/RS Study Guide (5th Edition)

National Environmental Health Association (2021)

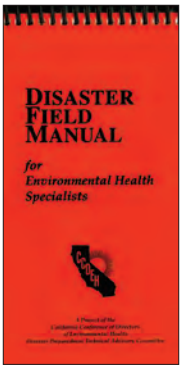


The Registered Environmental Health Specialist/Registered Sanitarian (REHS/RS) credential is the premier credential of the National Environmental Health Association (NEHA). This new edition reflects the most recent changes and advancements in environmental health technologies and theories. Incorporating the insights of 29 subject matter experts from across academia, industry, and the regulatory community, paired with references from over 30 scholarly resources, this essential reference is intended to help those seeking to obtain the NEHA REHS/RS credential. Chapters include general environmental health; statutes and regulations; food protection; potable water; wastewater; solid and hazardous waste; hazardous materials; zoonoses, vectors, pests, and poisonous plants; radiation protection; occupational safety and health; air quality and environmental noise; housing sanitation and safety; institutions and licensed establishments; swimming pools and recreational facilities; and emergency preparedness.

261 pages / Paperback
Member: $169 / Nonmember: $199

Disaster Field Manual for Environmental Health Specialists

California Association of Environmental Health Administrators (2012)



This manual serves as a useful field guide for environmental health professionals following a major disaster. It provides an excellent overview of key response and recovery options to be considered as prompt and informed decisions are made to protect the public's health and safety. Some of the topics covered as they relate to disasters include water, food, liquid waste/sewage, solid waste disposal, housing/mass care shelters, vector control, hazardous materials, medical waste, and responding to a radiological incident. The manual is made of water-resistant paper and is small enough to fit in your pocket, making it useful in the field. Study reference for NEHA's Registered Environmental Health Specialist/Registered Sanitarian credential exam.

224 pages / Spiral-Bound Hardback
Member: $37 / Nonmember: $45

Certified Professional–Food Safety Manual (3rd Edition)

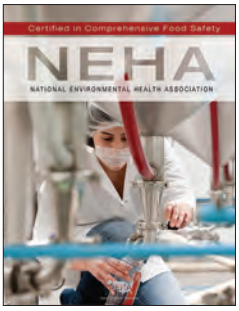
National Environmental Health Association (2014)

The Certified Professional–Food Safety (CP-FS) credential is well respected throughout the environmental health and food safety field. This manual has been developed by experts from across the various food safety disciplines to help candidates prepare for the NEHA CP-FS exam. This book contains science-based, in-depth information about causes and prevention of foodborne 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

Certified in Comprehensive Food Safety Manual

National Environmental Health Association (2014)



The Food Safety Modernization Act has recast the food safety landscape, including the role of the food safety professional. To position this field for the future, NEHA is proud to offer the Certified in Comprehensive Food Safety (CCFS) credential. CCFS is a mid-level credential for food safety professionals that demonstrates expertise in how to ensure food is safe for consumers throughout the manufacturing and processing environment. It can be utilized by anyone wanting to continue a growth path in the food safety sector, whether in a regulatory/oversight role or in a food safety management or compliance position within the private sector. This manual has been carefully developed to help prepare candidates for the CCFS credential exam and deals with the information required to perform effectively as a CCFS.

356 pages / Spiral-bound paperback
Member: $179 / Nonmember: $209

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A Tribute to Our 25-Year Members

We would like to thank and honor the individuals listed below who have had active, continuous memberships with the National Environmental Health Association for 25 years or longer. We sincerely appreciate their commitment to our association and the environmental health profession.

A

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Gregory Cabose

"Retrospectively, NEHA provided a path toward a profession-based Maslow's hierarchy of needs. Through training, education, credentialing, community, and service, NEHA enabled and accelerated a personally and professionally rewarding career in environmental health. I am indebted."
– Brian Collins, MS, REHS, DAAS

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Donald T. Fanning

"NEHA has provided me with great professional development by offering excellent training, a top-notch website, and a professional journal. These benefits and the great service I receive from the staff have made my NEHA membership a great value. I am grateful to be part of such an excellent organization."
– Frank A. Brown, MBA, RS, REHS

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"I remember my first NEHA annual conference as a young sanitarian in the late 90s in Grand Rapids, Michigan, and being amazed by the 'veterans' of the profession and all of their experience. NEHA conferences and journals have given me a national perspective that is invaluable. NEHA inspired me to get involved and I served several roles on the executive board of the Michigan Environmental Health Association. I am grateful to my early mentors who encouraged me to become a NEHA member 'way back when' and I embrace being called a veteran of this profession."
– *Carolyn Hobbs Kreiger, REHS/RS*

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"Being a NEHA member connected me with the top environmental health leaders in the country. These environmental health giants became my mentors and friends."
– Bob Custard, RS, CP-FS

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"My membership in NEHA was a positive influence in my environmental health career. Seeking leadership opportunities within my state affiliate and then NEHA was a growth experience for me. The time I spent on the NEHA Board of Directors and then as NEHA president in 2010–2011 was the capstone of my environmental health career. I encourage other younger members who are either well into their environmental health career or just beginning one to also seek out leadership opportunities in which to grow their career."
– Keith L. Krinn, MA, RS, DAAS, CPHA

NEHA **NEWS**

Call for Nominations

By Angelica Ledezma (aledezma@neha.org)

The National Environmental Health Association (NEHA) is governed by a board of directors who oversee the affairs of the association. There will be four board positions up for election in 2022:

- Region 4 vice-president (represents Iowa, Minnesota, Nebraska, North Dakota, South Dakota, and Wisconsin; 3-year term);
- Region 6 vice-president (represents Illinois, Indiana, Kentucky, Michigan, and Ohio; 3-year term);
- Region 9 vice-president (represents Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, and Vermont; 3-year term); and
- second vice-president (national officer; 5-year term that progresses through the national offices and will serve as NEHA president in 2025–2026).

We seek diversity on the board in terms of gender, ethnicity, and a balance between regulatory officials, academia, and industry. Most importantly, we want people who will help us develop a new strategic vision, have experience managing diverse organizations, and can open doors for NEHA in building relationships with industry, academia, federal and state agencies, foundations, and other associations.

Requirements to serve on the board include:

- membership with NEHA (individual or life) for 3 consecutive years prior to assuming office on July 1, 2022;
- not simultaneously holding a voting position on the board of a NEHA affiliate;
- endorsement by at least five voting members of NEHA (from members residing in the region for regional vice-president candidates and from members residing in at least three different regions for second vice-president candidates); and
- willingness to commit the time necessary to actively serve on the board.

If you are interested in serving on the NEHA Board of Directors, please visit www.neha.org/elections for information on the nomination and election process. You can also contact NEHA Immediate Past-President Sandra Long, chairman of the NEHA Nominations Committee, at ImmediatePastPresident@neha.org. The deadline to submit a nomination is **December 1, 2021**.

NEHA Embarks on Rebranding Process

As an association grows, welcomes new generations of members, and takes on increasingly more ambitious endeavors, its identity and brand should grow alongside those changes. With that purpose, NEHA has begun the important task of rebranding the association.

Branding is a term often used in industry to describe efforts to compete for market share through advertising, marketing, and use a recognizable logo with a distinctive design. While the environmental health profession has not typically sought market share, we do desire to communicate effectively and consistently to enhance our professional community standing, recognition, respect, and support. Our communications, advocacy, and programs are not the brand, and neither is the logo. Branding is a marketing practice.

A brand conveys that something is different about us as an organization—differentiating values. Our values are compassionate leadership; integrity and accountability; technical expertise; and diversity, equity, and inclusion. In public health parlance, brand is equivalent to our image or our personality. Brand is what comes to mind when community members, elected officials, funders, partners, clients, policy makers, and other stakeholders think about us.

Our communities value environmental health but often do not connect this value with our profession. To successfully promote our profession it is essential that we be visible and valued by governments, funders, policy makers, private sector partners, and the community at large. Our aim is to be a valued, effective, and trusted voice of the profession.

NEHA has assembled a team of two board members, along with five staff members ranging from fresh hires to senior staff to bring the largest possible variety of background, experience, and perceptions to this project. The team is working under the guidance of The Bain Group, a rebranding firm with extensive experience in the science and strategy of rebranding. Committee members include Seth Arends, graphic designer; Jonna Ashley, membership manager; Gina Bare, associate director of Program and Partnership Development; Roy Kroeger, NEHA president; Sandra Long, NEHA immediate past-president; Jordan Strahle, marketing and communications manager; and Christl Tate, training operations and logistics manager of the Entrepreneurial Zone. Oversight support for the committee is provided by Kristie Denbrock, chief learning officer, and Dr. David Dyjack, executive director.

The rebranding process involves a deep examination by the committee of NEHA's history, current identity, strengths, weaknesses, competition, and membership composition. After auditing these important factors, the team will then look forward to the future goals of our organization and how we see members and their needs changing over time.

An important aspect of the rebranding process is identifying what makes NEHA unique and why our members value their relationship with our association. For some, NEHA membership is most valuable because it provides discounts and resources related to their credentials. For others, the value comes from NEHA events, predominantly the Annual Educational Conference & Exhibition. These are a few examples the rebranding team has identified as reasons for how our organization provides value to our members. While it is crucial we identify what currently makes NEHA a valuable asset, we must also recognize that NEHA is constantly gaining new generations of members and identify gaps, or areas of opportunity, to meet the ever-changing needs of our community.

Only after this work of introspection and identification of our goals can the exciting task of developing a new logo take place. Designing a logo does not simply consist of appealing shapes and deciding if we like blue more than green. We must look at the deep values that make up our organization and the persona we want to portray with our logo. For example, do we value innovation over tradition? Do we want to be seen as an association for everyone or a more exclusive institution that serves a more niche market? Are we fast moving and risk taking or methodical and structured? These are just a few examples and a brand will rarely fall to the extreme of any of these values. Identifying where NEHA falls in the spectrum of these principles will then drive the deliberate elements behind the development of our new logo. Each element of the logo will be thoughtfully designed to represent our unique identity in the market.

The NEHA rebranding team is currently working hard to be introspective, listen to the needs of our members, and be intentional about who we are and what we hope to be for our members. It is important to understand that no one organization can be all things to all people and we offer more value when we understand our identity and how that aligns with the needs of our members. We are confident that our new brand will reinvigorate our board of directors, staff, and membership, as well as paint a clearer picture of our future.

The rebranding team is currently in the process of discussing several new logo concepts and will decide on two options that will be presented to the NEHA Board of Directors in November. The board will have the final decision regarding which logo they feel best portrays our value and persona. The rebranding team expects to unveil the new NEHA logo in 2022.

NEHA Staff Profiles

As part of tradition, NEHA features new staff members in the *Journal* around the time of their 1-year anniversary. These profiles give you an opportunity to get to know the NEHA staff better and to learn more about the great programs and activities going on in your association. This month we are pleased to introduce you to two NEHA staff members. Contact information for all NEHA staff can be found on pages 46 and 47.

Gina Bare

I had the pleasure of joining NEHA in November 2020 as the associate director of Program and Partnership Development (PPD). As a long-time NEHA member, I have always admired the organization but it wasn't until I took on this role that I truly understood the extraordinary value NEHA brings to its members and the profession.

I have been in the medical and public health fields for over 25 years. Most recently I worked at Boulder County Public Health as both a registered nurse and an environmental health professional. Stepping into my new shoes at NEHA gave me a chance to reflect on the work of my colleagues in environmental health who had been going nonstop since the beginning of the COVID-19 pandemic to save lives and serve their communities. The dedication of my fellow environmental health colleagues at Boulder County, throughout Colorado, and across the nation has left me in awe.

We know that environmental health professionals are the second largest public health workforce behind nursing. The NEHA COVID-19 Rapid Needs Assessment conducted in 2020 highlighted the massive role environmental health professionals have played during this pandemic. From developing infection control plans, performing case investigations, and running vaccine clinics, environmental health professionals do it all. These professionals wear their invisible cloaks while they silently protect our food, water, air, and health of the public in general. They respond to hurricanes, wildfires, floods, and pandemics. They are and will be vital in moving the needle on climate change. What I really want people to know is that here at NEHA, we SEE YOU! We will work tirelessly to advocate for you and the profession. I couldn't be prouder to carry out NEHA's mission to "build, sustain, and empower an effective environmental workforce." I genuinely am passionate about the members we serve and the work we do.

As the associate director of PPD I get to work with an amazing team that secures funding and creates and disseminates educational and training resources to environmental health professionals. The department implements the National Environmental Public Health Internship Program; creates policy and position statements; leads member program committees; and creates, implements, and evaluates a variety of workforce development programs. I assist in the day-to-day management of the PPD team, including entry-level through career professional employees. Some other key functions of my position are assisting the director of PPD with grant writing and award management, as well as consistent reevaluation of project and budgetary management to meet expectations and support the goals of the PPD department.

Christopher Walker

I joined NEHA in November 2020. It has been an absolute pleasure to work for an organization that is so passionate about what they do to support the environmental health workforce. Every day is a chance to make a positive impact in the field of environmental health. I am a senior program analyst at NEHA where my focus is primarily general environmental health and emergency preparedness in PPD. In this role I am able to engage in dialogue with stakeholders while working on different project and committee activities. I truly enjoy all aspects of environmental health and this role provides me the opportunity

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to share my passion in areas such as air pollution, body art, childcare, institutional facilities, onsite wastewater, recreational waters, and water quality, to name a few. I am an educator at heart and relish chances to teach and be a resource to others.

I have practiced as an environmental health specialist for over 16 years. I received my undergraduate degree in environmental health from East Carolina University (ECU)—go Pirates! I worked in local government as an environmental health specialist in North Carolina for over 10 years before going back to ECU where I graduated with a master of science in environmental health.

After graduation, I had the privilege of working for Whole Foods Market as a regional safety specialist and the Durham County Health Department as an environmental health program specialist/field supervisor. Though I loved what I was doing in North Carolina, my wife was offered the opportunity to practice law in the Washington, DC, metro area. It was not an easy decision to leave our family and friends to move to Maryland but we both believed that we were meant to be in the Washington, DC, area. Thankfully, I was still able to practice as an environmental health specialist where I worked at the Fairfax County Health Department in Virginia and the Montgomery County Department of Environmental Protection in Maryland before choosing to join the NEHA office in Washington, DC.

I was born and raised in rural Rocky Mount, North Carolina. If you talk to me long enough, you may hear a southern accent. I am married to my college sweetheart and best friend of almost 23 years. We lived mostly in the Raleigh–Durham area in North Carolina. We have three wonderfully spoiled rotten children—two girls and one boy. My oldest daughter is a junior in college while my younger daughter is a freshman in high school. My son is our youngest child and he is in middle school. To say that they keep me busy is an understatement. When I am not working, I love to cook, sing, watch movies and sports, hit the gym, and travel. I am a comic nerd and have spent some late nights binge watching Marvel or DC films. Anything that causes me to smile or laugh is fair game.

Outside of NEHA I love to garden, read, and am an avid photographer. My two amazing teenagers are always teaching me new things about our world and myself. I love to travel, meet new people, and learn as much as I can. I never want to stop being curious. I am thrilled to be working at NEHA and look forward to working with you to improve environmental health programs nationally.

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DirecTalk
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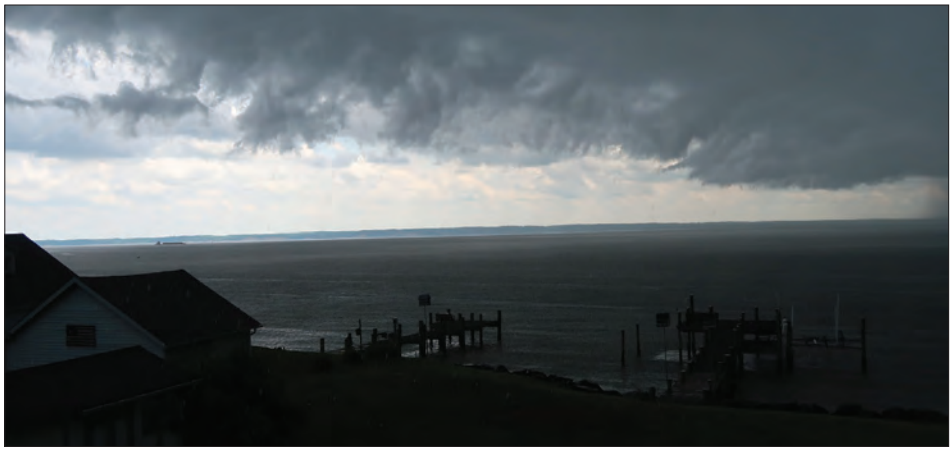
cans would take public health, pandemics, and climate change more seriously. His response floored me. He replied yes to us potentially entering in a new era. Then came a sobering clarification. These are not his exact words but he said something to the effect that public health's job is to divide and isolate us, industry's job is to connect and bridge us. Ouch. Emanuel has been nominated to be ambassador to Japan and in that role will continue to be an outsized influencer. Divide and isolate is not the essence of public health. What went wrong?

I have been asked to speak on the future of environmental health at an upcoming Food and Drug Administration regional seminar. While my allotted time is 45 minutes, I've prepared 42 slides. I am reluctant to remove even one slide because I feel each is like a gem, carefully considered and complementary of those before and after. We all know that's way too many slides for a 45-minute presentation. Perhaps I am part of the problem. I'm so obsessed with being right with my slide deck that I've left the Rahm Emanuels of the world to draw their own conclusions about public health and the environment.



Ahead of the storm. Photo courtesy of David Dyjack.

In professional life we rarely have a second chance to make a first impression. I sense that moment is now. Various parts of the country are simultaneously under drought or flooding conditions, are arguing about masks, are suffering from algal blooms, and are victims of tornadoes—all the while enrollments in academic public health programs are skyrocketing. This time is our generation's Florence Nightingale moment. I must get to Emanuel before he jets off to Tokyo.

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DirecTalk MUSINGS FROM THE 10TH FLOOR

David Dyjack, DrPH, CIH

Bite at the Cherry

Hurricane Ida is predicted to announce its arrival in my neighborhood this evening, sometime around sunset. While the wind and rain will be less pronounced in Maryland than it was in Mississippi and Louisiana, we nonetheless anticipate gully washers and abnormal tides in the Chesapeake Bay drainage system. The storm is arriving. Tornados are predicted. We know the drill. "History doesn't repeat itself but it often rhymes"—a quote inaccurately attributed to Mark Twain. What can we learn from our forebearers?

Florence Nightingale might offer some insight. She almost single-handedly reframed the manner in which we think about sanitation, hygiene, and disease. Nightingale was assigned to a barrack that had been converted into a military hospital in November 1854 during the Crimea War. As the story unfolds, she had been alerted to the deplorable conditions of the wartime healthcare by Sir William Howard Russell, a reporter who described the setting there as having "not the least attention paid to decency or cleanliness." Nightingale used her considerable charm and connections to ascend to the position of barrack administrator and went about the business of changing British army hospital policy.

Nightingale enjoyed considerable influence in the U.S., though I find no reference of her ever visiting here. American Unitarian Minister Henry W. Bellows was inspired by what was learned from the British and lobbied Secretary of War Simon Cameron in 1861 to create a Civil War-era sanitary commission. President Abraham Lincoln issued an executive order to create what he referred to as the "fifth wheel" to the coach of state. Environmental health was formally recognized as an essential element of government, a decision that proved to reduce morbidity and mortality in dramatic fashion when compared to the Mexican–American War of a few years earlier.

In professional life we rarely have a second chance to make a first impression.

As we see, individuals matter. Their personalities and enthusiasm matter. The linkages between the press, an inspired nurse, a committed minister, a secretary of war, and ultimately the president of the U.S. matter. Seeing ourselves as essential workers would benefit from a reframing. This moment in time we must think about ourselves individually and collectively as modern-day Florence Nightingales. In that spirit I can't free myself of an experience I had with Chicago Mayor Rahm Emanuel in 2013.

I hosted a meeting convened in Chicago, Illinois, focused on primary care–public health integration. Bechara Choucair was health director of the city and in that capacity secured the commitment of the mayor to speak for 5 minutes to jump-start the proceedings. Most people know that Emanuel is assertive and has a reputation for being abrasive. I found his staff to be nice but difficult to work with. For weeks they pummeled me with endless questions in an effort to pin down details and preparations—all for a 5-minute welcome speech. His administrative staff did not speak with his security detail. In the end I negotiated the details among and between the various internal city hall factions who desired to control every moment of his visit, including which door he would enter. Minutes before he arrived, I was exasperated. I expressed my frustration to my boss inclusive of a few animated words not suitable for print. Then the moment arrived.

As I introduced Emanuel, he was unlike anything I had expected. He was humorous, knowledgeable, and spontaneous. He sensed he had a friendly audience and he worked them. The 5 minutes turned into 10, then 15. His staff were somewhat apoplectic as they tried in vain to get his attention by tapping on their wrist watches. He was on a roll. He demonstrated a masterful display of a politician at the peak of his game. As he wrapped up, I believe he sensed my nervousness and asked me if I would validate his parking voucher, much to the amusement of the attendees. He had won me over.

The same Rahm Emanuel was recently interviewed by a reporter for a podcast to which I subscribe. The host asked him if we have entered a new era, perhaps one where Ameri-

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