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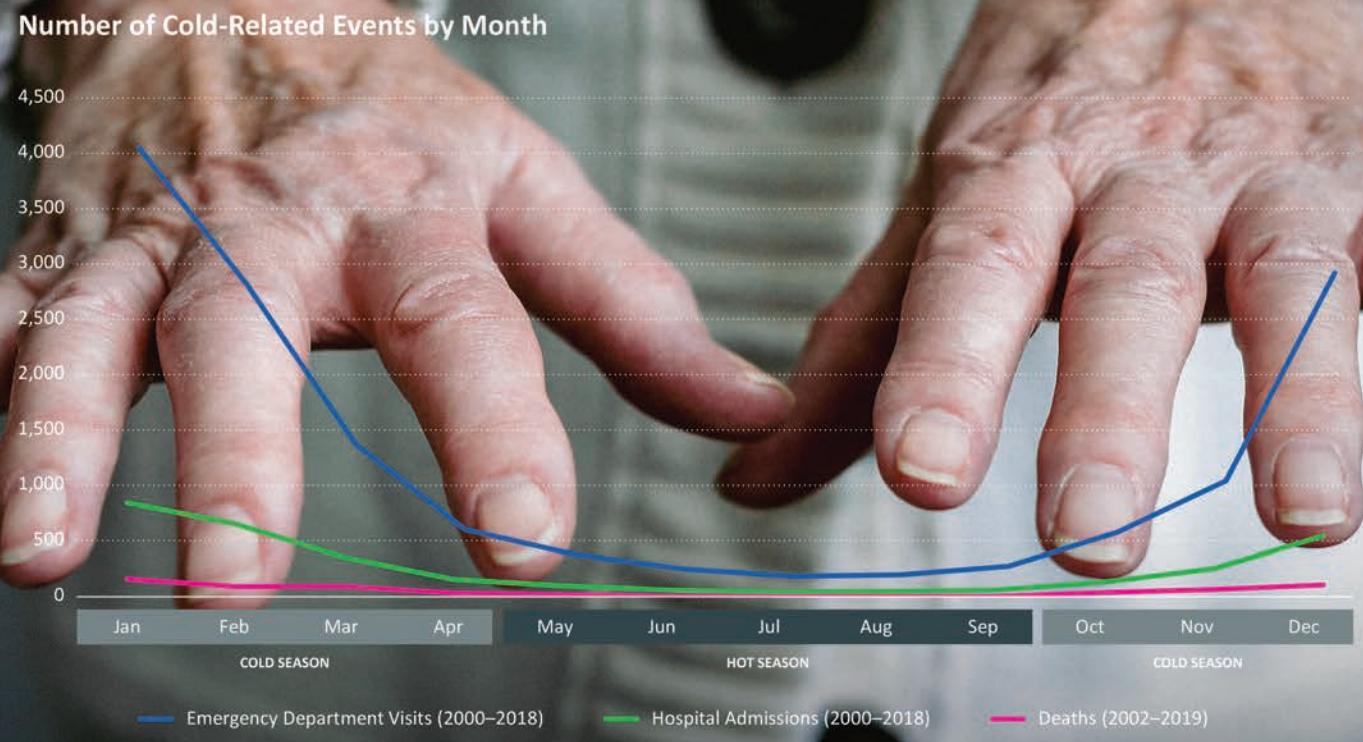

Assessing the Burden of Cold-Related Illness and Death in Minnesota

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ABOUT THE COVER

Exposure to cold temperatures can have negative health impacts that lead to cold-related illness or death. This month's cover article, "Assessing the Burden of Cold-Related Illness and Death in Minnesota," explored the case definition for cold-related illness and assessed the burden of cold-related illness and death in Minnesota. As climate change is extending the typical winter season, the authors recommend other jurisdictions consider expanding their surveillance window to include all seasons. Cold-related illness surveillance can detect changes over time and identify high-risk populations for prevention initiatives.

See page 8.

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PRESIDENT'S MESSAGE

Tom Butts, MSc, REHS

Environmental Health Data—Can We Make More Powerful Decisions?

While we serve our communities, we work in a more and more connected environment where sharing information and data are required. Doing this sharing in a consistent way, with limited data manipulation, supports better decision making. Environmental public health systems have historically collected a variety of community-, program-, and project-related information and data. These important and potentially useful data have often been placed in spreadsheets, custom databases, or enterprise software systems designed around workflow, workload management, and ensuring regulatory compliance. The information is sometimes publicly available but often kept behind one or more layers of "protection."

There are changes that have occurred with some information that the public and consumers actively sought to access. Retail food inspections are a great example of how demand from the for-profit world has made these data more available and widely used. Initially, big data players (e.g., Yelp and others) worked to gather these data to add to the information that they provided to their customers and system users who were consumers. Now, many (maybe even most) retail food inspections are available on a state or county website, or even shared via social media in near real time. We still have a wide range of data modifiers that are added (e.g., color codes, category descriptors, scoring systems) that often require significant explanations and caveats.

Community members should be encouraged to check and understand the narratives or scores of their favorite eateries and patronize those establishments with higher ratings. When data reveal recurring issues in certain establishments, does it prompt targeted interventions or increase consumer interest? I have certainly seen these instances occur. Food safety inspections are not only a formality but also a tool for continuous improvement.

> *The effective collection and use of data are crucial for both public health and environmental health initiatives.*

Another element of retail food safety data that is of particular interest and importance is the growing reference to one set of standards. It is a program where a national model exists (i.e., the Food and Drug Administration model *Food Code*). Data can become more powerful if they are uniform. By consistently applying one set of standards, a step toward data standardization is possible. Various versions of the *Food Code* from 1995 to 2022 have been adopted in most states (Food and Drug Administration, 2023). These data sources are, however, still fraught with a wide range of implementation models (i.e., varying adoption of the *Food Code* or state and local variances from the *Food Code* for local, regional, or governance reasons). As such, there is room for improvement.

There are many local, state, and national efforts to use program information and data to improve food safety, assure safe practices are adopted, and document regulatory compliance. These data are also used on a much more limited basis for academic research, which I suspect is in part due to the wide range of ways the data are collected and the limits around data access. When artificial intelligence (AI) use grows and taps into this information and data, how—for better or worse—will environmental health programs, consumers, the private sector, and even academia be impacted?

- Data analysis and decision support: AI algorithms can process large volumes of data quickly and accurately, helping professionals analyze regulatory requirements, identify patterns, and make informed decisions based on the data. It could help with workload analysis and program funding.
- Compliance monitoring and risk assessment: AI can assist in monitoring and ensuring compliance with regulations by analyzing data from various sources and identifying any anomalies or noncompliance activities. It can flag potential issues for further investigation, which can reduce the burden of manual monitoring and increase the effectiveness of regulatory oversight. This process could also assist with workload analysis, fee-for-service justification, or early outbreak risk factor identification that could be addressed with targeted educational outreach.

Next, let us consider air quality information and data. As we work to address air quality impacts from national or international sources, transportation, and point sources

in our communities, there is a range of historical data and a set of predictive (i.e., leading indicators) that are being used to reduce exposure or impacts. Detailed data on air quality measurements, emissions from industries, and traffic patterns can be collected from state and local regulatory agencies and the sources themselves for analysis. Some communities use asthma hospital admissions to document historical impacts.

These granular data might allow experts to identify hotspots of pollution and the industries responsible. Provided with this information, communities can work to have these industries adopt cleaner technologies, increase monitoring, and implement warning systems. Inspections of industrial facilities become more stringent and compliance with emission standards can be monitored more closely, which could result in a noticeable drop in air pollution levels.

There are many good examples of tools that provide near real-time data available to guide community or individual behaviors.

On a national level, the Smoke Forecasting System from the National Oceanic and Atmospheric Administration integrates information on wildfire locations with National Weather Service inputs from the North American Mesoscale model into smoke dispersion simulations to produce a daily 48-hr prediction of smoke transport and concentration. The model also incorporates U.S. Forest Service estimates for wildfire smoke emissions based on vegetation cover. This system is intended as guidance to air quality forecasters and the public for fine particulate matter emitted from large wildfires and agricultural burning that can elevate particulate concentrations to unhealthful levels. The system is a great near real-time resource for decision making within environmental public health (https://digital.mdl.nws.noaa.gov/airquality).

On a local level, data on community water quality for cyanobacteria (also known as blue-green algae) in Vermont is collected by regulatory agencies and citizen scientists on an ongoing basis. These online reports are continually updated and are then displayed on the Cyanobacteria (Blue-Green Algae) Tracker (www.healthvermont.gov/environment/tracking/cyanobacteria-blue-green-algae-tracker). This resource can be used by individuals as well as water resource managers and health officials.

This local example is just one of many data sources available via the National Environmental Public Health Tracking Network (www.cdc.gov/nceh/tracking/index.html). At local, state, and national levels, the Tracking Network uses groups of people and information systems to deliver a core set of health, exposure, and hazards data; information summaries; and tools to enable analysis, visualization, and reporting of insights drawn from data. As discussed above, gathering the data from a wide range of sources and systems, and getting it into a usable form, is a large part of the effort to make these data available and useful.

The effective collection and use of data are crucial for both public health and environmental health initiatives. Environmental public health can benefit immensely from data-driven decision making. By implementing these practical strategies, local community needs, and national initiatives, we can better understand the unique challenges and work toward creating healthier and more sustainable environments. Data alone will not be enough to inform community members or elected officials about these challenges and needs. Relatable stories must accompany the data to create and support the case for change or program improvement.

On a final note, the Building Capacity column in the September 2023 *Journal of Environmental Health* provided a nicely written and thought-provoking discussion about generative AI considerations (www.neha.org/Images/resources/JEH9.23-Column-Building-Capacity.pdf). You can also find a new Building Capacity column in this issue that explores programmatic AI adoption.

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Reference

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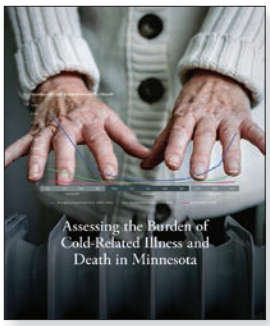

Assessing the Burden of Cold-Related Illness and Death in Minnesota

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Abstract **Exposure to cold temperatures can have negative health impacts that lead to cold-related illness or death. We explored the case definition for cold-related illness that was developed and piloted by the National Environmental Public Health Tracking Network within the Centers for Disease Control and Prevention. Using their case definition, we assessed the burden of cold-related illness and death in Minnesota. We analyzed the results by season, demographics, and chronic disease. Overall, <10% of all cold-related events in Minnesota occurred during the hot season; we did not identify any distinct differences between the type of cases by seasons. During the cold season, there was an average annual rate of 13.3 cold-related emergency department visits per 100,000 population (*n* = 704) and 2.8 cold-related hospitalizations per 100,000 population (*n* = 155). There was an average annual rate of 0.6 cold-related deaths per 100,000 population (*n* = 33). Climate change is extending the typical winter season. Therefore, we recommend other jurisdictions consider expanding their surveillance window to include all seasons. Cold-related illness surveillance can detect changes over time and identify high-risk populations for prevention initiatives.**

Introduction

Cold-related illness and death are common and occur across different U.S. regions. The National Center for Health Statistics within the Centers for Disease Control and Prevention (CDC) found that almost two thirds (63%) of all mortality coded as weather-related from 2006 to 2010 in the U.S. was due to cold exposure, while less than one third (31%) was attributable to heat exposure (Berko et al., 2014). While climate change is contributing to increasing average winter temperatures, cold-related illness and death will continue to be health risks. One study found that most cold-related mortality was caused by exposure to moderately cold temperatures, but that the contribution of extremely cold temperatures was comparatively low, suggesting that reductions in cold-related mortality from climate change might be smaller than initially assumed (Gasparrini et al., 2015).

Climate change can have other impacts on cold weather, such as increases in the intensity of extreme cold events and winter storms, which in turn have important implications for cold-related illness and death (Conlon et al., 2011; Noe et al., 2012). The purpose of our assessment was to develop and evaluate locally relevant surveillance measures for cold-related illness and death that capture a broad range of known risk factors and exposure circumstances, as well as emergent climate change-related conditions, using methods that can be duplicated in other jurisdictions.

Cold-related illness occurs when the body loses heat faster than it can be produced. This category of conditions includes hypothermia (a reduction in the body's core temperature to below 95 °F [35 °C]) and injuries such as frostbite, trench foot, or chilblains (skin sores or bumps that occur after exposure to cold temperatures but rarely cause permanent damage). While these conditions are most likely to occur due to prolonged exposure to subfreezing temperatures (i.e., <32 °F), they can occur at temperatures as high as 40 °F in wind or rain, or 70 °F in some individuals with underlying medical conditions (Nixdorf-Miller et al., 2006).

Most previous research has focused on the impacts of climate change on heat-related illness, with few studies describing vulnerable populations or contributing factors to cold-related illness and death. Similar to heat-related illness, infants, older adults (>65 years), and individuals with specific chronic conditions (e.g., respiratory disease, cardiovascular disease) are more susceptible to cold-related illness and death (Berko et al., 2014; Gronlund et al., 2018; Nixdorf-Miller et al., 2006). Individuals who consume alcohol, take illicit drugs, or use some medications are also more susceptible, as these substances can adversely affect the body's ability to sense the cold (Gronlund et al., 2018; Nixdorf-Miller et al., 2006).

One study found that hyperthermia-related visits were more frequent than hypothermia-related visits among Medicare

claims data (Noe et al., 2012). Hypothermia resulted in higher mortality rates, longer hospital stays, and higher total healthcare costs, however, indicating an increased burden of cold-related illness and death among older adults (Noe et al., 2012). Other studies have found higher rates of cold-related illness and death among men and individuals experiencing homelessness.

A study from New York City (Lane et al., 2018) found that men, older adults, and those with multiple chronic conditions were more likely to be hospitalized or die due to cold exposure compared with those treated and released from the emergency department (ED). The most common chronic conditions found among those hospitalized with cold-related illness included cardiovascular disease, substance use, and mental illness (Lane et al., 2018).

The majority of the state of Minnesota is located in the humid continental climate zone, a zone that is characterized by hot summers and cold winters (Peel et al., 2007). Despite being in a cold weather climate zone, however, cold-related illness and death have not been systematically monitored by the Minnesota Department of Health. The Cold-Related Illness Content Work Group within the CDC Environmental Public Health Tracking Network piloted the case definition in Kentucky, Massachusetts, New Jersey, New Mexico, New York, Vermont, and Wisconsin, as well as in New York City. The case definition excluded events occurring during the hot season—defined as the months of May through September—due to evidence from the pilot testing suggesting that events in the hot season were related to cold water exposure rather than cold temperature.

Our assessment evaluated the utility of this case definition for cold-related illness and death in Minnesota. The findings from this assessment can be used to identify vulnerable populations and develop targeted interventions to prevent adverse outcomes from cold exposure in Minnesota and inform other jurisdictions about monitoring cold-related illness and death.

Methods

Cold-related illness and death in Minnesota were assessed using the International Classification of Diseases (ICD), 9th and 10th Revisions, Clinical Modification (ICD-9-CM and ICD-10-CM) codes from the case definition developed by the Cold-Related Illness Content Work Group. We examined Minnesota Hospital Discharge Data (MNHDD) for ED visits and hospitalizations for cold-related illness from 2000 to 2018, the period for which complete data were available. MNHDD is a comprehensive data set that includes patient-level claims data from the majority of hospital visits in the state (excluding the Minnesota Department of Veterans Affairs and Indian Health Service).

We defined ED and hospital cases as patients with any ICD-9-CM diagnosis code of 991 ("effects of reduced temperature"); external cause of injury code E901.0, E901.8, E901.9, or E988.3 ("excessive cold" or "extremes of cold" of unintentional or undetermined intent); or ICD-10-CM code of X31, T68, T69, T33, or T34 ("exposure to excessive natural cold," "hypothermia," "other effects of reduced temperature," "superficial frostbite," or "frostbite with tissue necrosis") in any diagnosis field. We excluded records with any diagnosis of ICD-9-CM E901.1 or ICD-10-CM W93 ("excessive cold of human-made origin") and non-Minnesota residents.

Cold-related deaths occurring from 2002 to 2019, the period for which complete data were available, were examined using death certificate data provided by the Minnesota Center for Health Statistics at the Minnesota Department of Health. Cases were defined as deaths among Minnesota residents with an ICD-10-CM code of X31, T68, T69, T33, or T34 as an underlying or contributing cause of death. We excluded records with any diagnosis of ICD-10-CM W93 and intentional deaths. We also excluded any out-of-state deaths, as we included only Minnesota death certificate records from Minnesota residents in our analysis.

The case definition for cold-related illness was developed and piloted by the Council of State and Territorial Epidemiologists and the Cold-Related Illness Content Work Group. We explored this case definition by examining the proportion and type of events that occurred outside of the cold season. The cold season was defined as January–April and October–December, and the hot season was defined as May–September. We also explored the hypothesis that cases in the hot season might be related to cold water exposure. Water-related ICD-10 codes included W69, W70, and W74 ("accidental drowning and submersion while in natural water," "drowning and submersion following fall into natural water," and "unspecified cause of accidental drowning and submersion"). After examining the proportion and type of cases in the summer months, we calculated rates for the cold months using the current winter season case definition.

We conducted descriptive statistics for cold-related illness and death in Minnesota. The annual number and rate of cold-related ED visits, hospitalizations, and deaths were calculated by age and sex. Race data were incomplete and homogeneously White. The most recent 5 years of data were aggregated for cold-related ED visits and hospitalizations, while 10-year aggregated data were used for cold-related deaths.

We extracted Minnesota population estimates for the relevant years from the U.S. Census Bureau and American Community Survey. Age-adjusted rates were calculated using the direct method and the U.S. 2000 standard population. We compared rates of cold-related illness and death across sex and age groups using variance testing (ANOVA) with post hoc Tukey tests. Statistical significance was defined as $p < .05$. We also examined the prevalence of cardiovascular disease, respiratory conditions, substance use, mental illness, and diabetes that co-occurred with the cold-related diagnosis, as these conditions are known contributing factors for cold-related illness and death (Berko et al., 2014; Gronlund et al., 2018; Lane et al., 2018; Nixdorf-Miller et al., 2006).

Results

Surveillance Window

Approximately 1 in 10 (10%) cold-related ED visits and hospitalizations from 2000 to 2018 occurred during the hot season, while >90% of cold-related ED visits and hospitalizations occurred during the cold season (Table 1). Similarly, only 6% of cold-related deaths from 2002 to 2019 occurred during the hot season, compared with 94% during the cold season. During the hot season, the highest proportion of ED visits, hospitalizations, and deaths occurred in May. Overall, the highest proportion of cold-related illness and death in any month occurred during January.

The type of cold-related illness and death events in the hot season were similar to

events in the cold season. We found that <1% of ED visits were water-related during the cold season and no water-related ED visits or hospitalizations were identified during the hot season. Additionally, only 2% of deaths were water-related in the cold season, while 6% of deaths in the hot season were water-related. There were no other clear distinctions between the type of events occurring during the hot and cold seasons. For the remaining analysis, we used the case definition implemented by the CDC Environmental Public Health Tracking Network, which restricts the definition to include only cold-season cases.

Hospital Visits

During each cold season from 2000 to 2018, there was an average rate of 13.3 cold-related ED visits per 100,000 population (n = 704) and 2.8 cold-related hospitalizations per 100,000 population (n = 155). The annual rate of cold-related ED visits and hospitalizations has been trending upward in recent years (Figures 1 and 2). The highest rate of cold-related hospitalizations during this time period occurred in 2018 (Figure 2). Overall, there were more cold-related ED visits than hospitalizations for the years analyzed.

Females accounted for approximately 30% of cold-related ED visits and hospitalizations, while males accounted for 70% (Table 2). There was a statistically significant difference between the sex distribution of the rate of cold-related ED visits and hospitalizations.

For age distributions by sex, males 15–34 years had the highest rates of cold-related ED visits, while males ≥65 years had the highest rates of cold-related hospitalizations (Table 2). Among females, there was a statistically significant difference between the rate of cold-related ED visits for the 15–34-year group and all other age groups. Among males, the rate of cold-related ED visits was significantly higher for the 15–34-year group compared with the 0–4, 5–14, and ≥65 age groups. For cold-related hospitalizations, there was a statistically significant difference between the rates for the ≥65-year group compared with the other age groups for females. For males, the 15–34, 35–64, and ≥65 age groups had significantly higher hospitalization rates compared with the other age groups. There was no statistically significant difference between the rates of cold-related hospitalizations or ED visits in the age groups of 0–4 or 5–14 years for males or females.

TABLE **1**

Number and Proportion of Cold-Related Events by Month in Minnesota

Month	Season	Emergency Department Visits, 2000–2018 # (%)	Hospital Admissions, 2000–2018 # (%)	Deaths, 2002–2019 # (%)
January	Cold	4,055 (28)	844 (26)	160 (26)
February		2,809 (19)	651 (20)	93 (15)
March		1,372 (9)	354 (11)	91 (15)
April		603 (4)	158 (5)	33 (5)
May	Hot	380 (3)	99 (3)	19 (3)
June		250 (2)	60 (2)	6 (1)
July		185 (1)	43 (1)	3 (<1)
August		197 (1)	49 (1)	3 (<1)
September		273 (2)	60 (2)	5 (1)
October	Cold	577 (4)	132 (4)	38 (6)
November		1,043 (7)	253 (8)	65 (10)
December		2,917 (20)	546 (17)	108 (17)
Total		14,661 (100)	3,249 (100)	624 (100)

Almost one half of the cold-related ED visits (45%) included diagnosis codes for substance use (Table 3). Other diagnosis codes co-occurring with cold-related ED visits included mental illness (11%), respiratory disease (8%), cardiovascular disease (7%), and diabetes (7%). Almost all the cold-related hospitalizations had at least one co-occurring diagnosis code (89%), including substance use (66%), mental illness (33%), respiratory disease (22%), or cardiovascular disease (20%; Table 3).

Deaths

We identified an average annual rate of 0.6 cold-related deaths per 100,000 population (n = 33) over each cold season from 2002 to 2019. Similar to the hospital discharge data, there was a statistically significant difference between the sex distribution of cold-related deaths, with females accounting for approximately 30% of cold-related deaths, while males accounted for 70% (Table 2). For both males and females, there was a statistically significant difference between the rate of cold-related deaths for the ≥65 age group compared with all other age groups.

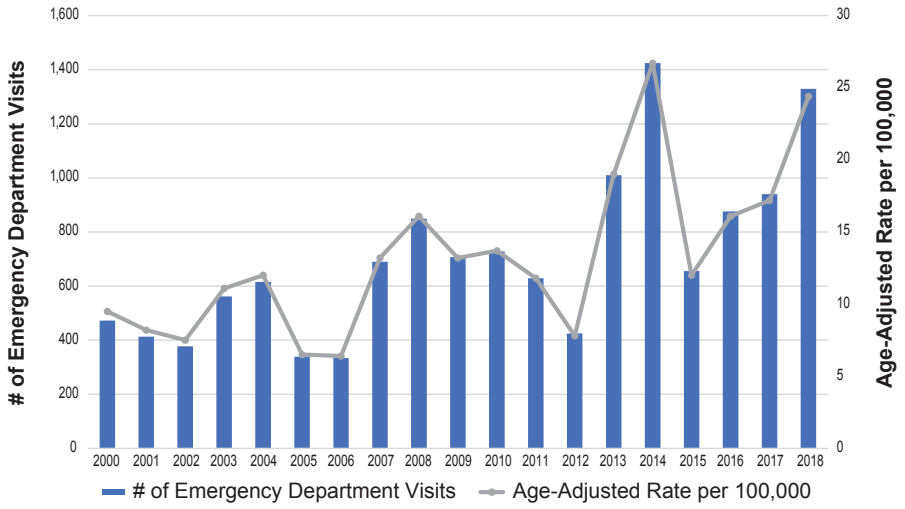
More than one half of all cold-related deaths (57%) had co-occurring diagnosis codes (Table 3). Almost one half of all cold-related deaths (44%) included a diagnosis code for substance use. Other co-occurring diagnosis codes included cardiovascular disease (19%), respiratory disease (8%), mental illness (2%), and diabetes (1%).

Discussion

Our study used hospital discharge data and vital statistics data to explore the case definition and assess the burden of cold-related illness and death in Minnesota. Overall, <10% of cold-related ED visits, hospitalizations, and deaths in Minnesota occurred during the hot season. We were unable to identify any distinct difference between the type of events occurring in the different seasons. We assessed the burden of cold-related illness and death in Minnesota using the case definition developed and adopted by the Cold-Related Illness Content Work Group, which includes cases only in the cold season. Using this case definition, we found that rates of illness and death in Minnesota were highest among older adults and males, which is consistent with previous studies (Gronlund et al., 2018; Lane

FIGURE **1**

Number and Rate of Cold-Related Illness Emergency Department Visits in Minnesota by Year, 2000–2018

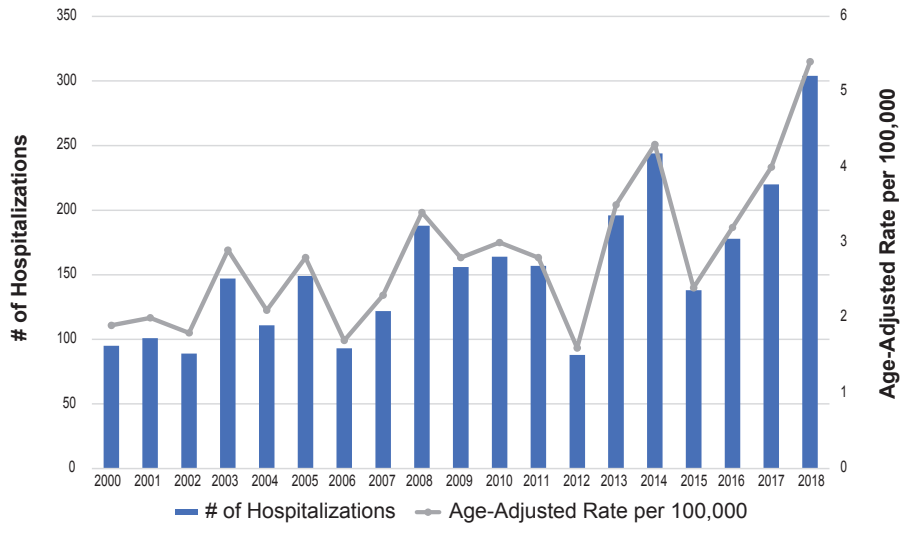


Note. Rates from 2000–2014 should not be compared with rates from 2015 onward due to a change in the International Classification of Diseases (ICD) coding from ICD-9 to ICD-10 on October 1, 2015.

Source: Minnesota Environmental Public Health Tracking Program data access portal (https://data.web.health.state.mn.us/web/mndata/cold_related_illness).

FIGURE **2**

Number and Rate of Cold-Related Illness Hospitalizations in Minnesota by Year, 2000–2018



Note. Rates from 2000–2014 should not be compared with rates from 2015 onward due to a change in the International Classification of Diseases (ICD) coding from ICD-9 to ICD-10 on October 1, 2015.

Source: Minnesota Environmental Public Health Tracking Program data access portal (https://data.web.health.state.mn.us/web/mndata/cold_related_illness).

et al., 2018; Nixdorf-Miller et al., 2006). Additionally, the most common co-occurring diagnosis with cold-related illness and death was substance use.

We hypothesized that cases in the hot season might be related to cold water exposure rather than cold weather or air temperature exposure. There were very few cases with water-related ICD codes, however, that occurred in the cold or hot seasons in Minnesota. Hypothermia could be due to cold water exposure in addition to cold temperature exposure; it is also possible that water-related hypothermia cases did not get properly documented with the ICD codes to indicate that water exposure was involved.

Our analysis also found that the highest proportion of cases in the hot season occurred during May, suggesting that a possible next step could involve expanding the definition to include this "shoulder-season" month. As climate change continues to disrupt patterns and distribution of rain and snow, we could see more snowfall outside of the typical cold season, further emphasizing the importance of expanding the surveillance window to include events in the hot season. Based on these findings, we recommend that other jurisdictions explore and present data on cold-related illness and death using both the case definition restricted to the cold season and the case definition that includes cases year-round.

In Minnesota, there were almost 2 times more cold-related illness ED cases than heat-related illness during the most recent 5 years of data (Minnesota Department of Health, n.d.). Both conditions had the same high-risk group profile of ED visits: highest among males 15–34 years and hospitalizations highest among males ≥65 years (Minnesota Department of Health, n.d.).

Additionally, there were more cold-related deaths annually compared with heat-related deaths during the study period, which is consistent with existing research comparing hyperthermia and hypothermia (Noe et al., 2012). Previous studies have also found that hyperthermia deaths were related to extreme heat events, while most cold-related deaths occurred on days that were colder than average, but not extremely cold—suggesting that it is important to prevent exposure to the cold even when the temperatures are not extreme (Gasparrini et al., 2015; Gronlund et al., 2018). Additional research could assess this

TABLE **2**

Number, Proportion, and Rate of Cold-Related Events by Sex and Age Group in Minnesota

	Emergency Department Visits, 2014–2018			Hospital Admissions, 2014–2018			Deaths, 2010–2019		
	# (%)	Rate per 100,000	95% CI	# (%)	Rate per 100,000	95% CI	# (%)	Rate per 100,000	95% CI
Total	5,227 (100)	–	–	1,048 (100)	–	–	426 (100)	–	–
Sex									
Female	1,546 (30)	11.4	[10.8, 11.9]	300 (29)	2.0	[1.8, 2.2]	134 (31)	0.4	[0.3, 0.5]
Male	3,681 (70)	27.2[a]	[26.3, 28.0]	748 (71)	5.7[a]	[5.3, 6.1]	292 (69)	1.0[a]	[0.9, 1.2]
Female age group (years)									
0–4	50 (3)	5.8	[4.3, 7.7]	9 (3)	1.0[c]	[0.5, 2.0]	0 (0)	0	0
5–14	112 (7)	6.3	[5.1, 7.5]	3 (1)	0.2[c]	[0, 0.5]	2 (0)	0.1[c]	[0, 0.2]
15–34	650 (42)	18.0[a]	[16.6, 19.4]	69 (23)	1.9	[1.5, 2.4]	14 (10)	0.2[c]	[0.1, 0.3]
35–64	502 (33)	9.4	[8.6, 10.2]	122 (41)	2.3	[1.9, 2.7]	44 (33)	0.4	[0.3, 0.6]
≥65	232 (15)	10.2	[8.8, 11.5]	97 (32)	4.2[a]	[3.4, 5.2]	74 (55)	1.7[a]	[1.3, 2.1]
Male age group (years)									
0–4	62 (2)	6.9	[5.3, 8.8]	7 (1)	0.8[c]	[0.3, 1.6]	0 (0)	0	0
5–14	125 (3)	6.8	[5.6, 7.9]	4 (1)	0.2[c]	[0.1, 0.6]	1 (0)	0[c]	[0, 0.2]
15–34	1,422 (39)	37.9[b]	[35.9, 39.9]	194 (25)	5.2[b]	[4.4, 5.9]	40 (14)	0.5	[0.4, 0.7]
35–64	1,702 (46)	31.6[b]	[30.1, 33.1]	427 (55)	7.9[b]	[7.2, 8.7]	137 (47)	1.3	[1.1, 1.5]
≥65	370 (10)	19.8	[17.7, 21.8]	152 (19)	8.1[b]	[6.8, 9.4]	114 (39)	3.2[a]	[2.6, 3.8]

Note. Data are restricted to cold-related events occurring in January to April and October to December. Rates are calculated using 2010 U.S. Census Bureau data for the denominators. CI = confidence interval.

[a] Significantly higher than other groups ($p < .05$).

[b] Significantly higher than other groups but not significantly different from each other ($p < .05$).

[c] Rates based on counts <20 are flagged as unstable because they can change dramatically with the addition or subtraction of one case.

relationship further by exploring other contributing factors involved in cold-related illness and death outside of temperature, such as occupational and social risk factors.

Chronic conditions, such as substance use, co-occurred with cold-related illness and death in Minnesota, which is consistent with previous studies (Berko et al., 2014; Gronlund et al., 2018; Lane et al., 2018). Substance use can adversely affect the body's ability to sense the cold and can cloud decision making, partially explaining this relationship. In Minnesota, rates of drug overdoses and deaths have been increasing, which might be contributing to the rise in cold-related illness and death in recent years (DeLaquil et al., 2020).

Substance use is both a cause and consequence of homelessness. Homelessness is an additional risk factor for cold-related illness and death, which has been on the rise in Minnesota (Minnesota Department of Health, 2023). People with mental health conditions might also be at increased risk for cold-related illness and death in part due to psychiatric medications that can impair thermoregulation (Gronlund et al., 2018). While mental illness was listed on only 2% of death certificate records, a similar study from New York City found that it was noted on a higher proportion of decedents in medical examiner records (Lane et al., 2018). Future studies in Minnesota could explore medical examiner records to obtain more detailed information on contributing factors in cold-related deaths.

There are several limitations to our analysis. These data only captured the individuals with the most severe or acute symptoms who were treated at the ED, hospitalized, or die. Thus, the cases likely are underestimated. We have provided a descriptive analysis of conditions co-occurring with a cold-related diagnosis and recommend that a more rigorous analysis be completed to elucidate the relationship between these conditions and cold-related illness.

Additionally, we do not have access to the full health records or patient history for individual hospitalizations and deaths, so we could be missing important contextual information. The data on hospitalization and death lack information on social factors, unhoused status, and occupation-related exposure, all of which would provide more insight into understanding the risk factors and context for the cases.

The Minnesota Department of Health is expanding its syndromic surveillance program and plans to pilot the cold-related illness case definition. These data often include more details and context that can give us a better understanding of the risk factors, high-risk groups, and geographical patterns of cold-related illness.

TABLE **3**

Number and Proportion of Other Health Conditions That Co-occur With Cold-Related Illness or Death in Minnesota

Other Health Conditions	Emergency Department Visits, 2015–2018 # (%)	Hospitalizations, 2015–2018 # (%)	Deaths, 2010–2019 # (%)
Any chronic condition	1,878 (56)	664 (89)	241 (57)
Cardiovascular disease	236 (7)	151 (20)	80 (19)
Diabetes	234 (7)	100 (14)	6 (1)
Mental illness	382 (11)	247 (33)	9 (2)
Respiratory disease	273 (8)	165 (22)	35 (8)
Substance use	1,487 (45)	492 (66)	187 (44)

Note. Emergency department visits and hospitalizations are not mutually exclusive. Any chronic condition is defined as having one or more of the following conditions: cardiovascular disease, substance use, mental illness, respiratory disease, or diabetes.

Conclusion

Our analysis examined the case definition and assessed the burden of cold-related illness and death in Minnesota. Despite warming winter temperatures due to climate change, cold-related illness and death will continue to be health risks. Additional research and discussion are needed to inform decision making about expanding the surveillance window, but we recommend that jurisdictions explore the case definition in both ways: restricted to the winter season and year-round cases. By assessing cold-related illness and death, changes in the distribution can be detected, high-risk groups can be monitored, and prevention initiatives can be developed. This study provides a locally relevant analytic framework for other jurisdictions to evaluate cold-related illness and death outside of the standard definition that is limited to the cold season.

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Evaluating the Impact of Food and Drug Administration-Funded Cooperative Agreement Programs on Conformance With the Voluntary National Retail Food Regulatory Program Standards

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Abstract **The Voluntary National Retail Food Regulatory Program Standards (Retail Program Standards) are a set of Food and Drug Administration (FDA) guidelines that provide a science-based framework for self-assessment and continuous improvement of retail food regulatory programs. FDA has funded multiple cooperative agreement programs for regulatory programs to progress toward conformance with the Retail Program Standards. Our study analyzed the 770 local health departments (LHDs) enrolled in the Retail Program Standards from 2002–2021 to 1) assess if the program's current guidelines are feasible for LHDs and 2) evaluate the effect of FDA cooperative agreement programs on conformance with the Retail Program Standards. Results indicate that LHDs are submitting necessary documentation close to the prescribed deadlines in the last 10 years. Grant-funded programs were shown to significantly improve the odds of achieving conformance with the Retail Program Standards in both self-reported and third-party audited submissions. Our study reports the first evaluation of FDA grant-funded programs aimed at improving conformance with the Retail Program Standards and highlights the importance of continued and sustainable funding for this work.**

Introduction

The Centers for Disease Control and Prevention (CDC, 2018) estimates that one in six people in the U.S. becomes ill from foodborne diseases each year. Of these individuals, 128,000 are hospitalized and 3,000 die. Due to the diversity of the retail food industry, responsibility is shared among interested parties at all levels including growers, processors, food service operators, and retail food establishment personnel. The roles of monitoring and regulating retail food establishments fall to state, local, tribal, and territorial (SLTT) government agencies, with guidance from the Food and Drug Administration (FDA). Tasks of SLTT agencies include inspection of retail food stores, restaurants, and institutional food service operations; removal of unsafe food products; enforcement of food safety regulations; and implementation of corrective action for out-of-compliance risk factors.

To help control these risk factors, FDA works with association and agency partners to encourage retail food regulatory agencies to implement the Voluntary National Retail Food Regulatory Program Standards (Retail Program Standards), which are a comprehensive set of guidelines that provides a framework for self-assessment (SA) and continuous improvement of food regulatory programs (Food and Drug Administration [FDA], 2023a). The Retail Program Standards provide a foundation and system on which retail food regulatory programs can build and continuously improve their retail programs and focus on the goal of reducing the occurrence of foodborne illness risk factors.

The Retail Program Standards consist of nine standards (Table 1) intended to reduce foodborne illness via capacity building, empowerment, and increased uniformity among SLTT retail food regulatory programs. In all U.S. states, one or more of the eligible state-level agencies with a retail food regulatory program has enrolled in the Retail Program Standards. In the U.S., 70.8% of the population reside in a locality in which an eligible local-level agency has enrolled in the Retail Program Standards (FDA, 2023b).

SLTT regulatory programs that participate in the Retail Program Standards conduct SAs that allow them to identify program needs, establish priorities, and create action plans to address the identified needs as resources become available (FDA, 2023a). The first guideline requires enrollees to submit an SA to FDA within 12 months of enrolling in the Retail Program Standards. Subsequent SAs are submitted 60 months after the initial one. If enrollees achieve conformance with ≥1 of

TABLE **1**

Voluntary National Retail Food Regulatory Program Standards and Desired Conformance Outcomes

Standard	Description	Desired Conformance Outcome
1	Regulatory Foundation	A sound, science-based regulatory foundation for the public health program and the uniform regulation of industry, such as equivalency to the FDA *Food Code*, ideally the most recent version
2	Trained Regulatory Staff	A trained regulatory staff with the skills and knowledge necessary to conduct quality inspections
3	Inspection Program Based on HACCP Principles	A regulatory inspection system that uses HACCP principles to identify risk factors and to obtain immediate and long-term corrective action for recurring risk factors
4	Uniform Inspection Program	A quality assurance program that ensures uniform, high-quality inspections
5	Foodborne Illness and Food Defense Preparedness and Response	A food regulatory program with a systematic approach for the detection, investigation, response, documentation, and analysis of alleged food-related incidents that involve illness, injury, or unintentional or deliberate food contamination
6	Compliance and Enforcement	An effective compliance and enforcement program that is implemented consistently to achieve compliance with regulatory requirements
7	Industry and Community Relations	Enhanced communication with industry and consumers through forums designed to solicit input to improve the food safety program; a further outcome is the reduction of risk factors through education outreach and cooperative efforts with interested parties
8	Program Support and Resources	The availability of resources to support a risk-based retail food safety program designed to reduce the risk factors known to contribute to foodborne illness
9	Program Assessment	A program that has identified elements that might need attention to further reduce the occurrence of foodborne illness risk factors

Note. FDA = Food and Drug Administration; HACCP = hazard analysis critical control point.

the 9 Retail Program Standards in their SA, they are required to submit a third-party verification audit (VA) within 6 months affirming their conformance. Enrolled programs are encouraged to continue work on achieving conformance with individual standards during a 5-year cycle.

In addition to FDA's efforts to promote enrollment in the Retail Program Standards, increases in funding and agency support at the national level have led to increased participation in the program. The Retail Program Standards Cooperative Agreement Program (RPS CAP) is a grant program offered by the National Association of County and City Health Officials (NACCHO) in which SLTT agencies enter into cooperative agreements directly with FDA to work on multiyear projects related to advancing conformance with the Retail Program Standards. FDA's total funding for RPS CAP from 2012 to 2021 was $30,412,000. Also offered is the NACCHO Retail Program Standards Mentorship Program CAP, which is a grant program that enabled SLTT agencies to participate in peer-to-peer mentorship and work with other agencies that have a record of sustained success with the Retail Program Standards. From 2012 to 2021, funding from FDA for the Mentorship Program CAP totaled $3,767,000.

In addition to funding opportunities and cooperative programs, we hypothesize that factors such as the size of the agency and the length of enrollment will affect conformance with the Retail Program Standards. In general, we observed that large SLTT agencies typically have more capacity to run additional programs, and therefore we would expect these agencies to have a higher conformance with the Retail Program Standards. A census of LHDs by NACCHO in 2019 revealed that the number of full-time equivalents (FTEs) at a department increases with the size of the jurisdiction (National Association of County and City Health Officials [NACCHO], 2019). With this increase in FTEs, we expect that more staff will be able to dedicate time to work on the Retail Program Standards. Furthermore, we also expect that the longer an agency has been participating in the Retail Program Standards, the more comfortable the agency will become executing the necessary steps toward achieving conformance with the standards and associated administrative procedures.

The objectives of our study were to 1) understand if the current guidelines of the Retail Program Standards are feasible for local retail food regulatory programs and 2) evaluate how grant funding is associated with conformance and the amount of time it takes for LHDs to submit the required documentation. As the Retail Program Standards are based on the most current science available to FDA, identifying programs that can increase conformance with the Retail Program Standards is likely to have a significant public health impact in the field of retail food service.

Methods

Study Design

In our study, a successful SA is defined as one that was submitted within 12 months of enrolling in the Retail Program Standards or 60 months after a previous SA was submitted and where the SLTT food regulatory program reported conformance with ≥1 standard. The study population included all LHDs enrolled in the Retail Program Standards from its inception in 2002 through January 2021. All observations in the initial data set that represented cycles for state and other nonlocal agencies were removed so that we could focus on Retail Program Standards conformance

at the local level. This population included 1,095 observations of cycles from the Retail Program Standards that were completed by 770 individual LHDs (Table 2).

Data and Analysis

Using the listing from FDA (2023b) of jurisdictions enrolled in the Retail Program Standards, we were able to observe the enrollment date and conformance with each of the standards in each 5-year SA cycle for all LHDs. Using these data, we created five outcome variables: 1) average time to SA submission, 2) average time to VA following successful SA, 3) number of standards achieved via SA, 4) number of standards achieved via VA, and 5) number of SA updates. SA cycles were broken down into four groups: Cycle 1 (770 observations), Cycle 2 (253 observations), Cycle 3 (64 observations), and Cycle 4 (8 observations). A dichotomous variable for participation in the Mentorship Program and a continuous variable for the size of population served by a jurisdiction were created using internal NACCHO data sources, including the *National Profile of Local Health Departments*. Grant funding for the Retail Program Standards through FDA for RPS CAP was identified using public funding data. Given that the data set used in our study contains the entire population of enrolled LHDs, 95% confidence intervals are not reported in text or tables beside their parameter estimates.

Effect Size Calculations

We used analysis of variance (ANOVA) to assess differences in outcome variables across several groupings: Mentorship Program participants, RPS CAP grantees, SA cycles, and jurisdiction size. Due to the number of statistical comparisons made in our study, Cohen's *d* and Cohen's *h* were calculated for each effect as a measure of the magnitude of the effect in the comparisons of continuous and dichotomous outcomes, respectively, in lieu of *p*-values. Effect size measures are a standardized metric to compare differences between two means or proportions. In our analysis, we considered values of <0.2 as non-meaningful, ≥0.2 as small, ≥0.5 as medium, ≥0.8 as large, and ≥1.2 as very large, in line with previous interpretations of Cohen's *d* and Cohen's *h* (Cohen, 1988; Sawilowsky, 2009). We highlight comparisons with large and very large effect sizes, as those independent variables are the most likely to be significantly associated with improved conformance with the Retail Program Standards.

TABLE **2**

Demographic Information of Local Health Departments (*N* = 770) Enrolled in the Voluntary National Retail Food Regulatory Program Standards

Demographic	# (%)
Grant program participation	
Mentorship Program	87 (11.3)
RPS CAP	37 (4.8)
Mentorship Program and RPS CAP	23 (3.0)
Neither	623 (80.9)
Jurisdiction population size *	
Small (<50,000)	199 (25.8)
Mid-sized (50,000–500,000)	309 (40.1)
Large (>500,000)	86 (11.2)
Missing	176 (22.9)

* Population size was determined using NACCHO member profiles. Missing jurisdictions did not have a current NACCHO profile.

Note. RPS CAP = Retail Program Standards Cooperative Agreement Program; NACCHO = National Association of County and City Health Officials.

TABLE **3**

Average Time to Submission of Self-Assessment (SA)

	SA Submitted Past Deadline (Mean # of Months)				
	Cycle 1	Cycle 2	Cycle 3	Cycle 4	Total
Grant participation					
Mentorship Program	5.0	27.9	1.4	1.0	12.0
RPS CAP	-2.0	3.1	-3.7	–	0.3
Mentorship Program and RPS CAP	-1.5	24.0	-14.3	–	10.2
Neither	6.1	14.7	2.0	-7.3	8.0
Jurisdiction population size *					
Small (<50,000)	3.3	0.1	-5.3	–	2.5
Mid-sized (50,000–500,000)	6.7	13.4	5.2	4.8	8.4
Large (>500,000)	10.5	24.4	0.5	–	14.0
Average	6.0	15.3	0.4	-5.3	8.0

* Population size was determined using NACCHO member profiles. Missing jurisdictions did not have a current NACCHO profile.

Note. RPS CAP = Retail Program Standards Cooperative Agreement Program; NACCHO = National Association of County and City Health Officials.

Regression Models

Negative binomial regression was used to estimate the relationship between participation in the Mentorship Program and RPS CAP

TABLE **4**

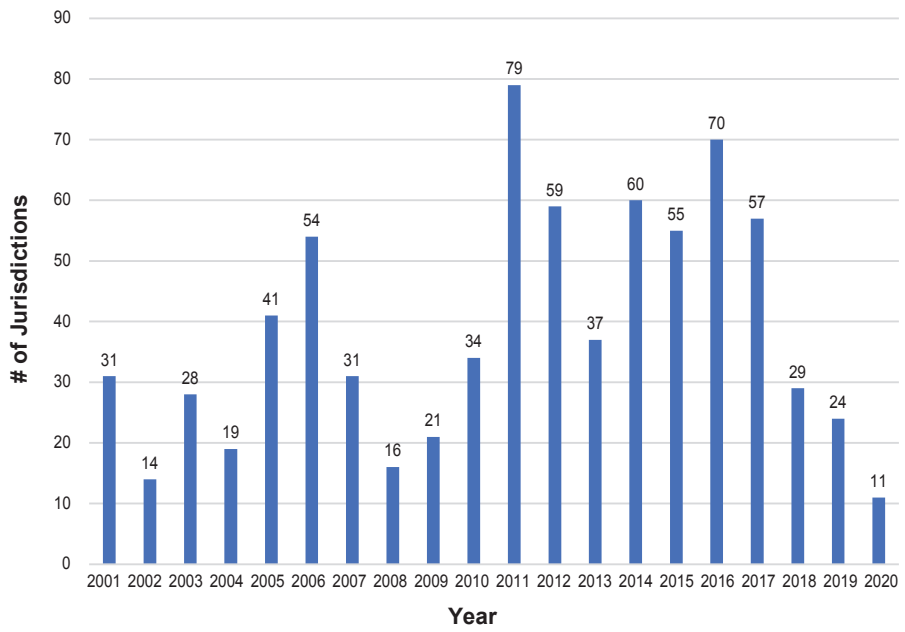
Average Time for a Third-Party Verification Audit (VA) Following a Successful Self-Assessment (SA)

	Time Between SA and VA (Mean # of Months)				
	Cycle 1	Cycle 2	Cycle 3	Cycle 4	Total *
Grant participation					
Mentorship Program	2.6	4.6	–	3.0	3.1
RPS CAP	–	0.8	0.4	–	0.6
Mentorship Program and RPS CAP	14.0	4.1	1.3	–	5.1
Neither	16.5	6.3	4.8	0.7	11.9
Jurisdiction population size **					
Small (<50,000)	12.89	6.23	1.0	–	10.6
Mid-sized (50,000–500,000)	13.0	6.5	4.6	0.7	10.0
Large (>500,000)	20.8	6.4	1.9	6.0	12.0
Overall	14.8	5.8	3.6	1.6	10.4

* Data in the comparison by cycle are skewed due to an administrative change to the Voluntary National Retail Food Regulatory Program Standards in 2008, which is explained further in the Discussion section.
** Population size was determined using NACCHO member profiles. Missing jurisdictions did not have a current NACCHO profile.
Note. RPS CAP = Retail Program Standards Cooperative Agreement Program; NACCHO = National Association of County and City Health Officials.

FIGURE **1**

Trends of Enrollment in the Voluntary National Retail Food Regulatory Program Standards for State, Local, Tribal, and Territorial Food Regulatory Programs



on the number of standards achieved and number of SA updates submitted. Rates for these comparisons represented the number of Retail Program Standards that a jurisdiction achieved conformance with during that cycle, and incidence rate ratios (IRRs) were used to represent the effect of grant programs and population size. Multiple logistic regression was used to estimate the odds ratios of achieving conformance with the Retail Program Standards and submitting SA updates related to participation in these grant programs. When developing multiple regression models, we tested the effect of the interaction between participation in the Mentorship Program and RPS CAP on the goodness-of-fit of the models. All statistical analyses were performed using Stata 17 BE.

Results

Objective 1

Average Time to Submission of Self-Assessment
Table 3 displays a comparison of the average time to submission of SAs across two groupings: grant participation and jurisdiction size. When comparing time to submission of SAs in jurisdictions that participated in grant programs with jurisdictions that did not, no meaningful difference was observed (Supplemental Table A1, www.neha.org/jeh-supplementals). In examining differences between individual cycles, we observed a large effect (Cohen's d = 0.73) when comparing small and large jurisdictions during their second SA cycles. Larger jurisdictions submitted SAs later than smaller jurisdictions.

Average Time to Verification Audit Following First Successful Self-Assessment
Table 4 shows the comparison of the average time to VA after an LHD submits a successful SA. We see a clear difference in the data in the amount of time it takes to verify conformance as LHDs continue to work on the Retail Program Standards. On average, it takes LHDs much longer to verify successful SAs via VAs (14.8 months) during their first cycle compared with subsequent cycles. Average time to VA following a successful SA did not differ meaningfully by jurisdiction size. As noted in Table 4, the data by cycles are skewed due to an administrative change in 2008 that altered the required time for verification from 36

months to 6 months (Figure 1). Observed effect sizes when comparing LHDs that participated in the Mentorship Program or RPS CAP with others were not large (Supplemental Table A1 and A2).

Objective 2

Self-Assessment Updates

Multiple updates to any given SA cycle can be submitted by an LHD in a 5-year cycle if the agency achieves conformance with a new standard during the period and wants to move toward verifying conformance via VA. Table 5 shows that, on average, jurisdictions that participated in grant programs were more likely to submit SA updates than those that did not. More mentorship participants (39%), RPS CAP grantees (48%), and jurisdictions that participated in both programs (50%) submitted SA updates than jurisdictions that did not participate in grant programs (19%).

Number of Standards Met During a Self-Assessment Cycle

We examined both self-reported conformance in SAs and verified conformance in VAs and found that LHDs achieved conformance with fewer standards in Cycle 1 than in subsequent cycles (Table 6). On average, Mentorship Program participants and RPS CAP grantees self-reported conformance with more standards (2.5 and 3.1, respectively) than LHDs that did not participate in either grant program (1.6). This finding was true even when comparing conformance verified by VA. In VAs, RPS CAP grantees achieved conformance with more standards than Mentorship Program participants (2.3 versus 1.8) or those who did not participate in either grant program (1.0).

Estimated Impacts of Grant Program Participation

Multiple logistic regression was used to estimate the effect of grant program participation on the odds of submitting an SA update, successful SA, or VA verifying conformance with at least one standard. As shown in Figure 2, participation in both the Mentorship Program and RPS CAP was associated with increased odds of achieving all three of the outcomes. Mentorship Program participation was significantly associated with odds of positive SA (*OR* = 3.4, 95% confidence interval (CI) [1.7, 6.8]), achieving conformance with at least one standard via VA (*OR* = 3.5, 95% CI [1.9, 6.3]), and submission of an SA update during a cycle (*OR* = 1.9, CI [1.0, 3.5]) compared with jurisdictions that did not participate in the Mentorship Program (Supplemental

TABLE **5**

Proportion of Local Health Departments That Submitted Self-Assessment Updates

	Cycle 1	Cycle 2	Cycle 3	Cycle 4	Total
Grant participation					
Mentorship Program	0.45	0.37	0.20	0	0.39
RPS CAP	0.25	0.50	0.56	–	0.48
Mentorship Program and RPS CAP	1.00	0.29	0.67	–	0.50
Neither	0.13	0.32	0.25	0	0.19
Jurisdiction population size *					
Small (<50,000)	0.16	0.31	0	–	0.18
Mid-sized (50,000–500,000)	0.15	0.30	0.29	0	0.20
Large >500,000	0.13	0.35	0.39	0	0.23
Overall	0.16	0.33	0.31	0	0.21

* Population size was determined using NACCHO member profiles. Missing jurisdictions did not have a current NACCHO profile.

Note. RPS CAP = Retail Program Standards Cooperative Agreement Program; NACCHO = National Association of County and City Health Officials.

TABLE **6**

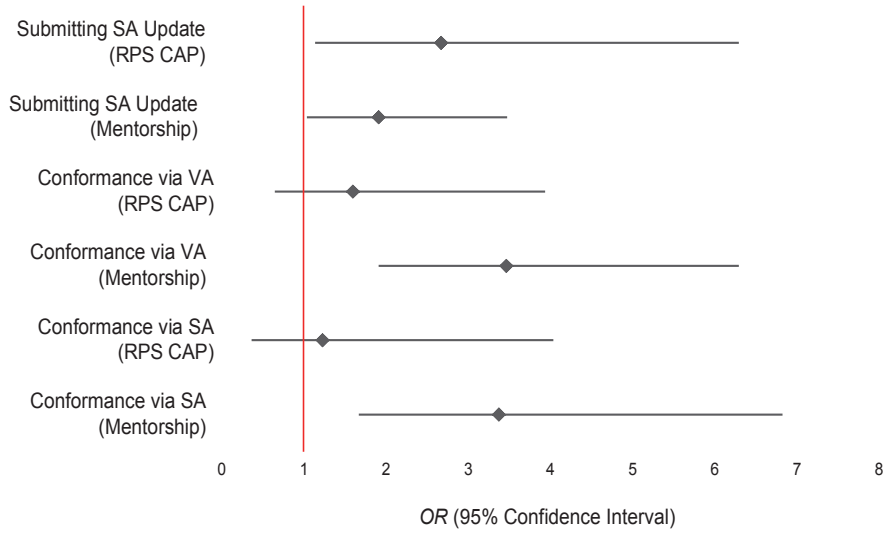
Mean Number of Standards Achieved via Self-Assessment (SA) and Third-Party Verification Audit (VA)

	Mean # of Standards Achieved via SA				
	Cycle 1	Cycle 2	Cycle 3	Cycle 4	Total
Grant participation					
Mentorship Program	2.0	3.6	3.6	1.0	2.5
RPS CAP	1.0	3.4	4.2	–	3.1
Mentorship Program and RPS CAP	2.0	3.9	5.0	–	3.8
Neither	1.3	2.6	2.6	2.2	1.6
Overall	1.3	2.7	3.0	1.9	1.7
	Mean # of Standards Achieved via VA				
	Cycle 1	Cycle 2	Cycle 3	Cycle 4	Total
Grant participation					
Mentorship Program	1.6	2.4	2.0	1.0	1.8
RPS CAP	0.3	2.4	3.8	–	2.3
Mentorship Program and RPS CAP	1.5	3.7	4.7	–	3.6
Neither	0.7	1.9	1.8	1.2	1.0
Overall	0.7	2.0	2.2	1.1	1.1

Note. RPS CAP = Retail Program Standards Cooperative Agreement Program.

FIGURE **2**

Forest Plot Highlighting the Odds Ratio (*OR*) of Achieving Various Success Outcomes During the Self-Assessment (SA) Cycle



Note. RPS CAP = Retail Program Standards Cooperative Agreement Program; VA = third-party verification audit.

Table B1). RPS CAP grantees had significantly higher odds of submitting SA updates (*OR* = 2.6, 95% CI [1.1, 6.3]). Moreover, RPS CAP grantees compared with non-grantees did not differ on odds of a positive SA (*OR* = 1.2, 95% CI [0.4, 4.0]) nor on achieving conformance with at least one standard via VA (*OR* = 1.6, 95% CI [0.7, 3.9]).

Negative binomial regression was used to predict the impact of these grant programs on the number of standards achieved via SA and VA, as well as the number of SA updates submitted by an LHD. Participation in the Mentorship Program was associated with an increased rate of conformance via SA (IRR = 2.2, 95% CI [1.2, 3.9]), conformance via VA (IRR = 1.7, 95% CI [1.3, 2.1]), and SA update submission (IRR = 1.8, 95% CI [1.3, 2.6]). RPS CAP participation was significantly associated with an increased rate of conformance via VA (IRR = 1.5, 95% CI [1.1, 2.0]) and associated with an increased rate of conformance via SA (IRR = 2.1, 95% CI [0.9, 4.8]) and an increased rate of SA update submission (IRR = 1.6, 95% CI [1.0, 2.4]).

Discussion

The first objective of our study was to understand if the current administrative guidance is achievable for LHDs that are currently enrolled in the Retail Program Standards. In this analysis, we observed a reduction in the time it takes LHDs to submit SAs and VAs, and submission averages that were close to the guidelines. The data in our study indicate that the current guidelines are feasible for current Retail Program Standards enrollees and that efforts to promote access to FDA Retail Food Specialists, enrollment, and active participation in the Retail Program Standards have been beneficial.

It is also noteworthy that administrative processes in the Retail Program Standards program have changed since its inception. For instance, LHDs that enrolled closer to program inception originally had 36 months to submit a VA following a positive SA, per the original administrative guidelines. These factors are important in framing the conversation regarding the feasibility of the current deadlines for submission of SAs and VAs. While examining the entire population of enrolled programs, it may seem that the current guidelines for submissions are not feasible, especially for those in their first SA cycle; however, our results indicate that LHDs have increasingly been able to meet the deadlines put forth by FDA. Based on this analysis, the current guidelines are feasible for LHDs that are enrolled in the Retail Program Standards.

We have highlighted efforts to achieve conformance, including RPS CAP and the Mentorship Program. Funding for these grant programs has drastically increased since the inception of these cooperative agreement programs. Annual funding from FDA for RPS CAP grants increased from $250,000 in 2009 to $3,530,000 in 2012. Significant funding also shifted participation in, and working toward conformance with, the Retail Program Standards from a purely voluntary activity to an effort that required outcomes to secure future funding for food regulatory programming.

Other efforts at the national level—including outreach from FDA Retail Food Specialists, promotion of Retail Program Standards training and webinars, and other financial incentives—are more difficult to account for in this type of analysis. We know that there are also efforts at the local level to improve LHD engagement with the Retail Program Standards, including formal networks that allow LHDs to work together on the standards, informal networks of LHD employees who collaborate across jurisdictional lines, and statewide peer-to-peer mentorship programs. These regional efforts become more successful as more LHDs enroll in the Retail Program Standards, which allow for more collaboration and a decreased workload for any individual agency (NACCHO, 2022).

The positive impact of participation in Retail Program Standards grant programs was also clear regarding advancement toward conformance with the standards. While participation in these programs was not associated with an improvement in timeliness of SA or VA submissions, grant participants were much more likely to achieve conformance with at least one standard and achieved conformance with more standards than other enrolled LHDs on average. It is important to continue to provide and expand both financial and programmatic support to continue to advance conformance with Retail Program Standards at the local level. The large odds ratios associated with the Mentorship Program and conformance with at least one standard via SA assessment and VA are important. NACCHO has collected quantitative and qualitative evaluation data during its 10 years leading the Mentorship Program. There are

many success stories and other anecdotal evidence from mentorship participants, but this study is the first time the program's relationship with conformance to the Retail Program Standards has been assessed and reported.

The relationship of jurisdiction size with timeliness of submission was unexpected. Generally, larger LHDs have increased capacity, perhaps due in part to greater staffing resources. In our study, small LHDs submitted SAs much sooner than mid-sized and large LHDs. While this result did not support our hypothesis, it is noteworthy that NACCHO's *National Profile of Local Health Departments* also reported that the number of FTEs per capita decreased with jurisdiction size. This finding provides an interesting case when evaluating the Retail Program Standards, as small LHDs might be more likely to have a dedicated staff member who can focus primarily on the standards. This association was reversed when comparing the impact of jurisdiction size on conformance. Thus, while smaller jurisdictions may hit administrative deadlines at a higher rate, larger jurisdictions still appear to be outperforming their smaller counterparts in conformance. It is important to continue to engage individuals at small LHDs to ensure that their passion for advancing conformance remains constant, but it is also necessary to improve support for mid-sized and large LHDs whose staff might be involved with the standards while working on several projects simultaneously.

Limitations

Due to the exploratory nature of our study, a significant number of comparisons are made. For this reason, we report effect sizes in lieu of reporting *p*-values. In addition, caution should be taken when considering comparisons—including Cycle 3 and Cycle 4—due to the small number of observations in those cycles. Future research assessing the longitudinal trends of grant program participants could provide more insight into how conformance to the Retail Program Standards improves during and after being awarded the RPS CAP and Mentorship Program grants.

Conclusion

The findings of our study suggest that continuing to expand and provide funding opportunities for LHDs is key to advancing conformance with the Retail Program Standards. The efforts undertaken by FDA to promote enrollment and active participation in the Retail Program Standards since its inception have significantly increased the capacity of LHDs to meet deadlines and achieve conformance at the local level. FDA and its association partners should continue to promote enrollment in the Retail Program Standards and provide opportunities for participating LHDs to collaborate on their efforts toward conformance.

To better understand the impact of grant funding and mentorship participation, additional longitudinal analysis of conformance in participating SLTT regulatory programs should be completed, which would allow for a better characterization of changes in conformance before and after grant funding or Mentorship Program participation. Furthermore, this type of analysis would provide stronger evidence for expanding funding streams to include more opportunities for cooperative agreements and peer-to-peer mentorship.

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INTERNATIONAL PERSPECTIVES/SPECIAL REPORT

Bacterial and Viral Pathogens in Drinking Water Sources in Pakistan: A Recent Perspective

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Abstract **Waterborne pathogens cause a serious threat to the overall health of people and the prosperity of a country. Pakistan has limited resources to sustain its increasing population. Because of socioeconomic factors, people tend to compromise on health safety standards. In Pakistan, waterborne diseases occur throughout the year, although the frequency usually increases after the monsoon season because rains provide a suitable environment for the growth of microorganisms that are causative agents of waterborne diseases. Contamination of drinking water with sewage, water flooding, and heavy rainfall are some important factors that can lead to waterborne diseases. Waterborne hepatitis, cholera, diarrhea, gastroenteritis, and typhoid are important diseases linked with water. Our article provides a recent overview of the frequency of waterborne pathogens in Pakistani water sources, outbreaks, and infections. The improper disposal of wastewater at the household and city levels increases the likelihood of these aforementioned diseases. Thus, there is a need to trace the origins of outbreaks in the Disease Early Warning System of Pakistan. Improvements in the treatment and filtration of drinking water, along with the awareness campaigns of vaccinations for common waterborne pathogens, are crucial for controlling these diseases in the country.**

Introduction

Water is an essential element for humans. An individual requires approximately 20–50 L of water per day for drinking, cooking, and other necessities of life. Approximately 70% of the Earth's surface is covered with water. Freshwater resources are approximately 3% of the total water resources and 0.01% of freshwater is utilized for human consumption (Berner, 2023). Waterborne diseases pose a major threat to public health in many developing countries, including Pakistan. Many developing countries face water scarcity due to the decrease in surface water and groundwater, which has led to increased use of unsafe water (Azfar et al., 2017). The consumption of unsafe water is one of the major constraints to the health and productivity of humans living in developing countries.

Currently, the population of Pakistan is estimated to be 240 million with an average density of 312 people per km^2 (Worldometer, 2023). Approximately 53% of the population lives in Punjab Province, 23% in Sindh Province, 15% in Khyber Pakhtunkhwa Province, 6% in Balochistan Province, 2% in Federally Administered Tribal Areas (FATA), and 1% in the capital city of Islamabad. The densely populated Punjab Province covers only 26% of the area of Pakistan. Overall, three out of the four top densely populated cities—Lahore, Faisalabad, and Rawalpindi—are also located in Punjab. Karachi, however, is the most populous city in the country and is located in Sindh. The population density per km^2 for these cities is provided in parentheses: Karachi (24,000), Lahore (6,300), Faisalabad (2,500), and Rawalpindi (1,322) (Finance Division, 2020). A high population density in megacities such as Karachi and Lahore, along with densely built houses, decreases the per capita availability of clean water.

Likewise, people living in sparsely populated areas in deserts do not have access to safe water. In some parts of the country, people—especially women—have to walk for several miles daily to get drinking water, and the water they retrieve is not potable (Talpur & Mari, 2021). Drinking nonpotable water increases the risk of waterborne diseases.

Owing to the poor availability of safe water, Pakistan is listed in the Extremely High-Water Stress category by the World Resources Institute (Food and Agriculture Organization, 2021). Approximately 27.2 million people in Pakistan are drinking unsafe water and approximately 12.8 % of infant deaths in the country can be attributed to waterborne diseases (Government of Balochistan & UNICEF, 2018).

FIGURE **1**

Waterborne Diseases Caused by Bacterial and Viral Pathogens in Major Cities in Pakistan

TABLE **1**

Studies Showing Percent Positivity of Waterborne Pathogens in Drinking Water Samples From Pakistan, 2010–2023

Pathogen	Positive Cases (%)	Region	Reference
Hepatitis A virus	13	Lahore	Ahmad et al., 2018
	21	Rawalpindi	Ahmad et al., 2018
Hepatitis E virus	41	Islamabad	Ahmad et al., 2010
	45	Rawalpindi	Ahmad et al., 2010
Rotavirus	23	Karachi	Rashid et al., 2021
	23	Lahore and Rawalpindi	Umair et al., 2018
Vibrio cholerae	–	–	–
Salmonella Typhi	22	Peshawar	Israr et al., 2022
E. coli	42	At provincial level	Younas et al., 2016
	75	Abbottabad	Jadoon et al., 2021
	52	Peshawar	Israr et al., 2022
Coliforms	60–69	Karachi	Fatima et al., 2021
	40	Islamabad	Hisam et al., 2014
	73	Lahore	Zareen et al., 2014

The population of Pakistan is growing at a very rapid pace, along with an accompanying constant decrease in water resources (Hassan Rashid et al., 2018). People seek alternative water sources when there is not a source for safe drinking water. Likewise, in densely populated areas, limited availability of water purification systems also leads to the consumption of unsafe drinking water (Batool et al., 2019). Further, the dry season in desert areas leaves people with limited options such that they often utilize unsafe drinking water.

Drinking contaminated water causes 20–40% of all diseases and approximately 40% of all deaths in Pakistan. Moreover, the financial losses of approximately 25–58 billion PKR (87–202 million USD), or 0.6–1.44% of the country's gross domestic product annually, are also attributed to waterborne diseases (Global Water Partnership, n.d.; Nabeela et al., 2014).

Myriad environmental and microbial factors contribute to waterborne diseases (e.g., cholera, diarrhea, gastroenteritis). The burden of waterborne diseases might become worse in the near future in response to increasing population, rapid urbanization, changing climate conditions, decreasing groundwater, and ineffective implementation of regulations regarding standards for drinking water quality. Therefore, we reviewed the occurrence of important waterborne diseases in Pakistan in locally relevant conditions (Figure 1). We also present prevention strategies for waterborne diseases in Pakistan.

We reviewed the published data from the last 14 years (2010–2023) of waterborne disease outbreaks and infections in Pakistan wherever an association with a water source could be established. If outbreaks and infections were not present, we included the studies on the identification of waterborne pathogens from drinking water. The priority of selection criteria for the review was based on three stages. At the first stage, we shortlisted research articles having reports of waterborne outbreaks (bacterial or viral). In the second stage, we added articles reporting sporadic cases related to waterborne pathogens. Lastly, if there was no report of an outbreak or cases related to a waterborne pathogen, we included detection studies.

Data were collected from Google Scholar, PubMed, and ScienceDirect using the following keywords (Table 1): waterborne, drinking water, freshwater, microbial load, diarrhea, hepatitis A, hepatitis E, rotavirus, cholera, typhoid, *E. coli*, coliforms, and Pakistan. Alternative keywords were used wherever required. Our article has special relevance to countries with similar socioeconomic, demographic, and climatic conditions, including Afghanistan, Bangladesh, India, Iran, Nepal, and Sri Lanka.

Demographics and Water Quality in Pakistan

Based on results from the Pakistan Social and Living Standards Measurement Survey (Pakistan Bureau of Statistics, 2013), the major sources of drinking water for people in Pakistan are tap water (32%), hand pumps (28%), motor pumps (27%), and dug wells (4%). Underground water is the most important water supply source in many areas of Pakistan. In Pakistan, groundwater availability has reduced from 5,000 m^3/year to 1,000 m^3/year since 1950 (Nabi et al., 2019).

In many cities in Pakistan, sewage water is illegally disposed of in rivers after only screening and straining—but without microbial decontamination. This untreated sewage water contaminates the sources of fresh water (e.g., lakes, rivers). Monsoon season, rainfall, and floods, along with the lack of adequate infrastructure and resources, lead to an increase in the odds of drinking water contamination. Ineffective sewage systems, extreme climatic conditions, and floods become sources of introducing microbial pathogens into the clean drinking system (Daud et al., 2017).

The mixing of microbial pathogens with industrial waste, domestic waste, pesticides, and fertilizers are basic determinants of water pollution (Praveen et al., 2016). According to guidelines of the World Health Organization (WHO) and Pakistan Environmental Protection Agency (2008), acceptable standards for microbial quality dictate that there should be zero *E. coli* or thermotolerant coliforms per 100 ml of drinking water. The regular surveillance by the Pakistan Council of Research in Water Resources suggests that the quality of drinking water in Pakistan has remained below standards (Soomro et al., 2011).

Diseases related to microbial contamination of water affect people across Pakistan. The water resources of major cities across all provinces, as well as in Islamabad, are worse than the permissible microbial standards that WHO sets for water. In addition to Islamabad, cities with drinking water below WHO permissible microbial standards include Lahore, Faisalabad, Rawalpindi, Sialkot, Gujranwala, Multan, and Bahawalpur in Punjab Province; Karachi and Hyderabad from Sindh Province; Peshawar, Abbottabad, Mingora, and Mardan in Khyber Pakhtunkhwa Province; and Quetta, Ziarat, Khuzdar, and Loralai in Balochistan Province (Nabeela et al., 2014). A national study analyzed the drinking water from the four provinces of Pakistan and found coliforms present in 64% (Punjab), 67% (Khyber Pakhtunkhwa), 83% (Sindh), and 78% (Baluchistan) of the water samples (Soomro et al., 2011). These data suggest that due to the presence of microbial pathogens, the country's drinking water is not safe for human consumption.

Water in Pakistan is heavily contaminated with coliforms and fecal coliforms, which was confirmed by a study that evaluated >7,000 drinking water samples and found total coliforms and fecal coliforms in an average of 58–71% of samples across the country (Nabeela et al., 2014). Lahore is Pakistan's second-largest city, with a population of approximately 10 million people. The bacteriological quality of bottled drinking water available in Lahore was evaluated and 2 out of 20 (10%) of the bottled water samples tested positive for fecal coliform contamination—suggesting that even some of the bottled water is unsafe for human consumption in Pakistan (Yousaf & Chaudhry, 2013).

Waterborne Hepatitis

Waterborne hepatitis is a highly contagious infection in humans that is caused by the hepatitis A virus (HAV) and hepatitis E virus (HEV). The disease is primarily transmitted via the fecal–oral route. In the early stages, the disease is asymptomatic, but viremia is present. In the clinical stage of infection, there is an acute inflammation of the liver. HAV has a high prevalence (up to 90%) in children who live in developing countries (Franco et al., 2012). Many cases of waterborne hepatitis appear in different cities of Pakistan in the form of outbreaks and sporadic cases.

In Karachi, contamination of drinking water with sewage water led to 79 cases of waterborne hepatitis at a boys' vocational training center. The affected boys were using the contaminated tap water for drinking purposes and for washing raw vegetables (Subuktageen et al., 2019). Rizwan et al. (2023) reported on another outbreak of viral hepatitis in Karachi that affected 109 people and reported HAV at 85%, HEV at 12%, and HAV/HEV at 2.1%. Vegetables that were being washed with contaminated water from rusted pipes were the possible source.

Another study examined an outbreak of HEV in Swat (Khyber Pakhtunkhwa Province) that affected 299 people. The source of the virus was found to be tap water in rusted drinking water pipes. When drinking water pipes are rusted, suction due to the negative pressure develops, leading to mixing of drinking and sewage water (Din et al., 2018).

Water contaminated with feces is the major source of virus transmission. Water from overflowing gutters seeps into supply lines of drinking water reservoirs, resulting in its contamination. A study conducted on the presence of HEV in Islamabad and Rawalpindi revealed that approximately 41% and 45% of the samples were positive for the virus, respectively (Ahmad et al., 2010). Similarly, Ahmad et al. (2018) determined the presence of HAV in drinking water in Lahore and Rawalpindi, with a prevalence of 12.5% and 21.1%, respectively (Table 1).

Moreover, water-associated HAV can remain infectious in water for up to 3 months (Barrett et al., 2019). These findings indicate that the lack of appropriate sewage water treatment is the leading cause of HAV in Pakistan. Currently, there is no special program in Pakistan to curtail the spread of HAV and HEV.

Rotavirus Neonatal Diarrhea

Rotavirus occurs most commonly in infants and causes a gastroenteric infection that leads to severe watery diarrhea, vomiting, fever, abdominal pain, and dehydration (Stanifer & Boulant, 2020). The virus can survive in the environment and can withstand low humidity. The morbidity of the virus is high and one third of infected children with severe diarrhea die.

In 2015–2016, Sadiq, Bokhari, et al. (2019) performed a study in Rawalpindi and Islamabad to evaluate the incidence of rotavirus. The study found that 26.5% of diarrheic samples from hospitalized children were positive for rotavirus (Sadiq, Bokhari, et al., 2019). After the vaccine was available in the same cities, the same research group found that the positivity rate was decreased to 21–22%, suggesting that rotavirus vaccination can help prevent rotavirus disease (Sadiq, Bostan, et al., 2019).

Rashid et al. (2021) tested the drinking water supplied by municipal authorities in Karachi and found that 23% of the samples were positive for rotavirus. Similarly, Umair et al. (2018) conducted a study at tertiary care hospitals in Lahore and Rawalpindi and found the overall rotavirus positivity rate to be 23.2%. Additionally, reports from Peshawar and Karachi suggest the associa-

tion of sewage water with rotavirus infection. Furthermore, Ahmad et al. (2016) detected amoeba along with rotavirus in Karachi.

The contamination of drinking water with wastewater increases the risk for transmission of rotavirus because this virus can survive better in the environment compared with other enteric viruses. As far as control measures are concerned, rotavirus vaccination has decreased the positivity and severity rate of infection globally. The Government of Pakistan included the rotavirus vaccine in its Expanded Program on Immunization in 2017. Nevertheless, further vaccine advocacy campaigns might be required for these immunization programs to be successful.

Cholera

Cholera is an enteric infection caused by *Vibrio cholera* and spread by consumption of contaminated food and water (Jutla et al., 2017). Cholera is characterized by vomiting and profuse watery diarrhea. In severe cases, cholera can cause dehydration and death. Cholera has been prevalent in South Asia throughout history. Among more than 200 serogroups, only O1 and O139 of *V. cholera* are associated with outbreaks. The prevalent strains in Pakistan are Pakistani subclade I (PSC-I) and Pakistani subclade II (PSC-II) (Shah et al., 2014).

The intake of fecal-contaminated water is the leading cause of cholera. Cholera outbreaks are seasonal in Pakistan and other South Asian countries. Natural disasters such as floods lead to the mixing of drinking water with feces or fecal-contaminated water. Thus, the occurrence of disease outbreaks increases after these events.

Approximately 13% of Pakistan's population still defecates in open spaces because of the lack of proper toilets. Other factors such as limited access to sanitation, poor hygiene, and inadequate water supply also can contribute to cholera outbreaks (Oguttu et al., 2017). Cholera is a notifiable disease in Pakistan; however, the quality of surveillance data is poor due to the lack of standard data collection techniques, limited focus on skill development of healthcare staff, and the lack of motivation and responsibility in collecting and handling data (Qazi & Ali, 2009).

Due to the lack of an appropriate reporting system, the exact magnitude of cholera is difficult to determine (Lopez et al., 2020). To overcome this issue, WHO launched the Disease Early Warning System (DEWS) in Pakistan in 2005 for the quick investigation of disease outbreaks nationally and to devise appropriate strategies for mitigating the spread of cholera in disaster-affected areas, especially earthquake-prone areas. This system is responsible for the Integrated Disease Surveillance and Response (IDSR) system at the level of provinces in coordination with public health laboratories in the Sindh and Punjab Provinces.

From 2005–2009, DEWS responded to 261 alerts and 46 outbreaks of diarrhea in Pakistan (Rahim et al., 2010). Two cases of cholera were reported in Rawalpindi, which led to further investigation and surveillance. Overall, 30 active cases of cholera and 2 deaths were identified. Of the affected people, 47% of cases were attributed to consumption of well water and 40% of cases were attributed to consumption of tap water. The water sources were found positive for *V. cholera* serotype Inaba and coliforms. Floods were the likely cause of the well water and tap water contamination (Akram, 2018).

From 2011–2014, DEWS/IDSR reported millions of cases of diarrhea across Pakistan. The annual data of the confirmed cholera cases in Pakistan are mentioned in parentheses: 2011 (527), 2012 (144), 2013 (1,069), and 2014 (1,218). Subsequently in Punjab, it was shown that 8.9% of acute diarrhea cases were suspected to be due to cholera from 2013–2016 (Lopez et al., 2020). Recently, heavy rains and devastating floods in Pakistan have resulted in several cholera outbreaks. Flood-affected areas were deprived of clean drinking water, leading people to consume contaminated water, which then led to outbreaks of cholera in multiple cities.

For example, 2,000 acute diarrheal cases were reported in Lahore alone from April through May 2022. Water contamination due to the substandard drainage system is believed to be responsible for these outbreaks (Naveed et al., 2022). A cross-sectional study conducted on 191 patient stool samples in Nishtar Hospital in Multan revealed that 11% of samples were positive for cholera (Ishfaq et al., 2022). Another study reported a contaminated drinking water-associated cholera outbreak comprising 90 suspected patients at the Dr. Ruth K. M. Pfau Civil Hospital Karachi (Abbasi et al., 2023).

Despite a continued rise in the incidence of cholera, a thorough understanding of the disease's major epidemiological aspects is still missing. There is a dire need to elucidate the major determinants of this disease. The existing gaps in knowledge can guide researchers, policymakers, and health professionals to devise appropriate disease control strategies at a local level.

Proper disposal of feces from infected people can prevent disease transmission. Cholera outbreaks can be prevented by the chlorination of stored water and proper hand hygiene. The Government of Pakistan has tried several ways to reduce the impact of cholera, especially after recent floods. For example, the government has established diarrhea treatment centers and diagnostic facilities in flood-affected areas. Additionally, it has ensured the provision of clean drinking water in these areas. Government-initiated community engagement programs included recruitment of social mobilizers and the provision of water-purifying tablets. In addition to these initiatives, the government has emphasized the chlorination of water and sanitation awareness.

Typhoid

Typhoid is a systemic infection caused by *Salmonella* Typhi via the ingestion of contaminated food or water. This bacterium is a Gram-negative rod that can be detected by a variety of serological and molecular tools.

A prospective population-based surveillance study in five Asian countries determined that the incidence of typhoid in Pakistan was the second highest, followed by India (Ochiai et al., 2008). This study found that in Pakistan, the overall incidence of typhoid fever was 573 per 100,000 people per year in children between the ages of 2 and 4 years. The incidence decreased, however, to 452 per 100,000 people per year in children and adolescents between the ages of 2 and 15 years. Owais et al. (2010) examined the incidence of typhoid in children <2 years in southern areas of Pakistan and found that the incidence was 443 per 100,000 children. Khan et al. (2012) determined the risk factors associated with the occurrence of typhoid fever in children and adolescents between 2 and 16 years and found that the incidence of the disease increased with increasing population density, although incidence decreased with advancing age. What is noteworthy is that a reduced incidence of typhoid was observed in households that consumed clean drinking water (Khan et al., 2012).

Khan et al. (2013) used diagnostic tests and reported that 550 out of 2,964 (18.6%) patients were positive for typhoid in Quetta (Balochistan Province). They found that typhoid occurrence was higher in children between the ages of 5 and 10 and in the summer season; disease occurrence was similar among genders. Siddiqui et al. (2015) conducted a cross-sectional study in Karachi and found that 19 out of 209 food handlers were positive for *S. enterica* serovars: 4.3% were positive for typhoidal serotype and the remaining were non-typhoidal serovars. All typhoidal serovars demonstrated antibiotic sensitivity against cefixime, chloramphenicol, nalidixic acid, and ofloxacin (Siddiqui et al., 2015).

An outbreak of 101 cases was reported from two subdistricts of Hyderabad between November 2016 and March 2017. The presumptive source of this outbreak was contamination of drinking water with sewage water. Children were more commonly affected, with a median case age of 0–60 months (Yousafzai et al., 2019). Israr et al. (2022) found that 22% of drinking water samples were positive for *Salmonella* Typhi in Peshawar. The higher occurrence of this disease in Pakistan is due to poor personal hygiene, substandard sanitation, and persistent poverty (Arif & Naheed, 2012).

Unfortunately, cases of extensively drug-resistant typhoid fever (XDR-TF) are rising in Pakistan. According to the Weekly Field Epidemiological Report by the Pakistan National Institute of Health, a total of 5,741 confirmed cases of XDR-TF were documented across all districts of the Sindh Province between November 2016 and June 2021 (Butt et al., 2022). Pakistan is the first country in the world to introduce a typhoid conjugate vaccine into its routine vaccination program (Akram et al., 2020), which can prevent the onset of typhoid disease.

E. coli

E. coli is a common cause of gastrointestinal infection in human beings. The severity of infection depends on the type of pathogenic *E. coli*. The bacterium has six known pathogenic types (Donnenberg, 2013): enteroinvasive *E. coli* (EIEC), enteropathogenic *E. coli* (EPEC), enterotoxigenic *E. coli* (ETEC), enterohemorrhagic *E. coli* (EHEC), enteroaggregative *E. coli* (EAEC), and diffusely adherent *E. coli* (DAEC). *E. coli* is the salient microorganism among the coliform group and drinking water quality is evaluated by its load. The bacterium is likely to be associated with many diarrheal outbreaks in Pakistan, but the data from those outbreaks have not been effectively documented and reported. Symptomatically, *E. coli* infection resembles rotavirus infection. Moreover, outbreaks are less likely traced to *E. coli* because of the standard treatment and management regimens for common diarrheal diseases. Researchers have, however, frequently reported the presence and isolation of *E. coli* from tap water, groundwater, and floodwater.

The concentration of *E. coli* in water sources correlates with socioeconomic status of communities. A dense population and low economic status lead to compromise on the proper disposal of wastewater and hence contamination of drinking water (Iqbal et al., 2019). Some places engineer a gravity-flow water system. This system of pipes, which brings water from the source closer to people, comes with a high risk of contamination, though. In Abbottabad, people drink water that is delivered via a gravity-flow water system. Specifically, surface water from a ravine in the east of Abbottabad is channeled downstream to supply water after treatment to city residents. The system overcomes the shortage of the availability of drinking water in Abbottabad and adjoining areas. Water likely gets contaminated, however, due to the choking of water supply through silt as the water is directed over a large distance.

A study that sampled water in different locations in Abbottabad determined that 75% of water samples tested positive for *E. coli* (Jadoon et al., 2021). A similar study from Peshawar reported 52% of water samples were contaminated with *E. coli* (Israr et al., 2022). Younas et al. (2016) studied a pediatric population and found the infection incidence of *E. coli* to be 42.4%, with EPEC at 20.2%. Fatima et al. (2021) conducted a comprehensive longitudinal study from 2018 to 2020 throughout different seasons to study the presence of coliforms in the drinking water of Karachi. They deemed a range of 60–69% of the drinking water samples unfit for consumption due to coliform presence.

Furthermore, studies from Islamabad and Lahore in 2014 found 40% and 73% of water samples tested positive for coliforms, respectively (Hisam et al., 2014; Zareen et al., 2014). Another comprehensive study was performed in 20 different locations within the city of Dera Ghazi Khan in Southern Punjab. Groundwater was reported to contain 25–50 CFU/ml of *E. coli* (Javaid et al., 2022). Surprisingly, in six villages of Vehari District in Eastern Punjab, another study team found zero *E. coli*/100 ml of water samples (Khan et al., 2022). The transmission of *E. coli* is fecal–oral in nature: Contamination of surface water and groundwater with feces is the main mode of *E. coli* transmission. Effective treatment of wastewater before it is disposed of in water bodies can decrease the *E. coli* load to an acceptable level.

Control Measures

Control of waterborne diseases requires the involvement of both public and private sectors along with the active involvement of local communities. There is a dire need in Pakistan for the implementation of legislation regarding the provision of safe water. Controlling and backtracking of outbreaks should be integrated with the Early Flood Warning System so that epidemiologists and microbiologists can effectively play their part in the control of waterborne diseases. The water quality of rivers and canals should be regularly monitored for microbial loads. Furthermore, industries or housing societies should be penalized—necessitating the implementation of a legal framework—for contaminating freshwater sources.

Additionally, the chlorination concentration in tap water and water treatment plants should be carefully monitored. The parameters of coliforms and other bacteria should be strictly in compliance with the Pakistan Environmental Protection Agency. And lastly, the availability of vaccines for rotavirus and typhoid should be ensured for the public.

Community awareness programs for good hygienic practices should be initiated and maintained. Mobilization of philanthropists is needed for the development of water filtration plants in remote areas where people rely on lakes or groundwater for drinking water. Waterborne diseases can be prevented by adopting personal hygiene measures, drinking boiled or chlorinated water, and washing vegetables and fruits with boiled or chlorinated water. Care should be taken when using community pools, as well as when swimming in lakes, rivers, and canals. Handwashing is recommended with soap and water for at

least 20–30 s, especially before eating food and after using restrooms.

Limitations

We followed a comprehensive approach to finding the most relevant articles, yet we might have overlooked some of the published scientific literature because it was not available via public databases. For example, reports published in the national language Urdu or local languages such as Punjabi, Pashto, Sindhi, Saraiki, Balochi, Hindko, Pahari-Pothwari, or Brahui were not accessible to us. Likewise, we were not able to access unpublished data mentioned in handwritten reports or internal/external registries at hospitals.

Furthermore, there was substantial variation in reporting, as some researchers could not associate specific outbreaks to water sources by laboratory testing. Considering the limitations, potential researchers may opt to trace back outbreaks to their pathogens and reviewers may consider covering the data present in local languages.

Conclusion

Pakistan is a developing country with the 5th largest population (>233 million) in the world. The increasing population; decreasing surface, ground, and river water; and limited resources to access clean water have led to the increasing consumption of unsafe water. Therefore, the likelihood of the occurrence of waterborne diseases is increasing. Based on recent studies at the provincial and city levels, rusted pipes and ineffective disposal of wastewater are commonly associated with infections of *Salmonella* Typhi and rotavirus. Furthermore, contamination of drinking water with feces leads to *E. coli* infection, while well water contamination in flood seasons is associated with cholera.

There is a dire need to address the issue of waterborne diseases at national and international scientific and policymaking levels to lead to the formulation and implementation of sustainable policies for improving the quality of drinking water in Pakistan. Communication, coordination, and collaboration among government authorities, communities, and individuals will help keep the burden of waterborne diseases in check. Implementing regulations for Pakistan's wastewater treatment plants is warranted. Furthermore, there is a pressing need to improve the outbreak reporting and investigation system. Lastly, the monitoring of water quality through the detection of these waterborne pathogens could help identify the limitations of the water supply system.

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BUILDING CAPACITY

Darryl Booth, MBA

Building Capacity With the Pragmatic Adoption of Artificial Intelligence

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 practice of environmental health. Acutely aware of these challenges, the *Journal* publishes the Building Capacity column to educate, reinforce, and build on successes within the profession using technology to improve efficiency and extend the impact of environmental health agencies.

This column is authored by technical advisors of the National Environmental Health Association (NEHA) Data and Technology Section, as well as guest authors. The conclusions of this column are those of the author(s) and do not necessarily represent the views of NEHA.

Darryl Booth has been monitoring regulatory and data tracking needs of environmental and public health agencies across the U.S. for over 20 years. He is the general manager of environmental health at Accela.

Some argue that generative artificial intelligence (AI), the technology behind popular tools like ChatGPT, is not ready for prime time. They point to rapidly emerging standards and capabilities. They point to behaviors like hallucinations and jailbreaking. Hallucinations refer to patently incorrect responses (i.e., fibbing) in ways that appear otherwise completely legitimate. Jailbreaking refers to the practice of tricking AI into responding in ways contrary to its training.

Others would point out that the government is not expected to chase down emerging technologies. Consistent and predictable are watchwords for most regulators, as well as attributes appreciated by their customers.

The Prompt Index, an AI newsletter, released a simple decision chart to determine if it is safe to use ChatGPT (Figure 1). In seven simple workflow shapes, the diagram shows what few people want to hear—Just cool your jets for a few minutes.

Turning the Corner

It was tremendously difficult for me to write the preceding paragraphs. With new technology, I am not a "cool your jets" kind of person. So, I keep probing, pushing, and asking leaders to not bury their heads in the sand. I urge them to be in tune and capture opportunity as it presents itself. Some opportunity exists now. Even more opportunities will come along soon enough.

What Is Exciting Now?

We have the opportunity now to be learners—to explore and build up personal and professional experiences. We have the opportunity today to guide and counsel those people who would integrate the technologies.

These opportunities can play out by encouraging an IT or departmental policy that welcomes exploration within guidelines intended to protect organizational standards such as respecting privacy, promoting equity, and supporting colleagues. Check out the Building Capacity column in the September 2023 *Journal of Environmental Health* (www.neha.org/Images/resources/JEH9.23-Column-Building-Capacity.pdf) for a sample policy for environmental health departments on the use of generative AI.

Many organizations are also forming AI adoption committees that are charged with allocating modest budgets, arranging training, and celebrating small wins. These committees can further signal to vendors what is expected in future software versions.

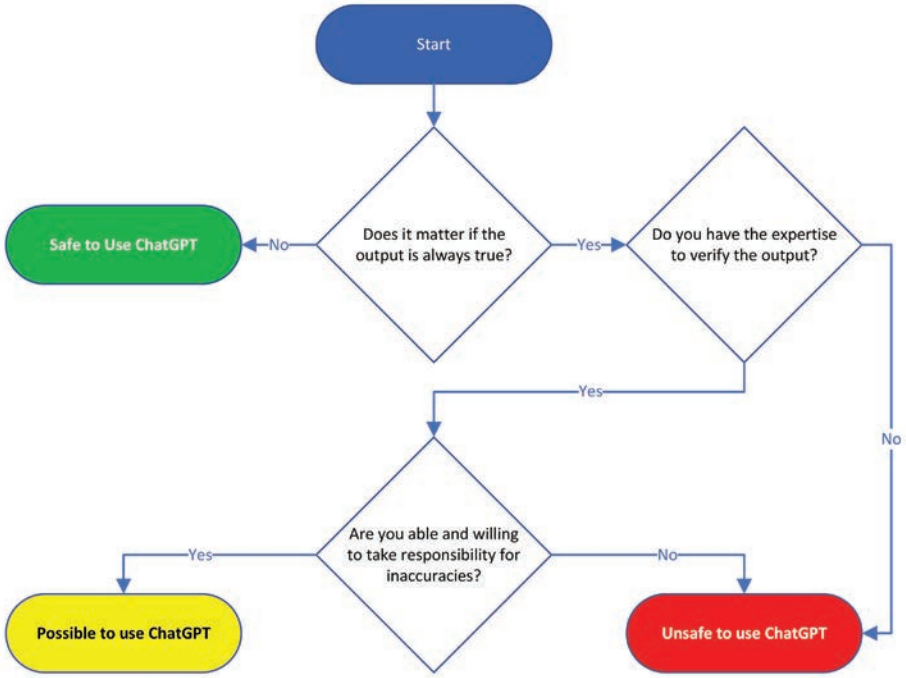
This degree of opportunity can be incrementally advanced through thoughtful and responsible training and exploration.

What Will Soon Be Exciting?

Most health departments are looking to their existing software vendors to integrate AI into the existing software. Expect Microsoft 365 Copilot soon, which will integrate generative AI into Word, Excel, Outlook, PowerPoint, and other Microsoft apps. Based on early access, we anticipate new capabilities that are expected to be offered as a fee-based add-on. For many health departments, this software tool (or its equivalent) will raise

FIGURE **1**

Decision Chart to Determine If It Is Safe to Use ChatGPT



Adapted from The Prompt Index (https://www.reddit.com/r/ChatGPT/comments/16ailop/is_it_safe_to_use_chatgpt/?rdt=34544).

TABLE **1**

Sample Feasibility Matrix

	Mission Alignment	Increased Efficiency	Nonfinancial Benefits	Technical Feasibility	Internal Readiness	External Readiness
Draft inspection reports	2	2	1	1	1	1
Respond to public inquiries	2	2	2	2	2	2
Education and training	3	2	2	2	2	2
Natural language dashboards	2	2	1	1	1	1
Regulatory assistant	1	2	1	1	1	1
Meeting deliverable summaries	2	3	1	3	2	3

Note. Ratings are based on a 5-point Likert scale (0 = not feasible and 5 = highly feasible).

expectations. After all, if Word will help me write a determination letter, why wouldn't my inspection software do the same?

Furthermore, your inspection and permit tracking software will be able to do so much more, from helping with inspection comments to creating dashboards using plain language. For example, "Which five inspectors cited handwashing violations in routine inspection of retail food establishments in the past year," is a request that can now be met in some systems. It is just going to get better and better.

When it comes to great ideas about AI, let me introduce a decision-making model known as a feasibility matrix (Table 1). In this model, your AI adoption committee agrees on a rubric and assigns scores to those measures. Common measures might be mission alignment (e.g., does the initiative impact public health), increased efficiency, and nonfinancial benefits (e.g., customer satisfaction), followed by potential headwinds such as technical feasibility, internal readiness, and external readiness. Internal and external readiness might, for example, consider compatibility with your AI policy.

Each score need not be completely scientific and will change over time. Readiness and technical feasibility can change every day. Reviewing and updating your feasibility matrix should be a quarterly exercise or part of your strategic planning. ChatGPT4 is advertised to be much better than ChatGPT3. Also, many organizations are regularly releasing their versions, such as LLAMA2 from Meta, Bard from Google, and Claude from Anthropic.

In Table 1, one might agree that "meeting deliverable summaries" and "education and training" are viable projects right now.

What Is on the Horizon?

It is no longer controversial to suggest that we will have personal AI assistants, automated responses to external queries, and software systems that talk to each other using just natural language. If you are in the workforce 10 years from now, you will be among the leaders who frame and usher in many of these changes.

For environmental health professionals, there will be massive changes not only in regulator offices but also in the kitchens and offices of the establishments you regulate.

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DIRECT FROM ATSDR



Stacey Konkle, MPH, PhD
D. Kevin Horton, MSPH, DrPH
Maureen Orr, MS

Assessment of Chemical Exposures (ACE) Program: Toolkit Advances and Recent Investigations

Editor's Note: As part of our continued effort to highlight innovative approaches to improve the health and environment of communities, the *Journal* is pleased to publish regular columns from the Agency for Toxic Substances and Disease Registry (ATSDR) at the Centers for Disease Control and Prevention (CDC). ATSDR serves the public by using the best science, taking responsive public health actions, and providing trusted health information to prevent harmful exposures and diseases related to toxic substances. The purpose of this column is to inform readers of ATSDR's activities and initiatives to better understand the relationship between exposure to hazardous substances in the environment, its impact on human health, and how to protect public health.

The findings and conclusions of this column are those of the author(s) and do not necessarily reflect the views of CDC or ATSDR.

Dr. Stacey Konkle is an epidemiologist for the Registries and Surveillance Section within the Office of Innovation and Analytics at ATSDR. Dr. D. Kevin Horton is chief of the Registries and Surveillance Section. Maureen Orr is an epidemiologist and the Surveillance Team lead for the Registries and Surveillance Section.

Introduction

In 2010, the Agency for Toxic Substances and Disease Registry (ATSDR) developed the Assessment of Chemical Exposures (ACE) Toolkit to assist state and local health departments with performing epidemiologic assessments after acute chemical releases (Duncan, 2014). The ACE Toolkit has been enhanced and adapted over the years for use in various types of acute environmental incidents, including the ability to conduct rapid epidemiological assessments after radiological and nuclear incidents, explosions, natural disasters, and other environmental incidents (Duncan & Orr, 2016).

The ACE Toolkit contains easily modifiable surveys, corresponding consent forms, training modules, and interoperable software tools that public health authorities can use to conduct rapid epidemiological assessments of exposed individuals (Agency for Toxic Substances and Disease Registry [ATSDR], 2022).

Toolkit Advances

The ACE team at ATSDR strives to incorporate innovative techniques and implement key takeaways from each investigation into its toolkits. The addition of the Epi CASE (Epidemiologic Contact Assessment Symptom Exposure) Toolkit allows for rapid person-level data collection (e.g., demographics, exposure data, clinical information) during an ongoing disaster investigation (ATSDR, 2020). The Epi CASE Toolkit contains ready-made surveys targeted for populations of interest (e.g., adults, children, first responders), household-level surveys, medical chart abstractions, and preapproved consent forms. The toolkit also includes a decision support tool (Figure 1) designed to help health authorities determine whether a postdisaster registry is a valid public health action.

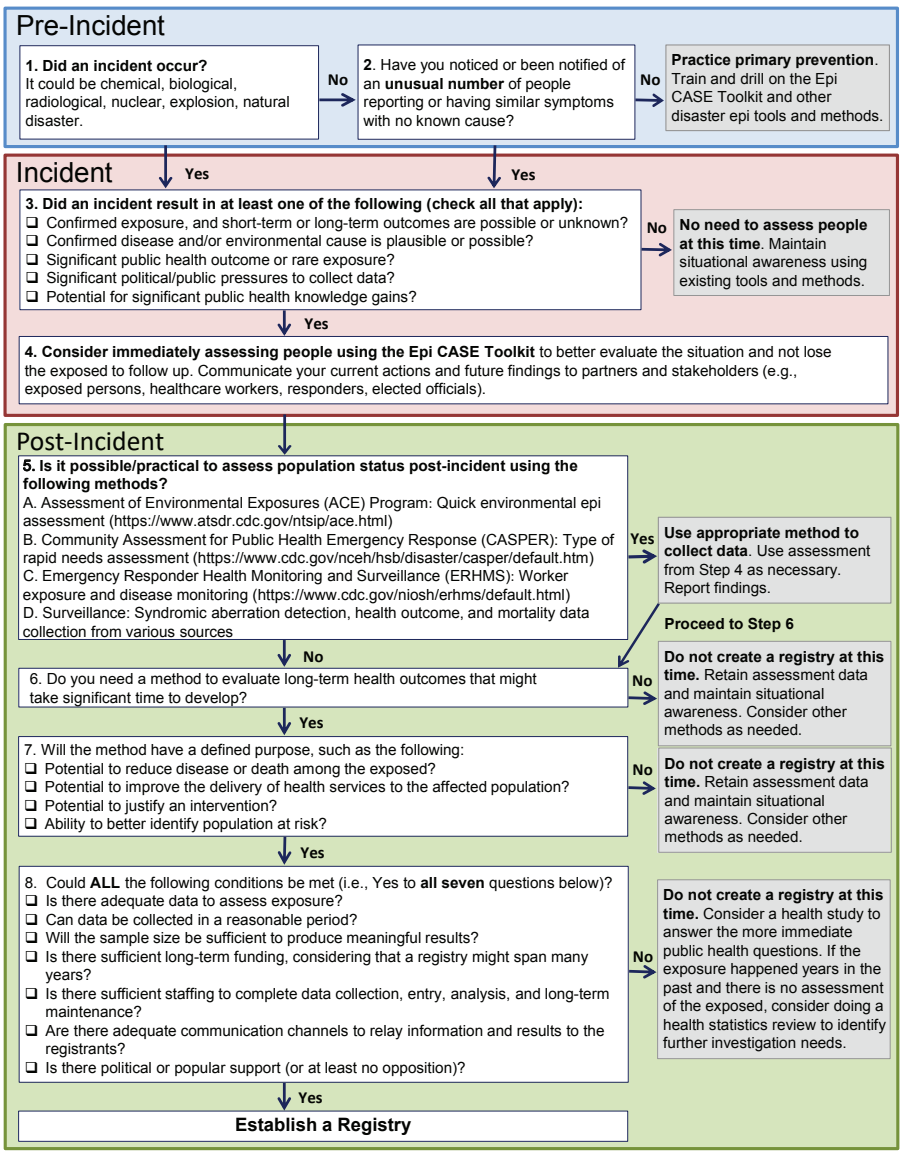
In addition to the traditional door-to-door and phone interviews conducted during disaster responses, recent modifications to the ACE and Epi CASE Toolkits allow for the rapid distribution of online surveys. The ability to reach large numbers of people quickly with limited staffing requirements, via online survey distribution and data collection, has increased the utility and reach of ACE investigations.

Qualitative questionnaires have been added to ACE investigations and will be incorporated into future toolkit enhancements. Qualitative questionnaires help gather feedback on community concerns and broader effects on community resources that might not have initially been identified. A more comprehensive understanding of community perceptions regarding the success of the response and any lingering concerns or needs can help authorities tailor future recommendations and appropriately allocate resources.

The ACE team has worked with the National Institute for Occupational Safety and Health and Federal Emergency Management Agency to develop the Disaster Related Exposures Assessment and Monitoring (DREAM) course, which is offered through the Center for Domestic Preparedness and provides free, hands-on training for public health responders on how to implement ACE and Epi CASE (Center for Domestic Preparedness, 2023).

FIGURE **1**

Epi CASE Decision Support Tool



Note. Epi CASE = Epidemiologic Contact Assessment Symptom Exposure.

Recent Investigations

The ACE program has completed 16 investigations in 10 states since 2010 (Figure 2). From 2010 to 2014, the program developed the original ACE Toolkit and completed five investigations (Duncan & Orr, 2016). Since 2015, 11 ACE investigations have been completed and acute chemical exposure-related data have been collected on more than 8,200 participants (Table 1). Each ACE investigation is unique—the exposure, the response, the community, and the needs. Most investigations begin with the ACE general survey. Investigators can easily modify the ACE and Epi CASE Toolkit features to produce final survey tool(s) specific to the exposure event. The ready-made tools make it easy to modify survey questions, distribute surveys, and manage databases in the field in real time. This feature allows investigators to rapidly address the exposed population size, type of exposure, severity of health outcomes, and special populations of interest.

Investigators have modified medical chart abstraction forms, key informant interviews, responder-specific questionnaires, survey sections focused on mental health, and qualitative questionnaires. ACE investigations frequently use mapping and analysis capacities from the Geospatial Research, Analysis, and Services Program (GRASP) within ATSDR for planning, evaluation, and presentation of the findings (ATSDR, 2023).

In 2021, the ACE team conducted the first community-level, post-acute-disaster follow-up investigation at the request of the Winnebago County Health Department and Illinois Department of Public Health (Sekkarie et al., 2023). Since the initial request, the ACE team has conducted two additional follow-up investigations at the community level. These follow-up investigations included the collection of qualitative data from residents and key informants, which resulted in data about lingering concerns and broad effects on community resources that were not available elsewhere. ACE follow-up investigations after an acute disaster have given public health authorities a distinct opportunity to gauge recommendation implementation and identify any continuing needs in the community.

Discussion

ATSDR created the ACE Toolkit in 2010 to help public health authorities conduct epidemiologic public health responses after chemical incidents. Since the development of the original toolkit, the ACE team has diligently incorporated innovative techniques and implemented key takeaways from investigations into the ACE tools. These modifications have enhanced user experience and enabled rapid initiation of acute chemical exposure investigations. The ACE Toolkit facilitates both rapid needs assessments and long-term health monitoring that capture the experiences of participating respondents and help guide public health action in a timely manner.

The ACE and Epi CASE Toolkits are designed to be easily modified. They are well suited for various exposure scenarios and for assessing health impacts to both first responders and the general public. Recent improvements to the toolkits provide the

ability to conduct follow-up impact and wellness assessments of an affected community, which can help public health authorities stay engaged with the affected community and guide additional public health needs.

The ACE and Epi CASE Toolkits are available to all public health agencies. Many investigations have used the methodology, which has proven to be an intuitive set of tools that provide data for timely public health action. The ACE team can provide technical assistance over the phone (404-567-3256) and via e-mail (ATSDRACE@cdc.gov), as well as deploy on-site when needed.

Limitations

ACE investigations are designed as rapid public health responses intended to facilitate rapid needs assessments that capture the experiences of participating respondents and rapidly guide public health action. ACE investigations are not rigorous epidemiological investigations and their results are not generalizable. ACE investigation teams often work with other government agencies that provide vital response capacity (e.g., environmental testing) and regulatory authority. ATSDR is not a regulatory agency, however, and ACE investigation recommendations are not enforceable.

Conclusion

Acute chemical releases in the U.S. frequently result in exposure to the public and first responders, with the potential to cause both short- and long-term physical and mental health issues. Such health effects raise a need for a rapid epidemiological assessment of affected, or potentially affected, populations. Many investigations have used the ACE Toolkit and methodology, and public health authorities continue to request them for critical investigations. The dedication of the ACE team to continuous improvements of the ACE and Epi CASE Toolkits has made ACE investigations a critical support tool for communities experiencing chemical incidents and other large-scale environmental emergencies. ACE investigations can now more rapidly collect data from more people in more varied situations to guide response and recovery efforts. Affected communities can also be revisited by investigators to ensure that their needs have been met.

FIGURE **2**

Map of Investigations Conducted Through the Assessment of Chemical Exposures (ACE) Program, 2010–2023

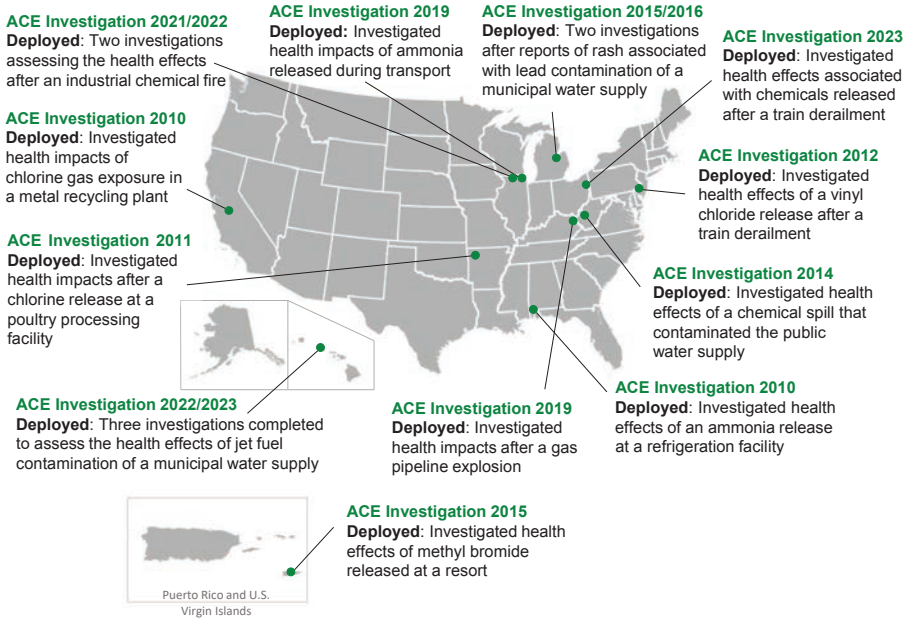


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TABLE **1**

Assessment of Chemical Exposures (ACE) Investigations After Acute Chemical Releases, 2015–2023

Incident	Year	Location	Chemical Agent	# of Participants	Surveillance Instrument
Exposure to indoor use of a prohibited pesticide (Kulkarni et al., 2015)	2015	U.S. Virgin Islands	Methyl bromide used as an indoor pesticide	16 participants	ACE general survey by phone
Skin rash after lead contamination in a municipal water system (Unified Coordination Group—Flint, Michigan, 2016)	2015	Flint, Michigan	Lead in a municipal water system	390 participants	ACE general survey by phone, dermatologist exam, and water quality testing done in conjunction with U.S. EPA
Clinical care follow-up of skin rashes after lead contamination in a municipal water system (Unified Coordination Group—Flint, Michigan, 2016)	2016	Flint, Michigan	Lead in a municipal water system	40 participants	ACE general survey by phone, dermatologist exam, and water quality testing done in conjunction with U.S. EPA
Explosion of a gas pipeline (Bui et al., 2022)	2019	Lincoln County, Kentucky	Natural gas pipeline fire and explosion	120 residents 105 first responders	ACE general survey conducted door-to-door, review of medical records, and first responder survey
Chemical release onto a roadway during transportation (Rispens et al., 2020)	2019	Lake County, Illinois	Anhydrous ammonia released onto a roadway during transportation	48 residents 38 first responders	ACE general survey conducted door-to-door, review of medical records, and first responder survey
Fire at an industrial chemical facility (Surasi et al., 2021)	2021	Winnebago County, Illinois	$PM_{2.5}$ and PM_{5} caused by an industrial fluid and grease fire	2,030 participants	ACE general and Epi CASE survey modified into a **single, electronic, self-administered online survey**
Contamination of a municipal water source by jet propellant (Miko et al., 2023; Troeschel et al., 2022)	2021	Oahu, Hawaii	Jet propellant (JP-5) in a municipal water system	2,289 participants	ACE general and Epi CASE survey modified into a single, electronic, self-administered online survey, as well as **in-person, key informant interviews**
Community-level follow up 1 year after an industrial chemical facility fire (Sekkarie et al., 2023)	2022	Winnebago County, Illinois	$PM_{2.5}$ and PM_{5} caused by an industrial fluid and grease fire	676 participants	ACE general and Epi CASE survey modified into an electronic, self-administered online follow-up survey, as well as **qualitative interviews with residents conducted door-to-door and by phone**
Community-level follow up 6 months after jet fuel contamination of a municipal water source *	2022	Oahu, Hawaii	Jet propellant (JP-5) in a municipal water system	986 participants	ACE general and Epi CASE survey modified into a single, electronic, self-administered online survey, **as well as use of the Registry Decision Support Tool**
Review of medical charts after jet fuel contamination of a municipal water source *	2023	Oahu, Hawaii	Jet propellant (JP-5) in a municipal water system	653 participants	**Comprehensive review of medical charts**
Train derailment *	2023	East Palestine, Ohio	Release of vinyl chloride and n-butyl acrylate after a train derailment	704 residents 339 first responders	ACE general and Epi CASE survey modified into electronic surveys available online, **administered in a health clinic,** and conducted door-to-door, as well as an online survey for first responders

* Publication pending.

Note. Bold text indicates the first use of that particular surveillance technique during an ACE investigation. Epi CASE = Epidemiologic Contact Assessment Symptom Exposure; PM = particulate matter; U.S. EPA = U.S. Environmental Protection Agency.

continued on page 44

DIRECT FROM CDC ENVIRONMENTAL HEALTH SERVICES

LCDR Nakia S. Clemmons, MPH, REHS, CIC

Tools From the Centers for Disease Control and Prevention Can Help Prevent and Control *Legionella* Growth and Spread

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

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

LCDR Nakia Clemmons is an environmental health officer in the Water, Food, and Environmental Health Services Branch (WFEHSB) of the National Center for Environmental Health. She manages WFEHSB's involvement in the Epidemiology and Laboratory Capacity for Prevention and Control of Emerging Infectious Diseases Program.

Assessing and Controlling *Legionella* in Complex Water Systems Is an Important Way to Prevent Illness

Legionella bacteria are naturally found in freshwater. In the right environment, these bacteria can cause illness when people inhale or aspirate aerosolized droplets of water containing *Legionella*. Legionnaires' disease (LD) is a lower respiratory illness characterized by severe pneumonia from these bacteria. This infection often causes hospitalization and is fatal in 1 out of 10 cases (Dooling et al., 2015). The incidence rate of LD is increasing in the U.S. due to a variety of factors, including aging infrastructure and population, increased awareness and testing, and urinary antigen test availability (Barskey et al., 2022). Pontiac fever is a milder illness caused by *Legionella* bacteria that does not cause pneumonia and usually does not require hospitalization.

Legionella bacteria are known to grow in large, complex water systems that are not adequately maintained. Internal and external factors contribute to *Legionella* growth in building water systems. Studies show that approximately 90% of LD outbreaks associated with buildings are due to a preventable environmental deficiency, including:

- Process failure (e.g., permissive temperatures in the favorable range for *Legionella* growth)
- Needed equipment repair (e.g., an automatic feeder no longer supplying disinfectant in a hot tub; Photo 1)
- Unmanaged external change (e.g., nearby construction that results in pressure drops that can dislodge biofilm containing *Legionella*)
- Human error (e.g., a person forgetting to change a water filter [Clopper et al., 2021; Garrison et al., 2016])

Legionella Assessment Tools Can Help Support Environmental Health Investigators

Environmental health knowledge is critical in preventing and controlling *Legionella* outbreaks, but many jurisdictions lack environmental health capacity. The Centers for Disease Control and Prevention (CDC) developed the *Legionella* Environmental Assessment Form (LEAF) to help environmental health practitioners and public health officials assess and understand facility water systems and aerosolizing devices. LEAF was originally developed as a printable PDF, but in 2022, CDC converted it to an electronic, fillable PDF. These options allow investigators to use LEAF in either digital or print formats.

LEAF assists facility water management teams with minimizing the risk of LD by identifying areas at risk for *Legionella* growth and spread. There are three main sections of LEAF that address facility characteristics, water supply sources, and premise plumbing systems. There are also five setting- or device-specific appendices:

- Healthcare, Assisted Living, and Senior Living Facilities
- Cooling Towers and Evaporative Condensers (Photo 2)
- Hot Tubs, Whirlpool Spas, and Hydrotherapy Spas
- Other Water Devices
- Recent or Ongoing Major Construction

Photo 1. Staff from the Centers for Disease Control and Prevention (CDC) visually inspect a hot tub during a Legionella *outbreak investigation.* Legionella *can grow and multiply in hot tubs that are not disinfected, cleaned, and properly maintained. Photo courtesy of Nakia Clemmons, CDC.*

Photo 2. Staff from the Centers for Disease Control and Prevention (CDC) inspect a poorly maintained cooling tower during a Legionella *outbreak investigation. Inadequately maintained cooling towers can aerosolize water containing* Legionella *bacteria. Photo courtesy of Nakia Clemmons, CDC.*

Legionella Resources

Explore these links to learn more about the *Legionella* Environmental Assessment Form (LEAF) and other *Legionella*-related resources.

- LEAF: www.cdc.gov/legionella/downloads/legionella-environmental-assessment-p.pdf
- LEAF Marking Guide: www.cdc.gov/legionella/downloads/legionella-environmental-assessment-marking-guide-508.pdf
- Preventing Legionnaires' Disease Training: www.cdc.gov/nceh/ehs/elearn/prevent-LD-training.html
- Sampling and Environmental Assessment Videos: www.cdc.gov/legionella/videos.html
- Additional *Legionella* and Legionnaires' Disease Resources: www.cdc.gov/nceh/ehs/water/legionella/index.html

In addition, CDC created the LEAF Marking Guide to provide users with instructions and additional considerations for each LEAF question. These considerations provide more context and background on relevant risk factors for *Legionella* growth and spread, and they educate users conducting the assessment. The marking guide includes key definitions, in-depth details about each question, and information that can help the user collect appropriate data. LEAF data can help improve water management programs, identify the need for environmental sampling, and develop life-saving interventions.

Using *Legionella* Assessment Tools Improve Environmental Health Decision Making

A Legionella environmental assessment should be performed by an environmental health specialist or epidemiologist who is knowledgeable of *Legionella* ecology, building water systems, and water treatment. The assessment should also involve a person, such as a facility manager, who is familiar with the building's systems and maintenance. Environmental health specialists or epidemiologists who have taken CDC's PreventLD training, watched our sampling videos, and studied the *Legionella* Control Toolkit will have the appropriate knowledge to perform an assessment and complete the assessment form.

Information from LEAF should be paired with relevant epidemiological information such as who was exposed or infected and where and when the exposure possibly happened. This information can guide the user to determine which environmental deficiency might have occurred and help them decide if environmental sampling is necessary and where sampling should occur. In addition, findings from LEAF can also be used to implement preventive measures in areas at high risk for *Legionella* growth or spread, and they might be used to develop or improve a water management program.

To learn more, visit our website for additional information and resources at www.cdc.gov/nceh/ehs/water/legionella/index.html.

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THE PRACTITIONER'S TOOL KIT

The Art and Science of Inspection: A Short Introduction

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Editor's Note: The National Environmental Health Association (NEHA) strives to provide relevant and useful information for environmental health practitioners. In a recent membership survey, we heard your request for information in the *Journal* that is more applicable to your daily work. We listened and are pleased to feature this column from a cadre of environmental health luminaries with over 300 years of combined experience in the environmental health field. This group will share their tricks of the trade to help you create a tool kit of resources for your daily work.

The conclusions of this column are those of the authors and do not necessarily represent the official position of NEHA, nor does it imply endorsement of any products, services, or resources mentioned.

When we introduced this column in 2022, we promised to share tricks of the trade that we take into the field that are based on good science and use a practical, common-sense approach to environmental health practice. In fact, the topics we offer started as mistakes, misinterpretations, or blatant errors in our practice. The columns are based on what we learned as we set out to make it right. Over the years, the most significant of our embarrassments was the realization that we lacked instruction on how to inspect.

As we said before, we are all quite adept at interpreting codes, rules, regulations, and policies. Unfortunately, applying this skill did not come with an owner's manual. Tradition has it that we learned to perform inspections from a mentor, who learned from a mentor, and so on ad infinitum. The very definition of inspection gives us an idea of how to use it and apply it as both an art and a science. So please, bear with us as we reintroduce this basic structure of an inspection and try to make it as painless as possible.

To begin, an inspection is more than an electronic tablet or clipboard, pen, inspection form, and a gimme-cap. There is nothing routine about a routine inspection. Simply put, an inspection is observation and verification. That is, checking or testing against established standards—regardless of the type of inspection (and yes, there are other categories of inspections)—in an objective manner that embodies scientific methods. Therefore, imagine every inspection as a miniature thesis with two primary purposes. The first purpose is to identify the change in circumstances or arrangements, whether at a restaurant, on-site disposal site, private well, tattoo parlor, or day care center. The second purpose of an inspection is to identify human error, failures in equipment and procedures, or policies and practices that present a risk to human health, safety, or well-being. Our job is to do this work within the backdrop of applicable regulations.

All inspections have a primary objective, which is to determine if practices and controls are adequate to meet requirements and whether the client implements and consistently maintains those practices and controls. The best example of this primary objective is measuring time and temperature and observing personal hygiene habits, particularly handwashing. The secondary objectives of inspections are to identify areas of potential improvement and to evaluate effectiveness in meeting requirements, as well as determine the facility's capability to meet those requirements. Using the food safety example, this objective involves conducting a mini plan review as part of the prelude to the inspection by scanning the menu and assessing if the kitchen equipment and layout can handle the complexity offered to the public. It is difficult to do sushi justice in a pizza parlor.

Understanding the purposes and objectives of an inspection is only the starting point. There are goals that ensure inspection accuracy, repeatability, and fairness. The most important of these goals is also the most difficult to understand—the goal to develop a predictive model to evaluate potential risks to the health of the public. This goal requires approaching the inspection process without bias (for which we are all guilty). Because most regulations are not absolute and their outcomes are not completely authoritarian, no situation fits neatly into a regulation box.

Consider the variability of time as it relates to temperature in food safety, as well as other considerations such as water activity and pH that might contribute to compliance. Therefore, try approaching an inspection with a null hypothesis in which everything is compliant at the onset of the inspection. It is then our professional knowledge, observation, and monitoring skills that identify the deviations from the ideal. We need to be impartial and if possible, completely objective. We understand there are regulatory criteria that require yes or no answers. But even with these criteria, allow for a degree of objectivity, along with an explanation. Approaching an inspection with the null hypothesis helps avoid the most common type 1 statistical error of

Image © Adobe Stock: auremar.

Goals to Ensure Inspections are Accurate, Repeatable, and Fair

1. Develop a predictive model to evaluate potential risks to the health of the public.
2. Gather empirical evidence.
3. Weigh and verify findings.
4. Analyze the results and develop a realistic, workable, and consistent abatement plan or plan for improvement.

committing false positive conclusions, and thereby compromising your credibility.

The second goal of an inspection is gathering empirical evidence, which translates into sampling and instrumentation. Sampling is an art unto itself—to sample without contamination or introducing bias ensures accuracy and fairness. The sampling process should be repeatable and the sample itself should be a representative part of a larger whole or group, especially when presented for inspection or shown as evidence of quality. Consider using a simple random or stratified sampling strategy. But more on this topic in a future article (and also check out our column on practical field sampling strategies in the April 2023 *Journal*, www.neha.org/Images/resources/JEH4.23-Column-Practitioners-Tool-Kit.pdf).

The other half of gathering empirical evidence is the proper use of field instruments. At the very least, read the manufacturers' instructions and be aware of the instrument's limitations, response time, readout, and interpretation of data. Calibrate or validate the instrument's accuracy before going into the field and check the adequacy of the instrument's power source. Most importantly, protect all field instruments against temperature and other physical extremes (e.g., a hot car, damage, contamination) by transporting them in a clean, insulated carrier, and maintain all field instruments in a well-maintained and presentable condition. Remember, improper use and maintenance of sampling tools and poor sampling strategies do not serve the objectives and purposes of the inspection.

The third goal of an inspection is weighing and verifying findings. We achieve this goal by creating a risk prediction model. The risk prediction model combines information about past events, as well as observed changes in conditions or circumstances. Together with these current observations, these data make predictions about future events. This practice is the basis for disease and injury prevention strategies. The data used in the risk prediction model come from your observations, your sampling acumen, and your proper use of field instrumentation. The inspection should be so structured that it is repeatable when done by a colleague.

The fourth goal of an inspection is analyzing the results and developing a realistic, workable, and consistent abatement plan or plan for improvement. Remember, you are the expert. It is your responsibility to translate the findings of the inspection in such a way that it is understandable to the client. Objectivity will allow the client to explore different pathways to compliance. Therefore, the final outcome of an environmental health inspection is prevention, where the preventive efforts become part of the client's normal operations.

Whether you use a paper inspection form or a computer program, the language used to detail your findings can make for ease of compliance, rather than having the client guess at an outcome. As you well know, the inspection process consists of both closed-ended and open-ended requirements. These requirements determine how decisions on abatement or improvement become part of the client's operations. In describing a violation, the most important consideration is the language we use to communicate the regulatory expectation. Closed-ended requirements are very objective, prescriptive, and specific. For example, "Water and ice from an approved source," where "approved source" already has a regulatory definition. On the other hand, open-ended requirements provide the maximum flexibility in interpretation and can (and often are) quite subjective. An example is, "Physical facilities installed, maintained, and clean." What does this statement even mean? If we cite an open-ended requirement, we have the obligation to provide specific language to clarify the intent of the regulation and compliance expectations beyond that written into the regulation. And we need to do so to resolve the differences between expected and planned results.

To gain consensus between the inspector and the inspected, avoid using open-ended words and phrases such as timely, promptly, and ongoing without agreement and clarification. Generalized or broad statements such as control or manage can apply to everything. Be specific. Do not use unclear or undefined words such as suitable, adequate, and exercise care. Each one of us evaluates these words and phrases in generalities based on our life and work experiences. We are all different, as are our interpretations. Do not use words that lack verifiable actions or outputs or provide no prescriptive requirements, such as clean and safe, without asking for desired objective outcomes.

As a final admonishment, never use emotional words and phrases. These include words that could create the appearance of

bias or slanted viewpoint. Words such as very, extremely, exceedingly. and seriously fit into this category. Do not report minor imperfections found during the inspection if there is no added value to public health. Avoid reporting names of individuals unless it is germane to the problem encountered. And never make recommendations. Recommendations confer ownership. On the other hand, suggestions provide guidance.

We always found it quite useful to provide the inspected with the names and contact information (with their kind consent, of course) of at least three businesses and individuals who successfully dealt with similar conditions and situations cited in an inspection report. This practice is particularly important for those violations deemed serious or that require significant modifications or additional services to correct physical plant deficiencies or operations.

As a final note, the information on the art and science of inspection started about 10 years ago in preparation for a lawsuit against an environmental health specialist at a health department. The errors made during this individual's inspections were significant and extreme, costing the restaurant owner loss of income and unwarranted damage to the restaurant's good reputation. One of the authors of this column served as an expert for the plaintiff and prepared a report detailing the errors and shortcomings of the inspection process and subsequent actions taken against the operator based on those errors. The case settled out of court with considerable compensation paid to the restaurant owner and the health department issued a public letter of apology. Significant to the settlement was an agreement by the health department that its inspectors receive training on conducting inspections and issuing reports. This situation could have been prevented by persistent instruction on the art and science of inspection and professional deportment.

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DIRECT FROM ATSDR *continued from page 39*

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PROGRAMS ACCREDITED BY THE NATIONAL ENVIRONMENTAL HEALTH SCIENCE AND PROTECTION ACCREDITATION COUNCIL

The following colleges and universities offer accredited environmental health programs for undergraduate and graduate degrees (where indicated). For more information, please contact the schools directly or visit the National Environmental Health Science and Protection Accreditation Council website at www.nehspac.org.

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Did You Know?

The National Environmental Public Health Internship Program is a 400-hr paid internship opportunity that links environmental health undergraduate and graduate students with funded internship placements at qualified environmental public health agencies. Dates for student applications for the summer 2024 session will be announced soon. Applications for environmental health agencies are always open and will be accepted on a rolling basis if positions are open and available. Learn more at www.neha.org/nephip.

ENVIRONMENTAL HEALTH **CALENDAR**

UPCOMING NATIONAL ENVIRONMENTAL HEALTH ASSOCIATION (NEHA) CONFERENCE

July 15–18, 2024: NEHA 2024 Annual Educational Conference & Exhibition, David L. Lawrence Convention Center, Pittsburgh, PA, https://www.neha.org/aec

NEHA AFFILIATE AND REGIONAL LISTINGS

Alabama
December 5–8, 2023: Annual Conference, Alabama Environmental Health Association, Rogersville, AL, https://www.aeha-online.com

Illinois
November 8–9, 2023: Annual Educational Conference, Illinois Environmental Health Association, Oglesby, IL, https://www.iehaonline.org

New Mexico
November 8, 2023: Annual Fall Conference, New Mexico Environmental Health Association, Albuquerque, NM, https://nmeha.wildapricot.org

North Carolina
March 14–15, 2024: Public Health Leaders Conference, North Carolina Public Health Association, Raleigh, NC, https://ncpha.memberclicks.net

Ohio
April 11–12, 2024: Annual Educational Conference, Ohio Environmental Health Association, Columbus, OH, http://www.ohioeha.org

Texas
December 6–8, 2023: 20th Annual TEHA-STC Educational Conference, South Texas Chapter (STC) of the Texas Environmental Health Association (TEHA), South Padre Island, TX, https://myteha.org/page/SouthTexas

TOPICAL LISTINGS

Food Safety
January 21–24, 2024: Integrated Foodborne Outbreak Response and Management (InFORM) Conference, Washington, DC, https://www.neha.org/inform

General Environmental Health
May 20–24, 2024: 17th IFEH World Congress on Environmental Health, International Federation of Environmental Health (IFEH), Perth, Australia, https://www.wceh2024perth.com

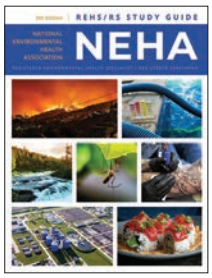
Water Quality
November 13–15, 2023: World Aquatic Health Conference, presented by the Pool & Hot Tub Alliance, Las Vegas, NV, https://wahc.phta.org

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 our online bookstore at www.neha.org/store for additional information about these and many other pertinent resources!

REHS/RS Study Guide (5th Edition)

National Environmental Health Association (2021)

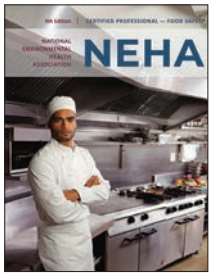


The Registered Environmental Health Specialist/Registered Sanitarian (REHS/RS) credential is the premier credential of the National Environmental Health Association (NEHA). This edition reflects the most recent changes and advancements in environmental health technologies and theories. Incorporating 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, spiral-bound paperback
Member: $169/Nonmember: $199

CP-FS Study Guide (4th Edition)

National Environmental Health Association (2022)



The fourth edition of the *Certified Professional–Food Safety (CP-FS) Study Guide* has been updated to the current FDA *Food Code* and includes information and requirements from the Food Safety Modernization Act. It was developed by retail professionals to help prepare candidates for the NEHA CP-FS credential exam with in-depth content, an examination blueprint, practice test, and many helpful appendices. The study guide is the go-to resource for students of food safety and food safety professionals in both regulatory agencies and industry. Chapters in the new edition include causes and prevention of foodborne illness, HACCP plans, cleaning and sanitizing, facility and plan review, pest control, inspections, foodborne illness outbreaks, sampling food for laboratory analysis, food defense, responding to food emergencies, and legal aspects of food safety. Also now available as an e-book!

358 pages, spiral-bound paperback
Member: $199/Nonmember: $229

Management and Supervisory Practices for Environmental Professionals: Basic Principles, Volume I (4th Edition)

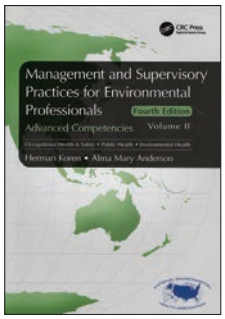
Herman Koren and Alma Mary Anderson (2021)

The fourth edition of this bestseller provides up-to-date information for newly promoted or management-aspiring professionals and engineers in the fields of environmental health, occupational health and safety, water and wastewater treatment, public health, and other environmental professions. The book is also an excellent resource for students interested in learning management skills prior to entering the workforce. Through nine sets of tools, the first volume explains the basic principles supervisors need to understand the structure of their organization, what leadership is, how to effectively plan and budget, how to manage other people, and best practices for achieving success in a management position.

258 pages, paperback
Member: $49/Nonmember: $56

Management and Supervisory Practices for Environmental Professionals: Advanced Competencies, Volume II (4th Edition)

Herman Koren and Alma Mary Anderson (2021)



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276 pages, paperback
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The National Environmental Health Association (NEHA) Board of Directors includes nationally elected officers and regional vice-presidents. Affiliate presidents (or appointed representatives) comprise the Affiliate Presidents Council. Technical advisors, the executive director, and all past presidents of the association are ex-officio council members. This list is current as of press time.

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NEHA 2023 AEC *Wrap-Up*

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National Environmental Health Association

Raising the Voice of the Environmental Health Workforce

The National Environmental Health Association's (NEHA) 86th Annual Educational Conference (AEC) & Exhibition continued our longstanding tradition of providing innovative content to meet the varying needs of attendees with in-person and virtual options. The theme for the 2023 AEC was, "Raising the Voice of the Environmental Health Workforce," with the goal of coming together as a profession. That is exactly what happened July 31–August 3 in vibrant New Orleans, Louisiana, and virtually. Over 1,300 environmental health professionals participated in the AEC, with nearly 1,200 gathering in New Orleans and 150 engaging virtually. Attendees gathered to share best practices, innovations, solutions, and research to amplify the voice of our often-unseen profession.

Dr. Maureen Lichtveld, dean of the School of Public Health at the University of Pittsburgh, opened up the conference on Monday, July 31, with an impactful presentation on the integral role of environmental health in multiple facets of public health and health systems. Dr. Lichtveld addressed some of the biggest concerns in public health today and the role environmental health professionals must play in raising awareness and increasing knowledge to create impactful solutions. She closed out her presentation with a call to action for environmental health professionals to work together with various partners to use data and research to create meaningful changes in our communities.

The second day of the conference on Tuesday, August 1, began with the first Grand Educational Session Kickoff—A Rodent Symposium: Effective Communications, Control Practices, and Utilizing Resources. The session was led by Dr. Claudia Riegel, director of the City of New Orleans Mosquito, Termite, and Rodent Control Board. Dr. Riegel

stressed the importance of breaking down silos between departments and organizations to improve cooperation and generate new ideas.

During the lunch hour, Dr. Umair Shah, secretary of health for the Washington State Board of Health, joined Dr. David Dyjack, our executive director, for the first Sound Check—An Honest Discussion on the Environmental Health Workforce and Leadership During Times of Change. The second day of the conference ended with Lt. General Russel L. Honoré, U.S. Army (Ret.), who delivered a powerful and engaging keynote address on leadership. He spoke candidly with attendees about effective leadership and communication, particularly during emergencies.

Day three of the conference on Wednesday, August 2, began with the second Grand Educational Session Kickoff—The Conundrum of Food Safety Culture: Breaking Through Barriers to Drive Improvement. Dr. Dyjack moderated the panel discussion on the food safety culture in the private sector with executive leadership from Chick-fil-A, McDonald's, and Topgolf. During the lunch hour, Dr. Darin Detwiler, a professor at Northeastern University, led an emotional conversation about his 30-year journey of educating and advocating for food safety after the devastating loss of his young son, Riley. This journey is featured in the Netflix documentary, *Poisoned: The Dirty Truth About Your Food*.

Finally, the 2023 AEC came to an end on Thursday, August 3, with an exciting presentation from Frank Yiannas, founder of FY Smarter Solutions and prior deputy commissioner of Food Safety and Response at the Food and Drug Administration. The presentation focused on creating a safer, smarter, and more transparent food system.

Over 250 educational sessions, preconference workshops, and meetings were held at the 2023 AEC. Of these events, over 80 were available to the virtual audience. More than 350 speakers shared their expertise to full rooms and virtual attendees throughout the conference. The Exhibit Hall was filled with exhibitors from various industries or organizations who showcased their innovative products and services designed to improve the job functions and performance of environmental health professionals.

During a time when many organizations have moved away from offering virtual conference options, we made the decision to continue the hybrid conference format. This format enables attendees with budget, travel, or staffing limitations the option to participate virtually. In total, 150 attendees participated virtually from 35 different states. Each virtual attendee was able to view live streamed sessions and network in real time within the virtual platform.

The Raising Your Voice Networking Event proved to be a highlight for many in-person attendees with live music, local tarot card readings, Mardi Gras characters, and Cajun cuisine. The event brought together 800 attendees who reconnected with old friends and made new connections.

We thank our attendees, members, board, technical advisors, presenters, exhibitors, sponsors, and staff who participated and contributed to the success of the 2023 AEC. We hope to see you next year in Pittsburgh, Pennsylvania, at the 2024 AEC. Check out the promotion for the 2024 AEC on page 71.

Photos courtesy of Blake Latiolais, B1 Studio LLC, https://b1studiollc.com; Kate Beasley, Adrienne Gothard, & Michéle Samarya-Timm, NEHA.

Featured Speakers

Keynote speaker Dr. Maureen Lichtveld explored the importance of raising awareness about the environmental health profession.

The Grand Educational Session Kickoff panelists addressed the need for effective communication about rodent control to raise community awareness.

The first of our new Sound Check sessions kicked off with Dr. David Dyjack (left) and Dr. Umair Shah (right) engaging in an honest discussion on the challenges facing the environmental health profession.

Lt. General Russel L. Honoré, our second keynote speaker, delivered a candid and colorful presentation on leadership during a crisis.

Keynote Address—Communities and Climate Through the Lens of Environmental Health Practice

Maureen Lichtveld, MPH, MD, dean of the School of Public Health at the University of Pittsburgh, delivered the opening keynote address on Monday, July 31. Her presentation focused on communities, especially those facing intransigent inequities that rely on solutions from environmental health practitioners. She addressed the triple threats many communities face—pollution, disasters, and climate change—and proposed a roadmap for action. Dr. Lichtveld stated, "If you look broader, you see that we need a systems approach to combat climate change. It is not just individual health but health systems." She continued by discussing the importance of raising awareness as well as fighting disinformation. While addressing the environmental health profession on all levels, from local to federal, she said, "These four things are what keep me up at night: infectious disease, extreme heat, food and water security, and poor air quality. I challenge anybody to tell me environmental health does not fit in here."

Grand Educational Session Kickoff—A Rodent Symposium: Effective Communications, Control Practices, and Utilizing Resources

The first of two Grand Educational Session Kickoffs took place on Tuesday, August 1. The first included an expert panel that discussed three specific areas of breaking down silos for effective communications, rodent control practices and knowledge among residents and local government workers, and using resources to further educate employees and clients. Panelists included Claudia Riegel, PhD, director of the City of New Orleans Mosquito, Termite, and Rodent Control Board; Imelda Moise, MPH, PhD, associate professor at the University of Miami; and Janet Hurley, MPA, senior extension program specialist at the AgriLife Extension Services within Texas A&M.

Dr. Riegel began the session with a discussion on why breaking down silos is important. She stated, "It encourages collaboration, supports better decision-making processes, boosts productivity, and fosters innovation." Dr. Moise continued the discussion with what she described as, "Our shared goal: To build partnership and data sharing to improve public and environmental health." Hurley explored how we educate our profession and the people we serve. Further, she presented the Seven Areas of Responsibility: assess needs; plan; implement; evaluate; administer and manage; serve as a resource; and communicate, promote, and advocate for the profession.

Sound Check—An Honest Discussion on the Environmental Health Workforce and Leadership During Times of Change

New to the 2023 AEC were two lunchtime Sound Check sessions where invited guests were encouraged to tell their stories and discuss important emerging environmental health issues. The first session held on Tuesday, August 1, featured Umair A. Shah, MPH, MD, secretary of health for the Washington State Board of Health. Joining him as moderator was David Dyjack, DrPH, CIH, our executive director. Dr. Shah spoke on the challenges facing the environmental health workforce and the responsibilities of leadership. He said, "I think this is a tough time right now, you have different generations and perspectives. I think you need to build on top of what you already have and you have to have stability. You also have to push the envelope and have a leader who says what is important and articulates a vision."

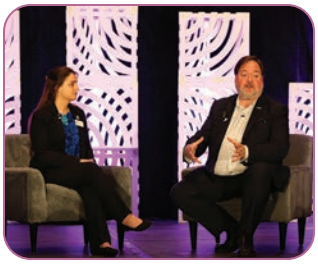
Keynote Address—Leadership: Getting the Difficult Job Done

Our keynote address speaker on Tuesday, August 1, Lt. General Russel L. Honoré, U.S. Army (Ret.), a native of Louisiana, delivered his famously no-nonsense decisive approach to leadership, vision, and resiliency during a crisis. Lt. General. Honoré served as commander of Joint

Featured Speakers

CAPT Timothy Jiggens provided an introduction for Lt. General Honoré and set the stage for our second keynote address.

Dr. David Dyjack moderated a panel of food industry leaders as they discussed how their respective businesses strive to maintain a culture of food safety.



Dr. Darin Detwiler shared with attendees his journey of educating and advocating for food safety.

In our closing session, Frank Yiannas asked the audience if we are winning the battle against foodborne illness and explored how we can create better food safety cultures.

Task Force Katrina and was responsible for the evacuation efforts in New Orleans. Being candid and colorful, he shared firsthand stories of the evacuation of the city and how change and unpredictability are constants, as well as how individual resilience is mandatory. He stressed many points of leadership during a crisis, including 1) see first, understand first, act first; 2) collaboration is key; 3) in crisis, the first report is usually wrong; and 4) your people are number one. Lt. General. Honoré was introduced by CAPT Timothy Jiggens from the Office of Laboratory Safety within the Food and Drug Administration.

Grand Educational Session Kickoff—The Conundrum of Food Safety Culture: Breaking Through Barriers to Drive Improvement

Presented by the NEHA Business & Industry Affiliate, the second Grand Educational Session Kickoff on Wednesday, August 2, was a panel of food industry leaders who spoke on the competing priorities in business, how their organizations achieve and maintain a culture of food safety despite rising inflation, workforce shortages, extreme weather, pandemic recovery, and food defense. The panel consisted of Courtney LaVallee, director of food safety culture for Chick-fil-A; Bob Stewart, North America supply chain officer for McDonald's; and Cheli Breaux, senior national director of operations for Topgolf. The panel was moderated by Dr. Dyjack. They panelists spoke of building trust with employees and consumers. As leaders, they need to be approachable with not only the big decisions but also the small decisions that are made every day. Stewart, addressing employee turnover, stated, "One in eight Americans have worked at a McDonalds." He did state, however, that employee retention is improving. All panelists agreed that if they do not have a trusted brand, customers will "not come, no matter the price point."

Sound Check—Poisoned: The Dirty Truth About Your Food

Darin Detwiler, LPD, was our second Sound Check invited guest on Wednesday, August 2. A U.S. Navy nuclear submarine veteran turned well-respected food safety academic, advisor, advocate, and author, Dr. Detwiler shared his 30-year journey of educating and advocating for food safety after the devastating loss of his young son, Riley, in the 1993 *E. coli* Jack in the Box outbreak. He is featured in the now-streaming Netflix documentary, *Poison: The Dirty Truth About Your Food.* On the day of the documentary debut, Wednesday, August 2, he walked the conference attendees through losing his son and setting us on the course of raising awareness for food safety. He said the goal of his participation in the documentary was to help raise the expectations of food safety for the next 30 years and for the next generation of food safety professionals. The session was moderated by NEHA staff member Laura Wildey.

Closing Session—Creating a Safer, Smarter, and More Transparent Food System

The final presentation of the conference on Thursday, August 3, featured food safety expert Frank Yiannas, founder of FY Smarter Solutions and prior deputy commissioner of Food Policy and Response within the Food and Drug Administration. Yiannas began the presentation by asking attendees if they are winning the battle against foodborne disease. When the answer was no, he proceeded to show the incidence of foodborne illness in the U.S. over the past 100 years. He described how we are facing "challenging times in our nation and in the world as the global food system faces unprecedented headwinds." He stated, "The sheer scope and scale of the global food system is daunting. On top of that, coming out of the pandemic, we're facing a multitude of new pressures, whether it's emerging food safety risks, labor shortages, supply chain bottlenecks, effects of climate change, regional conflicts, or inflationary headwinds, just to name a few." Yiannas ended with examples of creating a food safety culture through traditional and behavior-based safety management, stating, "Food safety is a choice."

Education & Training

The 2023 AEC served as a dynamic platform where environmental health professionals, educators, researchers, policymakers, and visionaries converged to explore the ever-evolving landscape of environmental health. This year's conference hosted 228 educational sessions with 359 speakers, 7 plenary sessions, and the viewing of 30 scientific posters. The more than 1,300 conference attendees—nearly 1,200 in-person attendees and 150 virtual attendees—had to make hard choices on which sessions to attend during the span of the conference.

Keynote speaker Lt. General Honoré spoke a second time and presented a deeper drive into crisis leadership within the Emergency Preparedness & Response track. This session was the highest attended breakout presentation of the conference. He was also available for the signing of his book, *Leadership in the New Normal, A Short Course*.

The Food Safety track was highly attended with sessions that packed the rooms, including:

- Evaluating and Improving Food Safety at Temporary Events
- Commercial Ice Machine Contamination: How to Properly Inspect and Clean
- A Food Safety Panel: Achieving Active Managerial Control Through Food Safety Consultation
- Have You Been Cleaning Wrong All Along? How Overlooking the Cleaning Step Hurts the Sanitation Goals of the *Food Code*

Additional session track presentations that were standing-room only and had a high virtual attendance were:

- Workforce & Leadership—Conflict De-escalation
- Climate & Health—Climate Change and Environmental Public Health: Research Strategies and Tools for Practitioners
- Infectious & Vectorborne Diseases—Climate Change Impact on Growing Threats of Vectorborne Disease

A new educational track added to the 2023 AEC was the NEHA-FDA Retail Flexible Funding Model (RFFM) Grant Program, which provided attendees with information on applying for grants, grant maintenance, and advancement, as well as guidance on mentorship, special projects, and training. The 2023 AEC also featured a track specific to the environmental health issues encountered in Louisiana.

Of the attendees who completed our survey after the conference, 87% indicated they agreed or strongly agreed that the conference sessions provided the knowledge and skills needed to be successful in their jobs. Furthermore, 88% of survey respondents stated they agreed or strongly agreed that the conference session topics were relevant and applicable to their jobs. Overall, the quality of the educational sessions was rated as good or excellent by 93% of survey respondents.

The multitrack educational aim of the conference is to delve deep into the transformative power of knowledge, exchange ideas that challenge the status quo, and chart a course for the future of learning with enlightenment, collaboration, and change.

Feedback From Our Attendees

All 2023 AEC attendees were asked to complete an evaluation survey after the conference ended. Of the respondents, 88% rated the quality of the conference as either very good or excellent. Furthermore, 97% of respondents indicated that they would attend a future AEC. Some of the reasons for attending the 2023 AEC included the educational opportunities for personal and organizational growth, the ability to earn continuing education for credentials, and the chance to network with other environmental health professionals.

Below is a sample of the comments we received from attendees:

- "I learned a lot about various environmental health topics from individuals with different backgrounds, which allowed me to expand my viewpoint on a large number of issues."
- "I felt the organization of the conference organically led to productive and enthusiastic conversations."
- "It was great to network with people from all over the country as well as other parts of my state."

French Quarter Pest Tour

Members of the City of New Orleans Mosquito, Termite, and Rodent Control Board conducted evening walking tours of the famous French Quarter on Tuesday, August 1. City officials shared how they manage termites, rats, and historical vectorborne diseases, as well as performed a pest inspection of an open-air market. The walking tours travelled around the French Quarter and attendees learned about each topic from different experts. More than 150 conference attendees signed up for the two tours offered. As one attendee stated, "The pest control tour was awesome!"

2023 AEC Session Tracks & Subtopics

1. **Climate & Health**
   - » Adaptation
   - » Air Quality
   - » Drought
   - » Extreme Heat
   - » Extreme Rainfall
   - » Extreme Weather
   - » Flooding
   - » Hurricanes
   - » Wildfires
2. **Data & Technology**
   - » Environmental Health Tracking & Informatics
   - » Technology & Environmental Health
3. **Emergency Preparedness & Response**
4. **Focused Populations**
   - » Children's Environmental Health
   - » Environmental Justice
   - » Industry
   - » Uniformed Services
5. **Food Safety**
   - » Cannabis
   - » Food Safety & Defense
   - » Retail & Home Restaurants
6. **General Environmental Health**
   - » Body Art
   - » Emerging Environmental Health Issues
   - » Fentanyl
   - » Food Waste
   - » General Environmental Health
   - » Global Environmental Health
   - » Hazardous & Toxic Materials
   - » Solid Waste
   - » Sustainability
7. **Healthy Communities**
   - » Health Impact Assessments for Environmental Health
   - » Healthy Homes & Communities
   - » Land Use Planning & Design
   - » Lead
   - » PFAS
   - » Risk Communication
   - » Schools & Institutions
8. **Infectious & Vectorborne Diseases**
   - » Pathogens & Outbreaks
   - » Vector Control & Zoonotic Diseases
9. **Louisiana Environmental Health**
10. **NEHA-FDA RFFM Grant Program**
    - » Administrative
    - » Capacity Building Add-On Grant
    - » Mentorship Add-On Grant
    - » Special Projects Add-On Grant
    - » Track 1 Development Base Grant
    - » Track 2 Development Base Grant
    - » Track 3 Maintenance and Advancement Base Grant
    - » Training Add-On Grant
11. **Water Quality**
    - » Onsite Wastewater
    - » Premise Plumbing
    - » Private Drinking Water
    - » Recreational Water
    - » Shorelines
    - » Water Quality
    - » Water Reuse
12. **Workforce & Leadership**
    - » Leadership & Management
    - » Student & Young Professional Career Development
    - » Workforce Diversity

Preconference Courses & Workshops

Compared with the 2022 AEC, nearly twice as many attendees participated in the 12 preconference courses and workshops that we offered at the 2023 AEC on July 29–31. Overall, 450 attendees participated in these preconference events.

We continued the tradition of hosting a variety of beneficial preconference offerings. The REHS/RS Review Course prepared 23 attendees for the REHS/RS exam and the CP-FS Review Course prepared 11 individuals for the CP-FS exam. Approximately 40 leaders from our affiliates gathered at their annual preconference workshop to learn and collaborate on predominant environmental health concerns such as advocating for the profession, developing policy statements, supporting the workforce, and partnering on our environmental health outreach campaign.

We continued to offer several workshops in 2023 that provided specific training to targeted groups of attendees. More than one dozen attendees participated in hands-on equipment demonstrations and learned about the fundamentals of body art facility inspection in the Body Art Facility Inspector Training. The Environmental Health and Land Reuse Certificate Program Workshop explored the environmental and health risks and social disparities associated with contaminated land properties, key players in land reuse planning and policy, and redevelopment techniques to improve community health.

Our Private Water Network held the Building Capacity Through Partnership and Collaboration for Safer Private Wells Workshop, which explored resources and challenges associated with well-water testing. Also, the second cohort of our Environmental Health Leadership Academy met to share their leadership projects and to recognize their completion of the program.

As in previous years, we leveraged our partnerships to provide crucial training to preconference attendees. We once again partnered with ecoAmerica to hold the always popular one-half-day Climate for Health Ambassador Training. Approximately 50 participants were equipped with knowledge, hands-on experience, and resources to speak and act confidently on climate change and related solutions. Following the Ambassador Training, Climate for Health hosted a new Ambassador Debrief where nearly 50 participants reviewed opportunities for engagement on climate change and were able to network with peers committed to climate action.

We also partnered with the Food and Drug Administration to offer the National Retail Food Regulatory Program Standards Self-Assessment and Verification Audit Workshop. The attendees of this workshop were given an overview of the criteria for the Program Standards and had hands-on opportunities to conduct a self-assessment or verification audit. New in 2023, we partnered with the Council for the Model Aquatic Health Code to provide the Certified Public Health Pool Inspector training to nine individuals who left the pilot training confident to inspect commercial pools.

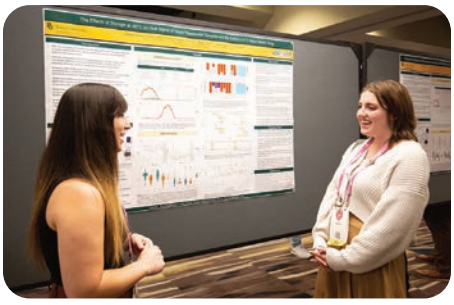
Our past presidents provided their insight in two new preconference workshops. More than 50 attendees of the Communication: Influencing Inspection Outcomes Workshop learned the value of effective communication to garner positive inspection outcomes. The Tools for Working Better, Smarter, Cheaper as You Utilize Data and Planning to Ensure Environmental Health Program Success: A Workshop for Current and Aspiring Environmental Health Leaders equipped over 50 participants with the tools, resources, and knowledge needed to effectively use data to achieve program goals.

Student Activities

Approximately 100 students attended the 2023 AEC, either in person or virtually. This attendance is encouraging as students continue to be an important part of our community. Based on feedback from previous student attendees and to recognize this key group of attendees, we partnered with the National Environmental Public Health Internship Program to hold a Student Welcome Reception on the evening of Tuesday, August 1. The event was held at Fulton Alley, a bowling alley adjacent to the conference center.

The students were welcomed by President Dr. D. Gary Brown. The lively networking event offered students the opportunity to connect with our leadership and get acquainted with the programs and services we offer for the next generation of environmental health professionals at the AEC and throughout the year. With bowling, music, and great conversation, students were able to set themselves up for success at the AEC and beyond.

We also showcased the research and work of our student attendees at the 2023 AEC. More than 20 student posters were displayed at the in-person Exhibit Hall and 8 posters were displayed in the virtual Poster Hall. Student poster presenters provided insight into the latest research on a variety of topics including rural private well testing, foodborne disease mitigation, and diversity in the workforce.



Social Events

Environmental Health Photo Exhibit & Lt. General Honoré Book Signing

The night of Tuesday, August 1, was filled with two new additions to our AEC program. First, we hosted a book signing with our keynote speaker, Lt. General Honoré. Attendees had the opportunity to connect one-on-one with the rousing keynote speaker and to purchase autographed copies of his book, *Leadership in the New Normal*.

The second event was the Environmental Health Photo Exhibit. Photography is a powerful storytelling medium. For the 2023 AEC, our members were invited to share photos in a variety of categories that represented the impact of environmental public health in our first-ever Environmental Public Health Photography Contest. The submitted photos were judged by Lloyd DeGrane, a Chicago-based photographer, and Gina Bare, one of our staff and an avid photographer. The selected photos were then showcased during a reception. The photos remained on display for the remainder of the conference.

We thank all who submitted for the photo contest. Congratulations to the submitters of the photographs that were selected for the exhibit. The winners of the photography contest were:

Climate Health and Emergency Preparedness Category

- **1st place: Harry Heafer,** Lincoln–Lancaster County Health Department
- **2nd place: Chris Manley,** Larimer County Department of Health and Environment
- **3rd place: Kathryn Haugen,** Minnesota Department of Health

Healthy Communities and Special Populations

- **1st place: Samantha Russell,** Skagit County Public Health
- **2nd place: Lisa Whitlock,** Retired Food and Drug Administration Retail Food Specialist
- **3rd place: Hector Morfin,** Sweetener Products Company

General Environmental Health

- **1st place: Chris Manley,** Larimer County Department of Health and Environment
- **2nd place: Harry Heafer,** Lincoln–Lancaster County Health Department
- **3rd place: Elizabeth Kavanah,** City of Hartford

Food and Water Safety

- **1st place: James Scales,** Orange County, Texas
- **2nd place: Karin Kasper,** Franklin County Public Health
- **3rd place: Kimberly Burgess,** Cheyenne–Laramie County Public Health

Infectious and Vector Diseases

- **1st place: Kathryn Haugen,** Minnesota Department of Health
- **2nd place: Harry Heafer,** Lincoln–Lancaster County Health Department

Breakfast & Town Hall Assembly

Our members packed the room early Wednesday morning, August 2, to get an update on the state of the association and to ask questions of our leadership. Our leadership opened the Town Hall by giving a brief review of the year. In the past year, we continued our goal of supporting the underlying foundation of the environmental health workforce by investing in local communities through direct funding, training, assessment, consultation, credentialing, and increasing the visibility of environmental health to policymakers. Closing the year in review, President Brown stated, "I know with your help, NEHA will take the environmental health profession to 'Infinity and Beyond.'"

Next, President Brown recognized 34 individuals who made exemplary contributions to the association during his term of office with Presidential Citations. A listing of these citations can be found on page 63. President Brown went on to recognize the great work taking place within our affiliate organizations through this year's Affiliate Certificates of Merit. Our affiliates represent a grassroots network of state-level and sector-specific environmental health organizations. We are connected through a shared mission of empowering and educating environmental health professionals. Affiliate associations are primarily run by dedicated volunteers who support the profession locally. Each year, we provide our affiliates with the opportunity to nominate outstanding individuals or teams who have contributed to the success of their

associations. A listing of the Certificates of Merit awarded can be found on page 62.

President Brown then invited James Balsamo, Jr., our Scholarship Committee chair, to come to the stage to present certificates to our scholarship recipients. Along with the American Academy of Sanitarians, we believe that structured education at the undergraduate and graduate levels is important to an individual's successful professional development in the field and that continuing education is a vital component in the continued career growth of environmental health professionals. As such, three scholarships are awarded annually—one to a graduate student and two to undergraduate students. A listing of the 2023 scholarship winners can be found on page 62. More information about our scholarships can be found at www.neha.org/scholarships.

One of the traditions of the Town Hall is to welcome to the stage candidates for the upcoming position of 2nd vice-president to speak to the membership. Michele DiMaggio, a long-time member and current board member, took the opportunity to state her interest in running for the position and shared her platform.

To close the Town Hall, President Brown recognized and thanked our technical advisors and outgoing board members. He also introduced our incoming board members. The Town Hall was concluded after several minutes of questions and answers among our membership, leadership, and staff.

Raising Your Voice Networking Event

Approximately 800 attendees got immersed in the local New Orleans culture at the Raising Your Voice Networking Event, which was held at Generations Hall, a former 1820s sugar mill. Attendees spent the evening connecting, dancing to a live 5-piece jazz band, and having their tarot cards read, a New Orleans tradition. Along with dinner, beverages, and live music, attendees were able to snap a photo in the event photo booth to commemorate the evening. Thank you to Hedgerow Software for sponsoring the photo booth and for providing our attendees with a small memento of the good times had while reconnecting with old friends and new colleagues. It was great to see that many attendees continued to network after the official event ended. Thank you to our attendees for making this event a memorable success.

2023 AEC Sponsors, Partners, and Contributors

We appreciate the following sponsors, organizations, and individuals who helped make the 2023 AEC possible!

Sponsors

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City of New Orleans Mosquito, Termite, and Rodent Control Board

Centers for Disease Control and Prevention, National Center for Environmental Health

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Council for the Model Aquatic Health Code

ecoAmerica, Climate for Health

Food and Drug Administration

FY Smarter Solutions

McDonald's

National Environmental Health Science and Protection Accreditation Council

NEHA Endowment Foundation Donors (see page 32)

NEHA-FDA Retail Flexible Funding Model Grant Program

NEHA Technical Advisors (see page 49)

New Orleans Health Department

Northeastern University

Topgolf

Uniformed Services Environmental Health Association

University of Pittsburgh, School of Public Health

Exhibition

The 2023 AEC Exhibit Hall was bustling with excitement on Monday, July 31, and Tuesday, August 1. As the conference was offered in person and virtually, attendees could connect with exhibitors in the Exhibit Hall or through the conference app. Attendees were also able to set up face-to-face meetings with the exhibitors during Exhibit Hall hours. Representatives from the exhibiting companies and organizations were available to answer attendee questions and display their products and services. Overall, there were 54 booths for attendees to visit and learn from. We were excited to have more exhibitors this year, which was a combination of everyone's favorites as well as many new exhibitors. And as in past years, the Poster Session was held in the Exhibit Hall for attendees to peruse the posters and engage with the presenters.

The Exhibition Grand Opening on Monday, July 31, was filled with attendees who made new connections and discovered new products, all while enjoying an assortment of food and beverages. The event also provided the opportunity to catch up with old friends. The first night of the exhibition always sets an energetic tone for the conference and creates a buzz of enthusiasm that lasts until the final day. The wide variety of exhibitors enabled attendees to explore the different industries and organizations that support their work and to connect with other professionals who have similar interests.

On the second day, Tuesday, August 1, the Exhibit Hall was the place to be. Demonstrations were offered in the Exhibit Hall during the morning and afternoon breaks. The morning demonstration was sponsored and presented by HS GovTech. The afternoon demonstration was sponsored and presented by the Bloomberg American Health Initiative. So many people attended the demonstrations that chairs were pulled over from anywhere they could be found and hotel staff rushed to bring in additional seating. We appreciate the hard work of the hotel staff to accommodate this unexpected number of attendees.

For the third year in a row, HS GovTech was the Presenting Sponsor of the AEC. HS GovTech also sponsored the inaugural Environmental Health Photo Exhibit. NSF sponsored the conference Wi-Fi and Tyler Technologies sponsored the conference app. In addition, the photo booth at the Raising Your Voice Networking Event was sponsored by Hedgerow Software, which always leads to a lot of attendee creativity, memory-making, and fun. Rounding out our support was Accela through its sponsorship of the Data & Technology educational session track and awarding four scholarships to attend the 2023 AEC.

We thank all of the 2023 AEC exhibitors and sponsors. We could not put on a premier event of this magnitude without your participation and generosity. The knowledge, products, and services you shared are vital to the success of our attendees in their work to ensure healthier environments for all. You are appreciated!

2023 AEC Exhibitors

Accela

American Academy of Sanitarians

American Public Health Association (APHA)

Association of Professional Piercers (APP)

Bloomberg American Health Initiative

CDC NCEH/ATSDR

CDP, Inc.

Council for the Model Aquatic Health Code (CMAHC)

Council to Improve Foodborne Outbreak Response (CIFOR)/ Epi-Ready

EcoSure–A Division of Ecolab

EMSL Analytical, Inc.

Environmental Information Association (EIA)

Food Safety Centers of Excellence

Hazel Analytics

Hedgerow Software

HS GovTech

HUD/Office of Lead Hazard Control and Healthy Homes

hydrosense

IAPMO R&T

IFEH Region of the Americas

IFPTI

Louisiana Environmental Health Association (LEHA)

National Environmental Assessment Reporting System (NEARS)

National Environmental Health Association (NEHA)

National Environmental Health Science and Protection Accreditation Council (EHAC)

National Environmental Public Health Internship Program (NEPHIP)

National Network of Public Health Institutes

National Onsite Wastewater Recycling Association (NOWRA)

National Restaurant Association Solutions

NEHA-FDA Retail Flexible Funding Model Grant Program

NSF

Peace Corps Response

Pool & Hot Tub Alliance

Private Water Network (PWN)

PURELL

SanAir Technologies Laboratory, Inc.

SciAps Inc

StateFoodSafety

Sweeps Software, Inc.

Tyler Technologies

UAB Deep South Center for Occupational Health & Safety

U.S. EPA Office of Research and Development

U.S. Food and Drug Administration/ Center for Food Safety and Applied Nutrition

USDA-FNS, Food Safety Branch

A Bit of Competition in the Exhibit Hall

To add to the engagement and fun of the Exhibit Hall, we offered a bingo game for attendees to play. Each square of the bingo card was filled with the name of an exhibitor and attendees had to completely fill their bingo cards with marks from those exhibitors when visiting each booth. The game added some competition and liveliness to the Exhibit Hall. After the Exhibit Hall closed, attendees dropped off their full bingo cards at the Information Desk and one lucky winner, Kimberly Burgess from Cheyenne–Laramie County Public Health, was selected to receive a complimentary registration for the 2024 AEC.


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Awards & Scholarships

We were proud to bestow several national awards and scholarships that represent outstanding individuals, programs, and groups throughout the country in 2023. From leaders working on diversity efforts to some of the most recognized names in our professional community, this year's recipients illustrate the dedication and selflessness of the professionals in our field.

The recipients of these awards and scholarships were honored at the AEC during the Breakfast & Town Hall Assembly or the Awards Celebration on Wednesday, August 2. For more information about our awards, please visit www.neha.org/awards.

AEHAP Student Research Competition Winners

For over 20 years, the Association of Environmental Health Academic Programs (AEHAP) has sponsored the Student Research Competition. The competition is a volunteer-judged competition. Students from schools with environmental health programs that are AEHAP members enter research projects to compete for monetary and travel awards to attend and present at the AEC.

Undergraduate: 1st Place Winner
Lily Metsker
University of Georgia, Athens

Graduate: 1st Place Winner
Sarah Morgan
East Kentucky University

Davis Calvin Wagner Sanitarian Award

COL Wendell A. Moore, MS, EdD, DAAS, RS, REHS, U.S. Army (retired)
This award represents the highest honor the American Academy of Sanitarians (AAS) bestows on one of its diplomates.

Dr. Bailus Walker, Jr. Diversity and Inclusion Awareness Award

Oreta M. Samples, MPH, DHSc
This award is given annually to recognize an individual or group who has made significant achievements in developing or enhancing a more culturally diverse, inclusive, and competent environment in their organizations and communities.

Joe Beck Educational Contribution Award

Daniel B. Oerther, PhD, CEHS, DLAAS, FCIEH
This award is given annually to recognize an individual or team for an educational contribution designed for the advancement and professional development of environmental health professionals.

NEHA/AAS Scholarships

Both NEHA and AAS believe that structured education at the undergraduate and graduate levels is important to an individual's successful professional development in the environmental health field and that continuing education is a vital component in the continued career growth of environmental health professionals. As such, three scholarships are awarded annually—one to a graduate student and two to undergraduate students. More information on the NEHA/AAS scholarships can be found at www.neha.org/scholarships.

Dr. Sheila Davidson Pressley Undergraduate Scholarship
Mitchell Kutz
University of Findlay

Dr. Carolyn Hester Harvey Undergraduate Scholarship
Pilar Santos
Montana State University

Graduate Scholarship
Karin Kasper, REHS
Kent State University

NEHA Affiliate Certificates of Merit

Certificates of Merit are awarded to NEHA affiliate members and teams who made exemplary contributions to the profession. Each affiliate selects winners based on its own criteria for recognition. The nominating affiliate is indicated in parentheses.

Individuals
Chirag Bhatt (TX)
Ivy Bremer (IA)
Debbie Dreves (MO)
Tammy Faulkner (VA)
Karl Hartman (UT)
Jennifer Heller (IN)
Carlene Hennie (Jamaica)
Scott Holmes (NE)
Joe Jurusik (MN)
Tom Kunesh (WA)
Crystal Lamb (National Capital Area)
Linda Launer (CA)
Adrea Lovejoy (OR)
Lynette Medeiros (NJ)
Mykel Murry (WY)
Melise Pederson (NM)
Josh Skeggs (CO)
Laura Temke (WI)
Melissa Vaccaro (Business & Industry)
Kathleen Waldron (MA)
Anna Yates (IL)

Teams
2022 Florida Environmental Health Association Annual Education Meeting Planning Committee (FL)
Arizona Environmental Health Association Board and Hybrid Conference Planning Committee (AZ)
Public Affairs Committee (OH)
Workforce Development Task Force Team (CT)

NEHA Past Presidents Award

Eric Bradley
Kristen Ruby-Cisneros
Dr. Wendell A. Moore
Each year, the NEHA Past Presidents Affiliate identifies and honors a hero or group of heroes from the environmental health profession.

NEHA Presidential Citations

Presidential citations are given to those individuals who made exemplary impacts on the association during the term of office of the NEHA president. President Brown recognized 34 such individuals who made

meaningful contributions to the organization during his presidential term. Below are the citations awarded by President Brown:

For exceptional service to the NEHA Government Affairs Program:

Doug Farquhar

For exceptional service to the NEHA History Project Task Force:

Dr. Hank Koren
Dr. Leon F. Vinci

For exceptional service to the NEHA-FDA Retail Flexible Funding Model Grant Program:

Rance Baker

For keeping me on the straight and narrow:

Katherine Sheppard

For marketing excellence:

Chana Goussetis

For superior organization and execution in support of the *Journal of Environmental Health* updating and open access research:

Kristen Ruby-Cisneros

For superior organization and execution in support of the NEHA office relocation:

Gina Bare
Christopher Walker

In recognition of outstanding leadership of the NEHA/AAS Scholarships:

James Balsamo, Jr.

In recognition of outstanding service and leadership on the NEHA Board of Directors during the last year:

CDR Anna Khan
Tom Butts

In recognition of outstanding service and support during my entire tenure on the NEHA Board of Directors:

Dr. Norbert Campbell
Alicia Collins
Brian Collins
Bob Custard
Ashlee Davis
Dr. Amer El-Ahraf
Dr. David Gilkey
Vonia Grabeel
Jamie Hisel
Mel Knight
Roy Kroeger
Sandra Long
Dr. Jason Marion
Dr. Wendell Moore
Dr. Priscilla Oliver
Mahesh Patel
Vince Radke
Dr. Welford Roberts
Dr. Henroy Scarlett
CDR James Speckhart
Dr. Sylvanus Thompson
RADM Webb Young

Uniformed Services Awards

Awards from the Environmental Health Officers Professional Advisory Committee were recognized at the 2023 AEC. These awards honor environmental health professionals within the uniformed services for their outstanding accomplishments in the environmental health field.

2022 Responder of the Year Award

CDR Leslie Jackanicz

2023 John C. Eason Award

LCDR Sarah Hughes

2023 Edward "Ted" Moran Award

CDR Beth Wittry

2023 Thomas E. Crow Mentor Award

CDR Joseph P. Laco

2023 John G. Todd Award

CAPT Aimee Treffiletti

Walter F. Snyder Environmental Health Award

Edward V. Ohanian, PhD

The Snyder Award was created in 1971 in honor of Walter F. Snyder, cofounder and first executive director of NSF. Presented by NSF and NEHA, this award is given annually to individuals who continue Snyder's legacy through outstanding contributions to environmental and public health. NSF and NEHA are proud to announce that Edward V. Ohanian, PhD, is the 2023 recipient of the Walter F. Snyder Environmental Health Award. Dr. Ohanian serves as the associate director for science for the Office of Water within the Office of Science and Technology at the U.S. Environmental Protection Agency (U.S. EPA). He is also a senior science advisor to the deputy assistant administrator in the Office of Water.

In his current role with U.S. EPA, Dr. Ohanian provides leadership and expert oversight for the development of risk assessments required by the Safe Drinking Water Act and the Clean Water Act. Recently, he was nominated by U.S. EPA for the Presidential Meritorious Rank Award for his sustained scientific accomplishments.

"Dr. Ohanian's lifelong dedication to protecting environmental health through his numerous roles and accomplishments has helped to strengthen the quality and safety of drinking water across North America. Over the past four decades, Dr. Ohanian has improved the health and well-being of hundreds of millions of people," said Pedro Sancha, president and CEO of NSF. "Dr. Ohanian's leadership and mentorship within the toxicology industry is unparalleled; he truly embodies the spirit and letter of the Snyder Award. His life's work as an educator, consensus builder, and subject matter expert is exemplary of a productive and impactful environmental public health career," said Dr. David Dyjack, executive director and CEO of NEHA.

Deeply committed to the environmental health community, Dr. Ohanian also serves as a professional lecturer for the Department of Environmental and Occupational Health within the Milken Institute School of Public Health at George Washington University. He led the development of and currently chairs NSF's Health Advisory Board, which is responsible for conducting peer reviews of the risk assessment basis for direct and indirect drinking water additives and promoting the application of state-of-the-art risk analysis methodologies. Additionally, for nearly 20 years, he has been a member of NSF's Public Health Council, which ratifies all NSF standards as being protective of public health.

A published author and editor, Dr. Ohanian has contributed articles and chapters on new and improved risk assess-

ment methodologies to scientific journals and books. He has served on the editorial boards of several risk assessment and toxicology publications. Presently, Dr. Ohanian is an associate editor of *Toxicological Sciences*. He is the past president of the Risk Assessment and Regulatory and Safety Evaluation Specialty Sections of the Society of Toxicology, as well as the 2010 recipient of that society's prestigious Arnold J. Lehman Award for his contributions to risk assessment and the regulation of chemical agents. Currently, Dr. Ohanian serves as the vice president of The Toxicology Forum.

Read the full award press release at www.nsf.org/news/dr-edward-v-ohanian-receives-walter-f-snyder-environmental-health-award.

Walter S. Mangold Award

Brian Collins, MS, REHS, DLAAS

Walter S. Mangold dedicated his life to the practice of environmental health in an extraordinary and exemplary way. In doing so, he became a beacon of excellence and inspiration for all environmental health professionals who followed after him. Created in 1956 and first awarded to Mangold, the Walter S. Mangold Award recognizes individuals for outstanding contributions to the advancement of environmental health professionals. It is the highest distinction that NEHA can grant one of its members. We are pleased to honor Brian Collins with the 2023 Walter S. Mangold Award.

In keeping with the legacy of Walter S. Mangold, Collins's impressive career is an example of both professionalism and service. He was nominated for the Mangold Award by Dr. Priscilla Oliver, president of the NEHA Past Presidents Affiliate from 2022–2023. In her nomination letter, Dr. Oliver wrote, "Throughout his career in environmental health, Brian Collins has demonstrated leadership not only as director of the Plano Environmental Health Department but also as president of the Texas Environmental Health Association and a regional vice-president and president of NEHA. During NEHA's most stressful period of change, he provided leadership and guidance as the interim executive director of NEHA from 2014–2015. Brian has taken time to mentor students of environmental health and support their education and training through internships. He has shared his experience and education through published articles in professional journals on food safety, HACCP principles, and a variety of environmental health topics."

Collins earned his bachelor of science degree in biology from the University of Texas, Arlington. Through his personal interactions and work in restaurants, he contemplated the linkage of interests in science, food, food safety, and public health. It was this interest that led him to a position as a quality control technician at a large food manufacturing and processing plant. After 1 year in that position, he studied and passed the Texas Professional Registered Sanitarian examination. He then started to search for career opportunities that better aligned with his interests in food service, food science, and food safety. In 1988, he was hired by the City of Plano as a health inspector. Thus began the start of a career path at Plano that would span 26 years with promotions from environmental health specialist supervisor in 1990, assistant director in 1991, and director in 1998. He earned his master of science in human relations from Amberton University in 2002. Collins retired from Plano in January 2014. Currently, he serves as principal of Hygieia Consulting, LLC.

Throughout his career, Collins published articles in peer-reviewed journals that presented novel approaches to food safety and experiences in the practice of environmental public health management and leadership. Training, coaching, and mentoring of others regarding personal development, lessons learned, and leadership were consistent areas of focus in his career efforts. Over his career, he has coached and mentored many staff to vertical career opportunities and professional credentials. He has also served as an instructor and mentor for a variety of different leadership and fellowship programs. Furthermore, Collins was a valuable member of numerous task forces, committees, work groups, councils, and other associations at local, state, federal, and national levels.

Collins served on state and national boards to highlight local components of environmental public health and to effect change in the practice and profession of environmental public health. He was president of the Texas Environmental Health Association from 2000–2001, Region 5 vice-president of NEHA from 2002–2008, and a national officer of NEHA from 2009–2014, serving as president from 2012–2013. He is a diplomate laureate of the American Academy of Sanitarians (AAS) and served as chair from 2020–2022. He was awarded the AAS Davis Calvin Wagner Sanitarian Award in 2014. Throughout his career, he has been recognized for his achievements by numerous local, state, national, and federal organizations and agencies.

As one past Mangold Award recipient stated, "While there are many members of our association who deserve recognition, I can think of no one person who is more deserving of the Mangold Award for his lifetime of achievements that he has given to our profession and our association. I am honored to welcome him as a distinguished member of this elite group of past recipients. It is my hope that the Mangold Committee agrees and conveys this honor to Brian, a true friend and dedicated professional." The comment from Dr. Wendell A. Moore in his support letter succinctly summarizes the character of Collins throughout his career: "Brian represents the epitome of the environmental health/sanitarian profession and possesses the attributes that embody the Walter S. Mangold Award. He is a leader of leaders and a servant of servants."

Sharing the Conference Experience

Social media was a great way for attendees to share their conference experiences, insights, and thoughts with a wide network of environmental health professionals. Attendees shared comments and photos of the 2023 AEC via Twitter, Facebook, LinkedIn, and Instagram. Attendees were encouraged to post using #NEHAAEC.

Twitter (X)

Bryan Brooks @BryanWBrooks

Indeed. Environmental health is the backbone of public health. In the US, there are profound workforce needs that affect local communities of all States, Tribes and Territories. Thank you @nehaorg for the opportunity to share my perspectives.

Russel L. Honoré @ltgrusselhonore

In my Favorite City in the World @New Orleans #NOLA speaking @nehaorg Convention @HiltonRiverside. "Finding Solutions for Pollution." #NEHAAEC #EHMatters @KepplerSpeakers

HS GovTech @HSGovTech

We look forward to seeing y'all in Pittsburgh in 2024. #BeyondData Management #HSGovTech

IAPMO @IAPMO

What an incredible week @nehaorg #NEHAAEC! Thanks to all who dropped by our booth, where vibrant discussions about IAPMO's mission & services were buzzing nonstop. Shoutout to the dedicated health inspectors & public health scientists—your work makes our world safer & better.

Roy Kroeger @Roykehs

NEHA talking to McDonalds, Chick-fil-A and Top Golf about a culture of food safety. #oneneha #NEHAAEC

Judy Lynn @justjudylynn

@frankyiannas speaking at #NEHAAEC "Challenges give way to opportunities." This is true in food safety but also across all #EHmatters. We can use the new climate reality of extreme heat to innovate. Think creatively quickly.

#NEHAAEC #EHMatters When @ltgrusselhonore was asked what his first priority was when he arrived for Hurricane Katrina response, he answered without hesitation, "Save lives." Addressing the equity issue of prioritizing security of property over human lives. #leadershipweneed

NACCHO @NACCHOalerts

We were at #NEHAAEC 2023 this year in New Orleans with our staff and members hosting various sessions, booths, and more! Here are staff reflections from the event: https://naccho.org/blog/articles/2023-neha-annual-educational-conference-reflections. Thanks to @nehaorg for a great conference!

Office of Dr. Umair A. Shah, WA Sec of Health @WaHealthSec

In the world of health—as we face emerging viruses & the ongoing impact of climate change—some of the most important research & work is shared at @nehaorg.

Facebook

Adam London

Well done, NEHA team! This AEC was one of the best yet. Thanks for all your great work!

Sandra M. Long

Great speakers, so much to choose from, great AEC! Excellent job NEHA Team!

Robert W. Powitz

I've been attending the AECs (missed a few) since '72. This was one of the best yet. Kudos to all the professionals who presented, and ENORMOUS shout out to Dave and his staff for all their efforts and incredible delivery. And before we forget, congratulations to Brian Collins for becoming a Mangold winner and Laureate Diplomate in the Academy. WOW!!!!!!

LinkedIn

Aimee R.

Kudos to the vector control team! What an outstanding group of dedicated and knowledgeable public health professionals. Thank you so much for this experience, very well put together!!

Vince Radke

It's wonderful to be here and see everyone. I get to see the whole person not just their head.

Denise Takehara, CP-FS

NEHA AEC NEVER disappoints! I had an amazing time this year especially catching up with old friends and made many new friends. LT General Honoré was nothing short of amazing! He kept everyone engaged. The sessions were very informative. I'm sorry I was not able to catch the various food safety presentations. Thank you to all those that presented. NEHA volunteers: Thank you for all your hard work and dedication to making this AEC a wonderful experience. Looking forward to next year!

A Tribute to Our 25-Year and Beyond Members

We thank and honor the individuals listed in this tribute who have had active memberships with the National Environmental Health Association (NEHA) for 25 years or longer. We sincerely appreciate their commitment to our association and the environmental health profession.

"For 25 years, my membership with NEHA has been a beacon of purpose and connection. It's been a source of knowledge, network, and personal growth. The sense of belonging to contribute to a shared vision has kept me engaged. This community shares public health values and aspirations. Here's to another 25 years of learning, evolving, and cherishing the relationships."
– *Chirag Bhatt*

A

Anthony C. Aiken, Sr.
Tunde M. Akinmoladun
Jane M. Anderson
Peter R. Andrews
Thomas W. Ashton
James H. Atkins

B

Gary Baker
James J. Balsamo, Jr.
Darryl B. Barnett
John M. Barry
Virginia Begay
Anthony E. Bennett
Chirag H. Bhatt
Michael E. Bish
Robert Blake
Allison M. Blodig
Arthur W. Bloom
Michael S. Bloom
Dean Bodager
Dustin Boothe
Mary J. Bowers
James H. Bowles
Michael G. Box
Jason L. Boyd
Freda W. Bredy
Alan Brewer
Corwin D. Brown
Frank A. Brown
Fredrick B. Brown
Jeffrey L. Buntrock
Thomas J. Butts

C

Carl I. Carroll
Charles Catlin
Diane Chalifoux-Judge
Bryan T. Chrisman
Jeffrey A. Church
Kenneth A. Clare
Steven K. Claybrook
Gary E. Coleman
Holly H. Coleman
Brian K. Collins
Richard F. Collins
Brian J. Commons
John P. Connell
Keith W. Cook
Jeffrey R. Coombs
Ralls M. Coston
David B. Cramer
Alan M. Croft
Bob W. Custard

D

Mark A. Darnell
Trenton G. Davis
Melburn R. Dayton
Daniel de la Rosa
Edward A. Deep
Alan J. Dellapenna, Jr.
Jami K. Delmore
John H. Dickson, II
Tricia A. Dreier
Lisa A. Duello
Jozaier T. DuGlas, Sr.
Thomas S. Dunlop
Donna R. Dunn
James A. Dunning

E

Katherine E. Earlywine
Diane R. Eastman
Douglas J. Ebelherr
Jean V. Edsall
Amer El-Ahraf
Terry L. Elichuk
Bill B. Emminger
Annette Eshelby
Diane L. Evans

"I am a long-time member of NEHA because of the support and assistance it provides to environmental health professionals. It is also the dedication and commitment of the staff that helped me see the value of NEHA membership. I feel like I am part of a family."
– Ralph Matthews

"I have been a happy member of NEHA since the start of my career in public health. NEHA has not only provided me with in-depth educational opportunities but also allowed me to collaborate with peers who supported or aided my growth in the field."
– Julie Fernandez

Honoring Our 50-Year Members

We especially want to honor our members who have been with us for 50 years or longer. Being a member for one half of a century is an amazing testament to the dedication and passion each of these individuals has for our organization and the profession.

James J. Balsamo, Jr.
Gary E. Coleman
Alan M. Croft
Trenton G. Davis
Edward A. Deep
Harry E. Grenawitzke
Ron L. Grimes
Horace E. Jones
Herman Koren
Oren L. Larson
George A. Morris
Robert R. Nelson
Dick A. Pantages
Robert W. Powitz
Adam R. Rocke
John G. Todd
Webster Young, Jr.

F

Wendy L. Fanaselle
Donald T. Fanning
Julie Fernandez
Lee C. Finley
Morris V. Forsting

G

Theresa A. Gallagher
Jeanne M. Galloway
Vincent Garcia
Diane Gartner
Mary Gentry
Bruce George
Ginger L. Gist
Raymond E. Glos
Debra Grabowski
Harry E. Grenawitzke
Ron L. Grimes
Kit C. Grosch

H

Mary D. Hahn
Michael G. Halko
Marlena M. Hamann
Robert C. Hamilton
Brian L. Hanft
Mark A. Hansell
Dexter A. Hardy
F.C. Hart
Wil H. Hayes, Jr.
Gregory M. Heck
Dan L. Hendershott
Robert E. Herr
Michael E. Herring
Peter W. Hibbard
Thomas A. Hill
John E. Hiramoto
Carolyn Hobbs Kreiger
Darren D. Holaday
Scott E. Holmes
Chao-Lin Hsieh

I

Joselito S. Ignacio

J

Cynthia A. Jackson

"So honored to be a long-time member of NEHA, which has provided profound ongoing education for professionals as well as highly skilled training, educational resources, and conferences that are very valuable to connect to others and provide professionals with the latest technologies and best practices in the field of environmental health."
– Jeannine Riess

"Being a NEHA member and credential holder has opened up so many incredible opportunities for me over the years. I can't imagine my career without NEHA being a part of it."
– Bob Custard

Charlotte R. Johnson
Horace E. Jones
William D. Justice, Jr.

K

Marty A. Kasman
Frank E. Kellogg
Diane L. Kelsch
David P. King
Sharon L. Kline
Mel Knight
Karin Knopp
Robert B. Knowles
Larry R. Kohl
Herman Koren
Larry E. Krebsbach
Keith L. Krinn
Roy Kroeger

L

Todd W. Lam
Jonathan Langer

"When I first joined NEHA, it was to help me advance in the environmental health workforce, but that quickly changed when I realized just what NEHA had to offer. NEHA became my extended family via networking with others, gaining experiences and knowledge, utilizing the training opportunities, shopping at a bookstore for not just books, finding interns, offering grants, and most importantly, providing an unlimited resource."
– Cynthia A. Jackson

Roland E. Langford
Oren L. Larson
Kathy L. Leinenkugel
Jason T. LeMaster
Allan R. Levesque
Matthew A. Lindsey
Tim A. Link
Percell Locklear
Sandra M. Long
Thomas I. Lovey
Mina Lovrich-Kerr

M

Scott L. Maass
Arthur N. Mabbett
Gloria T. Mackie
Kathleen MacVarish
Joseph M. Malinowski
Kathleen A. Mallet
Louise F. Maranzana
John A. Marcello
Shane Martin
Ralph M. Matthews
Harold C. McDowell
Scott A. McKenzie
Wayne Melichar, III
Tricia A. Metts
Debbie L. Meyers
William R. Milardo, Jr.
Peter M. Mirandi
Lincoln N. Mitchell
Nicholas G. Molchan
Wendell A. Moore
George A. Morris
Christine Moser-Fink
Patrick J. Murray

N

Robert R. Nelson
Bart Nighswonger
Gary P. Noonan
Naphtali O. Nyagwachi

O

Gregory J. O'Brien
Mary B. O'Connor
Priscilla Oliver
Charles S. Otto, III

P

Bette J. Packer
Dick A. Pantages
Joseph M. Parker
Clark A. Pearson
Janet A. Phelps
James M. Phillips
Robert W. Powitz

Q

Michael M. Quinn

R

Laura A. Rabb
Vincent J. Radke

"I have remained a long-term member of NEHA because, in my view, it is one of the few professional organizations that maintains an inseparable bond between environment and health. The relationship between environment and health should continue to remain a core focus. NEHA continues to keep that relationship on the forefront of its mission."
– Norman Weiss

"My NEHA membership has been priceless to me. It has provided a place to discuss ideas and be part of a larger network of environmental health professionals who are willing to help each other."
– Sandra Long

"NEHA provides its members with useful and timely information on a wide variety of topics. This is your environmental health village. You don't have to explain yourself because people here just get you and what you are asking. Membership is an investment in your career."
– Jean Edsall

Michael R. Ramdhan
Jackie L. Rayburn
Karen E. Reid
Michael L. Reiss
Leonard F. Rice
Daniel L. Ries
Jeannine Riess
David E. Riggs
Janet E. Rittenhouse
Welford C. Roberts
Perry L. Robinson
Adam R. Rocke
Jeff Rubin

S

Dorothy C. Saldanha-David
Michéle Samarya-Timm
Vickie M. Sandoval
Heather L. Savalox
Vickie Schleuning
Jeffrey R. Schmidt
Peter M. Schmitt
Bruce E. Schroer

"Over the years, membership with NEHA has provided me invaluable opportunities to network with environmental health professionals from around the world. It has provided me with learning opportunities that have enhanced my experience and leadership in the field. It has been a great pleasure to be part of an organization that supports all environmental health professionals and enhances what we do."
– Jeff Coombs

Ellen M. Schroth
Lucy S. Schrum
Frank S. Sedzielarz
Schossow R. Shelly
Craig A. Shepherd
John H. Shrader
Zia Siddiqi
Donnie Simmons
Doug R. Smith
Marcia G. Snyder
Denise C. Sockwell
Chris J. Soltis
Carl W. Stein
Laura Studevant
Kevin G. Sumner

"Why membership? It's a lot of fun and intellectually stimulating to be surrounded by people who are dedicated to environmental health. Value? To exchange ideas and be mentored by colleagues who are passionate about the same profession that I love, to access new information and resources, and to discover new opportunities for career growth. Benefits? To be invited for projects that were not on my radar helped me become more confident as I set out to start my own food safety business. NEHA will open doors for you so the choice is yours to participate a little or a lot."
– Ellen Schroth

"I have found NEHA an excellent means to keep current with the happenings and trends in environmental health, even in my retirement. I urge all environmental health professionals to become members."
– Adam Rocke

"For the past 49 years, NEHA has been an instrumental resource and pathway that has helped enable me to have a very successful global environmental health career."
– Peter W. Hibbard

"I am very proud to be a part of the NEHA community of professional members, scientists, and educators across the nation."
– John Haliday Dickson, II

T

Stephen R. Tackitt
Kelly M. Taylor
Elizabeth Tennant
David W. Tharp
Peter D. Thornton
John G. Todd
Monty K. Torres
Brian Turner

U

Andrea D. Unger

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c. Total Paid Distribution *[Sum of 15b (1), (2), (3), and (4)]* ▶			709	636
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f. Total Distribution *(Sum of 15c and 15e)* ▶			754	683
g. Copies not Distributed *(See Instructions to Publishers #4 (page #3))* ▶			166	117
h. Total *(Sum of 15f and g)*			920	800
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87th Annual Educational Conference & Exhibition

NEHA **NEWS**

Call for Nominations

By Katherine Sheppard (ksheppard@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 2024:

- Region 2 vice-president (represents Arizona, California, Hawaii, and Nevada; 3-year term)
- Region 3 vice-president (represents Colorado, Montana, Utah, Wyoming, and members residing outside of the U.S. [except members of the U.S. armed services]; 3-year term)
- Region 8 vice-president (represents Delaware, Maryland, Pennsylvania, Virginia, Washington, DC, West Virginia, and all NEHA members of the U.S. armed services residing outside of the U.S.; 3-year term)
- Second vice-president (national officer; 5-year term that progresses through the national offices and will serve as NEHA president in 2027–2028)

We seek diversity on the board in terms of gender, race and ethnicity, and a balance between regulatory officials, academia, and industry. Most importantly, we want people who will help us develop new strategic visions; have experience managing diverse organizations; and can open doors for our organization 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 18, 2024, at our 2024 Annual Educational Conference & Exhibition.
- 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).
- Willingness to commit the time necessary to actively serve on the board.

If you are interested in serving on our Board of Directors, please visit www.neha.org/election-process for information on the nomination and election process. You can also contact Immediate Past-President Dr. D. Gary Brown, chairperson of our Nominations Committee, at gary.brown@eku.edu. The deadline to submit a nomination is **December 1, 2023**.

New Concurrent Disaster and Recovery Resources

Now more than ever, environmental public health professionals are part of each stage of the emergency response cycle and also face concurrent disasters. To help you access the most useful resources quickly and easily, we have created a Preparedness Resource Library filled with forms, templates, exercises, reports, and guides for environmental public health professionals that are ready to download. Topics include:

- Assessment
- Concurrent disasters
- Continuity of operations
- Equity
- Evacuation
- Mental health
- Partnerships
- Policy
- Risk communication
- Sampling
- Special populations
- Specific hazards, such as hurricanes, wildfires, floods, power loss events, and more

The library also includes:

- Must Reads: Recommended resources from our Preparedness Program Committee
- Reviews: Resources can be rated up to 5 stars and visitors can leave reviews
- Filters: Topics can be further expanded or filtered to find what you need

The library is organized into two sections:

- **Concurrent Disasters Resources:** This collection of resources is for environmental health professionals to use to prepare, mitigate, respond, and recover from disasters such as hurricanes, wildfires, earthquakes, and infectious diseases that occur at the same time or consecutively. The repository includes resources to facilitate knowledge sharing across jurisdictions on concurrent

Credit: Image @ Adobe Stock: sakhorn38.

disasters that were developed by state, local, tribal, and territorial health departments; academic institutions; nongovernmental organizations; and governmental agencies. We highlight a few must-read resources, including:
  - » Federal Emergency Management Agency Hurricane Pandemic Plan
  - » Natural Hazards Center: Lessons on Concurrent Disasters
  - » Dual Disaster Handbook—Flooding
- **Disaster Preparedness, Response, and Recovery Resources:** This collection of resources is for environmental health professionals to use to prepare, mitigate, respond, and recover from natural and human-made emergencies and disasters. The repository includes resources to facilitate knowledge sharing across jurisdictions that were developed by state, local, tribal, and territorial health departments; academic institutions; nongovernmental organizations; and governmental agencies. We highlight a few must-read resources, including:
  - » Wells—What to Do After a Flood
  - » Disaster Guide for Retail Food Facilities
  - » Wildfire Response Guide

  Explore all these resources at www.neha.org/preparedness.

Membership Hits Record Number

We are delighted to announce that we surpassed 7,000 active members in September—the largest membership in our history! The more members we have, the louder our voice. Let's keep it going and spread the word about the value of membership.

Membership provides environmental health professionals with connection, education, and advancement in their careers. Our nationally recognized credentials, extensive learning opportunities, and community of dedicated leaders position our members for greater professional success. We believe that the success of our members elevates the entire environmental health profession.

We offer several membership options:

- **Professional:** Individuals active in the field of environmental health employed in government, uniformed services, academic, or industry sectors.
- **Emerging Professional:** Students or individuals within the first 5 years of their environmental health career, or individuals who are active-duty military.
- **Retired Professional:** Individuals retired from the field of environmental health.
- **International:** Environmental health professionals who reside outside of the U.S.
- **Life:** Life membership with no renewals and a one-time fee.

You can benefit from membership at any stage of your career—from student to retiree. You can also take advantage of these valuable benefits:

- **Community:** We offer an online platform called Community that allows our members to gather insight, ask questions, and build connections. Our Annual Educational Conference & Exhibition provides high-quality environmental health training, education, networking, and advancement. You can also learn and network through the webinars and training we offer.
- **Credibility:** Our credentials demonstrate a level of expertise and competence, based on education and experience, that is nationally recognized. Members receive discounts on exams and renewal fees. Members can download a customized certificate signifying a commitment to their career. Professional members have the opportunity to vote in our elections and hold leadership positions such as members of our board, technical advisors, and committee members. We also offer an online Job Board where members can post job announcements at no cost or at a reduced cost for organizations that employ our professional members.
- **Learning:** Our *Journal of Environmental Health* provides innovative and practical ideas to carry into the field and office. Our bimonthly newsletter highlights the most recent and relevant environmental health news and is delivered to members by e-mail 20 times a year. Members can also maintain and track their continuing education contact hours for free via our E-Learning.
- **Influence:** Our Government Affairs program is the liaison between environmental health professionals and government officials to gather and present the data needed to inform policymakers on the importance of a well-supported and well-funded workforce. We collaborate with members to raise the voice of the environmental health profession through policy and position statements. Members can also contribute their time and expertise to help develop resources on the topics that matter most to our members. We also offer a discount to professional members when they place advertisements on our platforms.

Learn more about the benefits of membership with us at www.neha.org/membership.

New Blogs From Government Affairs

One of the ways we keep you updated on our government affairs activities is through the blogs written by Government Affairs Director Doug Farquhar. As of press time, two new blogs were posted in October.

The first blog provides an update on 2023 state legislation regarding food safety. We provide a table of food safety topics and the number of bills introduced to state legislations in 2023. Retail food, food freedom, and food safety had the highest number of bills introduced. Overall, a total of 233 bills related to food safety legislation were introduced during the 2023 legislative sessions, with 63 bills enacted, adopted, or passed by state legislation that were sent to state governors for signing.

The second blog explores the story we have to tell related to how the work we do saves lives. From food safety and water safety to disease prevention, our profession has tackled seemingly impossible challenges to ensure the health and safety of our communi-

NEHA **NEWS**

ties. As Farquhar states at the end of the blog, "We have a story to tell—A positive story that every elected official, appointed board member, and public health leader in this country must hear."

Visit www.neha.org/government-affairs-blog to view all the blogs and get caught up on what we are doing to advocate for the environmental health profession.

Spark! Webinar Series

Spark! is an ongoing series of skill-building webinars just for our members. The webinars are provided in short 30-minute segments to fit into your busy schedules. Each webinar provides 0.5 continuing education contact hours toward maintaining your NEHA credential. These webinars are available only on our Community platform at https://community.neha.org/community.

Recordings of past Spark! webinars are available for members to watch any time:

- September 2023: Enhancing Environmental Public Health With Artificial Intelligence and Machine Learning—Part 2
- August 2023: Enhancing Environmental Public Health With Artificial Intelligence and Machine Learning—Part 1
- June 2023: Leveraging Social Media for Success
- May 2023: Effective Communication for the Environmental Health Professional
- March 2023: Caring Leadership
- February 2023: Thought Leadership
- January 2023: Conversational Leadership
- November 2022: Leadership Matters

Learn more about Spark! at www.neha.org/spark.

Support the Future of Environmental Health

We will be participating again in GivingTuesday on November 28 to raise money to replenish and expand our scholarship fund. The more support we receive, the more support we can give to environmental public health students to help them join the workforce.

Even a little can go a long way. A lot can be life-changing!

- $100 can cover the cost of a textbook.
- $200 can cover 1 month of student groceries.
- $1,000 covers the average cost of 1 month for student room and board.

Consider donating on November 28 to support the future of environmental health at www.neha.org/donate. And of course, donations are welcome any time.

NEHA Staff Profile

As part of tradition, we feature new staff members in the *Journal* around the time of their 1-year anniversary. These profiles give you an opportunity to get to know our staff better and to learn more about the great programs and activities going on in your association. This month we are pleased to introduce you to one staff member. Contact information for all our staff can be found on pages 48 and 49.

Amy Chang

I joined NEHA in November 2022 as a senior program analyst on the Program and Partnership Development team. I work on several different projects, including climate and health, emergency preparedness, and food safety. During this brief time, I have been fortunate enough to work in diverse and engaging experiences. These experiences range from learning and engaging with Alaska Natives about climate change impacts in Alaska to having hands-on environmental public health training in emergency environmental response in Alabama.

Before working at NEHA, I worked at the National Association of County and City Health Officials as the lead on food safety and climate and health projects for the environmental health team. Additionally, I have interned at the District of Columbia Department of Health on the communicable disease team, served as an epidemiologist and environmental health specialist at private consulting companies, and taught English in Japan. I received my undergraduate degree in environmental science from the University of Virginia and a master's degree in global health from George Mason University.

I currently reside in Irvine, California, with my partner and two children, but have spent most of my life in the mid-Atlantic region. While not working, I enjoy attending concerts, reading, watching movies, and exploring new activities and developing new skills with my children. My favorite things to do are going to the beach, pool, or a water park. Basically, anything with water! I am excited about working at NEHA and look forward to meeting and working with you all.

Did You Know?

Check out our new online store of NEHA-branded items at https://neha.checkoutstores.com. Show off your pride in your association and support students as a portion of the sales will go to the NEHA/AAS Scholarship Fund.

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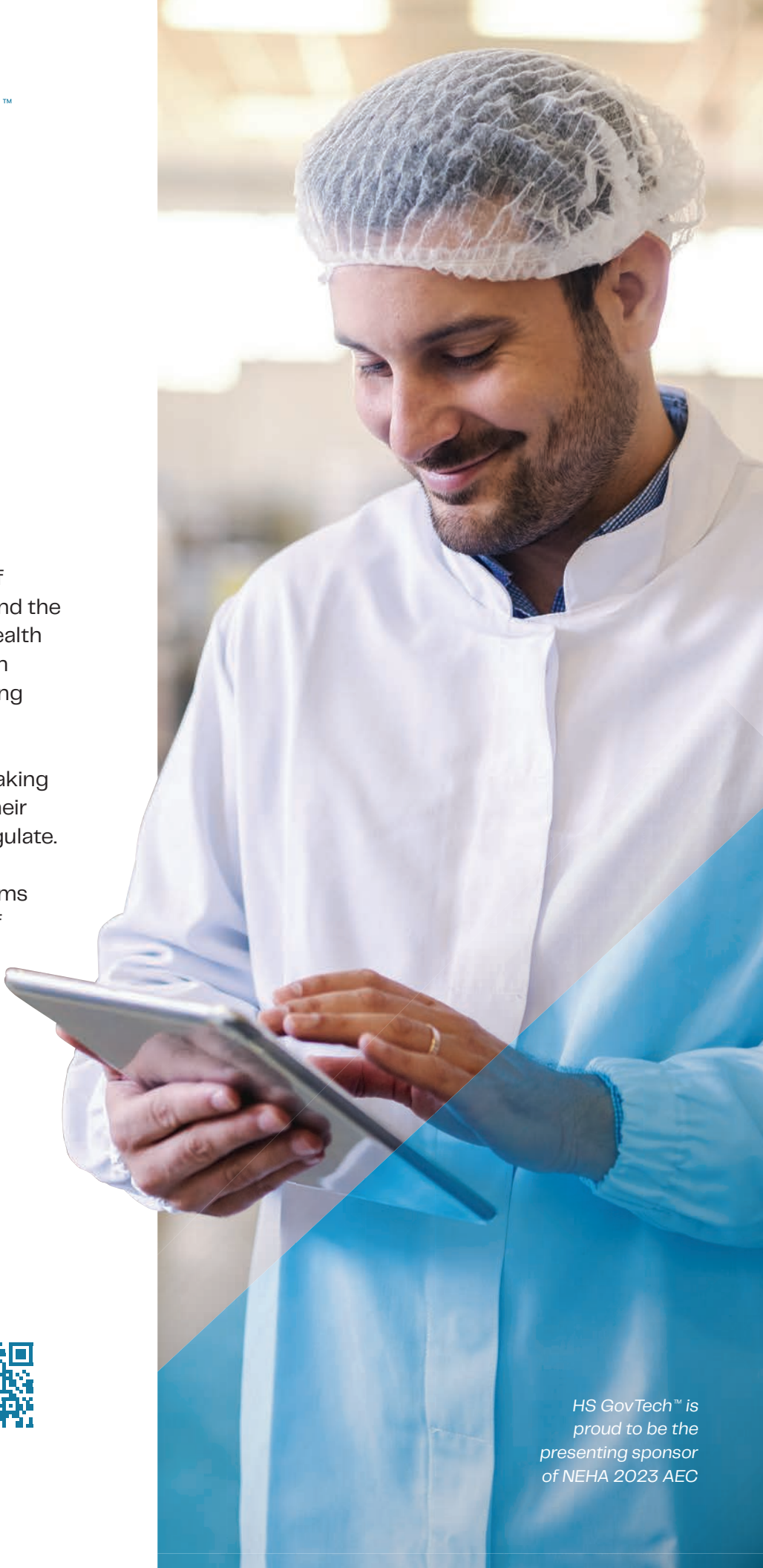

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