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FDA FOOD CODE ADOPTION

Exploring Variation Among State Regulatory Agencies

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ABOUT THE COVER

Frequent and timely state adoption of the Food and Drug Administration *Food Code* signals a commitment to the use of contemporary science-based interventions for the control of foodborne illness risk factors in retail food establishments. This month's cover article, "A Matter of Time: Exploring Variation in Food and Drug Administration *Food Code* Adoption Among State Retail Food Regulatory Agencies," examined the relationship between mode and frequency of adopting the most current edition of the *Food Code* over time among 64 state retail food regulatory agencies. By understanding the variables that affect *Food Code* adoption, more targeted efforts and resources can be leveraged to assist jurisdictions with maintaining up-to-date food safety controls within their retail food regulations.

See page 8.

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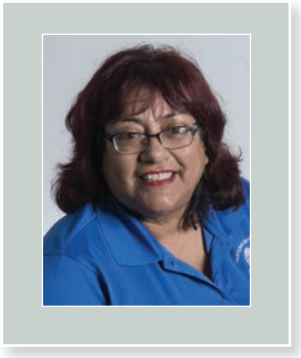

Sandra Long, REHS, RS

Adapting to Change in an Ever-Changing World

In general, most do not like change and resist it because it moves us into the unfamiliar. By definition, change is the act or instance of making or becoming different. We have all had to become different in our processes, interactions, and daily lives lately. I prefer to look at change from a positive perspective. Looking at the positive outcomes of change allows us to recognize the change and make it familiar. Did you know it actually takes more energy and time to resist change than it does to go along with or initiate change? Resisting change can be exhausting and mood altering.

Everyone is speaking of the new normal, but really, what is normal? Normal is the typical state, the status quo, or the expected. When we realize that change usually occurs in small subtle ways and over time, it then becomes our normal and what we consider normal is really evolving daily. The changes we have seen and been involved in have occurred rapidly, challenging us to adapt and accept the unfamiliar quickly. Did you ever see yourself using the phrase social distancing on a daily basis, much less trying to enforce that concept?

The status quo was disrupted in such a way that jurisdictions for the first time in many years (or in some cases for the first time) had to implement their emergency management plan (EMP) and their continuity of operations plan (COOP). This change in daily operations reshaped our standard operating procedures. The value in maintaining updated EMPs and COOPs has never been more obvious. The time and effort in keeping these plans updated has made us aware of the value of maintenance. I have always thought it was better to have a plan and not need it, rather than not have a plan and need it. So many have been working in emergency operations centers for longer than we ever expected. They are dealing with not only the changing face of the pandemic but also hurricanes, flooding, and other disasters, all the while adapting to change and performing these functions with professionalism and character.

> *I prefer to look at change from a positive perspective.*

Food service operations have adapted and changed. While food safety is always a priority for food service operations, the change in food service provided a more intense focus on food safety. In order to generate sales, some food establishments began assembling meal kits with raw ingredients to sell to customers, as well as transitioned to offering food through takeout, drive-thru, and delivery services. These new features from food establishments were unfamiliar territory. This situation provided an opportunity for food safety professionals and food service operations to partner to provide proper handling and preparation information to customers, thereby extending the reach of food safety education.

Environmental health programs have participated in educating the public on topics of disease transmission and prevention, which is not new to the profession but is now more visible and necessary. Disease testing criteria and protocol information have become more routine than ever before. Providing instructions on proper hand washing and emphasizing the overall importance and impact of hand washing to the public is again not new but necessary. These instances are changing the scope of daily activities and providing a platform for environmental health to emphasize a variety of topics ranging from basic hand washing to active managerial control. It is also changing how the public views environmental health and how we carry out our jobs, and overall, it is changing how we interact.

Interactions have become virtual due to the need to keep personnel safe. State and local health departments have become engaged in providing virtual inspections, education, and training, as well as meetings. While the technology to go virtual has been available, the change in circumstances has been the catalyst to move in this direction. Microsoft CEO Satya Nadella has commented that the pandemic has caused her company to experience "two years' worth of digital transformation in two months."

To everyone in all aspects and fields of environmental health—thank you! Since the beginning of the year, we have been challenged with new responsibilities, new ways to perform our duties, new working conditions, and new protocols that change frequently. The flexibility and dedication shown have been outstanding. Looking at our profession from a fresh perspective and realizing that we are adaptable and creative can shape the future of our profession.

Author Mary Anne Radmacher said, "Change, of any sort, requires courage." We, as environmental health professionals, possess that courage.

Sandra Long

President@neha.org

SUPPORT THE NEHA ENDOWMENT FOUNDATION

The NEHA Endowment Foundation was established to enable NEHA to do more for the environmental health profession than its annual budget might allow. Special projects and programs supported by the foundation will be carried out for the sole purpose of advancing the profession and its practitioners.

Individuals who have contributed to the foundation are listed below by club category. These listings are based on what people have actually donated to the foundation—not what they have pledged. Names will be published under the appropriate category for 1 year; additional contributions will move individuals to a different category in the following year(s). For each of the categories, there are a number of ways NEHA recognizes and thanks contributors to the foundation. If you are interested in contributing to the Endowment Foundation, please call NEHA at (303) 756-9090. You can also donate online at www.neha.org/about-neha/donate.

Thank you.

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A Matter of Time: Exploring Variation in Food and Drug Administration *Food Code* Adoption Among State Retail Food Regulatory Agencies

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Abstract **Frequent and timely state adoption of the Food and Drug Administration *Food Code* signals a commitment to the use of contemporary science-based interventions for the control of foodborne illness risk factors in retail food establishments. The regularity with which states adopt each new edition of the *Food Code*, however, remains unclear. This study examined the relationship between mode and frequency of adopting the most current edition of the *Food Code* over time among 64 state retail food regulatory agencies. Among agencies that adopted an edition of the *Food Code*, the amount of time until adoption was approximately 1.4 years for the 2013 Food Code (current), 3.5 years for the 2009 *Food Code* (recent), and 3.3 years for the 2005 *Food Code* (older). When considering adoption over time, approximately 23% of agencies tended to adopt a current edition (current adopters) of the *Food Code*, 41% of agencies tended to adopt recent editions (moderate adopters), and 36% of agencies tended to adopt older editions (late adopters). There was no significant difference, however, in the odds of an agency being a current, moderate, or late adopter, regardless of an agency's mode of adoption.**

Introduction

State legislatures and regulatory agencies in the U.S. have long adopted model codes into the construction and public safety regulations of their jurisdictions (Nelson, 2012; Wilking, Cradock, & Gortmaker, 2015). Adoption of model codes allows jurisdictions to stay consistent with consensus-based guidelines intended to safeguard public safety. Most of the more than 2,000 agencies responsible for regulating the retail food and food service establishments in the U.S. have based their retail food safety regulations on one of eight editions of the Food and Drug Administration (FDA) *Food Code*, which provides a uniform system of provisions that address the safety and protection of food offered in retail and food service establishments (FDA, 2019).

As a model code, the *Food Code* provides a technical and legal basis for regulating the retail segment of the food industry at all levels of government (Grossman, 2014). Adoption of the *Food Code* indicates consistency with national food regulatory policy and a commitment to the goal of preventing and reducing the incidence of foodborne illness in retail and food service establishments in the U.S. (Levitt, 2001). With a full edition issued every 4 years, the frequent and timely adoption of each new edition of the *Food Code* ensures retail food regulatory policy incorporates the most current food safety principles and science-based interventions (FDA, 2020a).

The influence of the *Food Code* on state retail food regulatory policy is a distinct example of vertical policy diffusion, a situation where national policy influences state-level program and policy adoptions (Gilardi, 2016; Lyson, 2016; Shipan & Volden, 2012; Starke, 2013). In certain cases of vertical policy diffusion, or influence, the federal government mandates state adoption of a national policy, which fosters uniform adoption (Allen, Pettus, & Haider-Markel, 2004). In other cases of vertical diffusion, the federal government promotes policy adoption but states have discretion over their decision to adopt the policy. This latter type of vertical influence can result in a number of differing policies at the state level intended to address the same issue (Lyson, 2016).

Currently, state and local regulators come together with industry, academia, consumers, and federal government stakeholders at the biennial Conference for Food Protection (CFP) to propose and deliberate recommendations to amend the *Food Code*. Based on the outcome of these deliberations, CFP submits

TABLE **1**

Mode of *Food Code* Adoption Among State Regulatory Agencies (*N* = 64)

Mode of Adoption	Agency # (%)
Adopt-by-reference	26 (40.62)
Section-by-section	38 (59.38)

recommended *Food Code* changes to FDA for evaluation and a decision on which changes to implement. The CFP process, therefore, perpetuates interdependence between federal and state regulators. FDA depends on the involvement of state regulators in stakeholder deliberations that influence the provisions of the *Food Code* and state regulators depend on FDA to ensure that the provisions of the *Food Code* are informed by science and in a form that can be easily adopted by state legislatures and regulatory agencies.

While *Food Code* adoption is encouraged, it is ultimately voluntary and at the discretion of state regulators. Since its inception in 1993, the *Food Code* was issued biennially through 2001. As of 2005, the full edition of the *Food Code* has been issued every 4 years. All 50 states and the District of Columbia have adopted an edition of the *Food Code* (FDA, 2019). Jurisdictions adopt the *Food Code* in various modes: in its entirety (termed adopt-by-reference or complete adoption) or in a section-by-section approach using specific *Food Code* provisions as the basis for drafting or amending their own regulations. As newer editions of the *Food Code* are released, jurisdictions periodically move toward adoption. The frequency with which jurisdictions adopt the most recently published edition (current) of the *Food Code* over time, however, has not been investigated. The purpose of this study was to investigate the relationship between mode of *Food Code* adoption and frequency of adopting a current edition of the *Food Code* over time.

FIGURE **1**

List of State Regulatory Agencies Examined (*N* = 64)

Alabama Department of Public Health (AL DPH)
Alaska Department of Environmental Conservation (AK DEC)
Arizona Department of Health Services (AZ DHS)
Arkansas Department of Health (AR DOH)
California Department of Public Health, Food and Drug Program (CA DPH)
Colorado Department of Health and Environment (CO DHE)
Connecticut Department of Consumer Protection (CT DCP)
Connecticut Department of Public Health (CT DPH)
Delaware Division of Public Health and Social Services (DE DPHSS)
District of Columbia Department of Health, Regulation and Licensing (DC DOH)
Florida Department of Agriculture (FL DOA)
Florida Department of Business and Professional Regulation (FL DBPR)
Florida Department of Health (FL DOH)
Georgia Department of Agriculture (GA DOA)
Georgia Department of Public Health (GA DPH)
Hawaii State Department of Health, Sanitation Branch (HI DOH)
Idaho Department of Health and Welfare (ID DHW)
Illinois Department of Public Health (IL DPH)
Indiana State Department of Health (IN DOH)
Iowa Department of Inspections and Appeals (IA DIA)
Kansas Department of Agriculture (KS DOA)
Kentucky Cabinet for Health and Family Service (KT CHFS)
Louisiana Department of Health and Hospitals (LA DHH)
Maine Department of Agriculture (ME DOA)
Maine Department of Human Services (ME DHS)
Maryland Department of Health and Mental Hygiene (MD DHMH)
Massachusetts Department of Public Health (MA DPH)
Michigan Department of Agriculture (MI DOA)
Minnesota Department of Agriculture (MN DOA)
Minnesota Department of Health (MN DOH)
Mississippi Department of Agriculture (MS DOA)
Mississippi Department of Health (MS DOH)
Missouri Department of Health and Senior Services (MO DHSS)
Montana Department of Health and Human Services (MT DHHS)
Nebraska Department of Agriculture (NE DOA)
Nevada Department of Health and Human Services (NV DHHS)
New Hampshire Department of Health and Human Services (NH DHHS)
New Jersey Department of Health and Senior Services (NJ DHSS)
New Mexico Environment Department (NM ED)
New York Department of Agriculture (NY DOA)
North Carolina Division of Public Health (NC DPH)
North Dakota Department of Health, Division of Food and Lodging (ND DOH)
Ohio Department of Agriculture (OH DOA)
Ohio Department of Health (OH DOH)
Oklahoma State Department of Health (OK DOH)
Oregon Department of Agriculture (OR DOA)
Oregon Health Authority (OR HA)
Pennsylvania Department of Agriculture (PA DOA)
Rhode Island Department of Health, Office of Food Protection (RI DOH)
South Carolina Department of Health and Environmental Control (SC DHEC)
South Dakota Department of Health (SD DOH)
Tennessee Department of Agriculture (TN DOA)
Tennessee Department of Health, Environmental Health Division (TN DOH)
Texas Department of State Health Services (TX DSHS)
Utah Department of Agriculture and Food (UT DAF)
Utah Department of Health (UT DOH)
Vermont Department of Health (VT DOH)
Virginia Department of Agriculture (VA DOA)
Virginia Department of Health (VA DOH)
Washington State Department of Health, Environmental Health (WA DOH)
West Virginia Department of Health and Human Resources (WI DHHR)
Wisconsin Department of Agriculture (WI DOA)
Wisconsin Department of Health Services (WI DHS)
Wyoming Department of Agriculture (WY DOA)

Methods

Sample and Mode of *Food Code* Adoption

The study sample included 64 retail food regulatory agencies from all 50 states and the District of Columbia**.** The retail food regulations for the 64 agencies available on July 1, 2017, were identified using Lexis Advance. Two independent researchers assessed the regulations for specific statements that the *Food Code* was adopted-by-reference. Adopting-by-reference involves adopting the code in its entirety with no or only slight modifications. If the agency was found to adopt-by-reference, the *Food Code* edition being adopted was recorded. For regulations that did not indicate the *Food Code* was adopted-by-reference, it

was recorded as adoption using a section-by-section approach. For these agencies, the 2016 FDA report on *Food Code* adoption was used to obtain the edition of the most recent code adopted (FDA, 2019).

Time Until Adoption

The *Food Code* editions investigated in this study were the 2005, 2009, and 2013 editions. We used the *Food Code* adoption data collected in 2008, 2012, 2013, 2014, 2015, and 2016 by the Association of Food and Drug Officials under contract with FDA to determine the year a *Food Code* was adopted. Time until *Food Code* adoption—the amount of time taken to adopt a specific edition of the *Food Code*—was computed for each agency that adopted a given edition of the *Food Code* using the year of adoption or data collection year minus the year the edition was available for adoption. For the purpose of this study, the year available for adoption was set to the beginning of the year following the initial release year. This designation was due to variations in the exact month within the initial release year each full edition was published. For example, the 2005 *Food Code* had an initial release year of 2005; therefore, the year the edition was available for adoption was designated as 2006. As such, if the 2005 *Food Code* was available for adoption in 2006, an agency that adopted this edition in 2016 would have a time until adoption value of 10 years.

Duration Since Adoption of the Most Recent Edition of the *Food Code*

Duration since adoption of the most recent edition (DRE) was indicated by a designation of short (S), medium (M), or long (L) for each of 6 years (2008, 2012, 2013, 2014, 2015, and 2016), taking into consideration the 4-year period between the release of the 2005, 2009, and 2013 *Food Code*, respectively. For the specific years investigated, a designation of short was given if the edition of the *Food Code* adopted was always ≤4 years from the most recently published edition of the *Food Code* (current edition). A designation of medium was given if the most recent edition of the *Food Code* adopted was always >4 years but ≤8 years (recent edition) from the publication of the current edition. A designation of long was given if the most recent edition of the *Food Code* adopted was always >8 years (older edition) from the publication of the current edition.

Given each agency DRE designation for the specific years investigated, we calculated an overall DRE frequency by dividing the proportion of agencies of a particular DRE designation (short, medium, or long) for a specific year by the total proportion (count) of agencies of all designations (short, medium, and long) in the same year multiplied by 100. For example, the overall frequency (%) of short DRE was the proportion (count) of agencies with a short DRE in a given year divided by the total proportion (count) of agencies of all DRE designations (short, medium, and long) in the same year multiplied by 100.

Type of *Food Code* Adopter

The type of *Food Code* adopter, describing how up-to-date with the most recent edition of the *Food Code* an agency tends to be over time, was determined by rating the combination of DRE designations across 3 years (2008, 2013, and 2016). These 3 years were selected because they are the years (within the available data for the 6 years studied) that, at year end, a new edition of the *Food Code* became available. Designating the year available for

FIGURE **2**

State Regulatory Agency Adoption Frequency by *Food Code* Edition (*N* = 64)

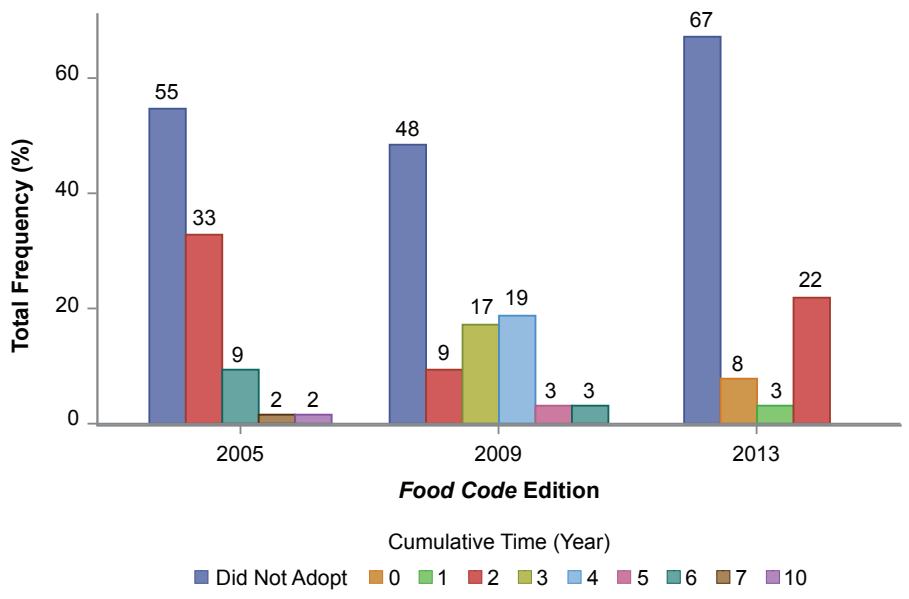


TABLE **2**

Average Adoption Time of *Food Code* Editions Among State Regulatory Agencies Between 2005 and 2016

Edition	# of Agencies	Adoption Time (Years)		95% Confidence Interval (*CI*)
		Mean	Median	
2005 *Food Code*	29	3.28	2.00	2.43, 4.12
2009 *Food Code*	33	3.48	3.00	3.11, 3.86
2013 *Food Code*	21	1.43	2.00	1.03, 1.82

TABLE **3**

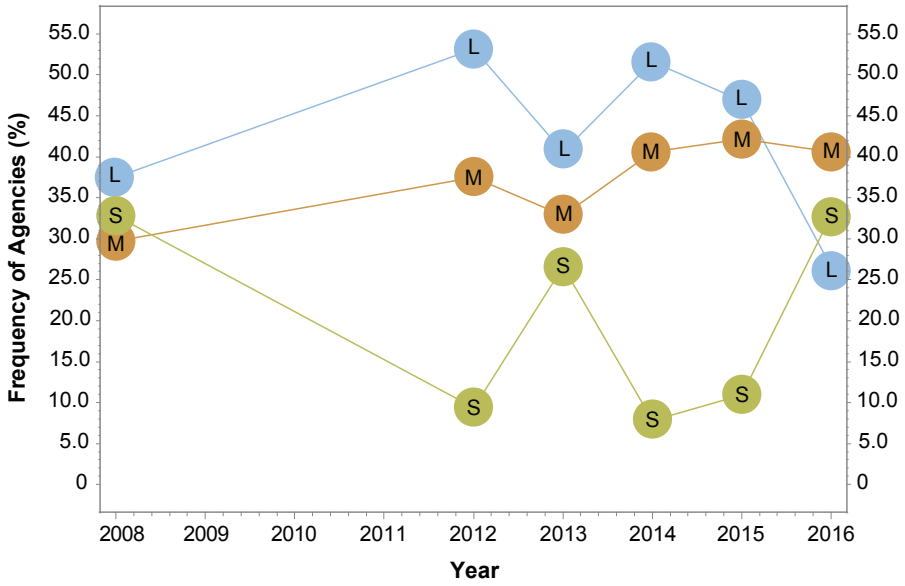
Cumulative Years Until Adoption of *Food Code* Editions by State Regulatory Agencies Between 2005 and 2016

Edition	Cumulative Years	Agency Abbreviation*
2005 *Food Code*	2	AL DPH, CT DCP, GA DPH, IL DPH, IA DIA, KS DOA, MD DHMH, MI DOA, MS DOA, MS DOH, NE DOA, ND DOH, OH DOA, OH DOH, RI DOH, UT DAF, UT DOH, VA DOH, WV DHHR, WI DOA, WY DOA
	6	AR DOH, CA DPH, NY DOA, PA DOA, VA DOA, WI DHS
	7–10	KY CHFS, NJ DHSS
2009 *Food Code*	2	DE DPHSS, MS DOH, NH DHHS, NC DPH, OK DOH, TN DOA
	3	AR DOH, CO DHE, FL DBPR, MI DOA, NE DOA, ND DOH, OH DOH, OR HA, VT DOH, WA DOH, WY DOA
	4	DC DOH, IA DIA, KS DOA, ME DHS, MO DHSS, NV DHHS, OH DOA, OR DOA, TN DOH, UT DAF, WI DOA, WI DHS
	5–6	FL DOA, HI DOH, ME DOA, MD DHMH
2013 *Food Code*	0	DE DPHSS, MS DOH, MT DHHS, PA DOA, SC DHEC
	1	NM ED, TX DSHS
	2	AL DPH, CT DCP, GA DOA, GA DOH, ID DHW, IL DPH, MS DOA, MO DHSS, NV DHHS, OK DOH, UT DAF, UT DOH, VA DOA, VA DOH

*See Figure 1 for a list of full agency names and corresponding abbreviations.

FIGURE **3**

Frequency of a Short Versus Medium or Long Duration Since Adoption of the Most Recent Edition (DRE) Among State Regulatory Agencies Between 2008 and 2016 (*N* = 64)



S = short; M = medium; L = long.

adoption in the year following issue of a *Food Code* allows for consistency across the years studied. For example, the 2005 *Food Code* transitioned to the 2009 edition in 2010, the 2009 *Food Code* transitioned to the 2013 *Food Code* in 2014, and the 2013 *Food Code* transitioned to the 2017 edition in 2018. A current adopter (1) was an agency with a DRE designation of short two or more times across the three time periods. A moderate adopter (2) was an agency with a DRE designation of medium two or more times, or one short, one medium, and one long, across the three time periods. A late adopter (3) was an agency with a DRE designation of long two or more times across the three time periods. We calculated the percentage of each type of adopter by dividing the proportion of agencies of a particular adopter rating (1, 2, or 3) in a given year by the total proportion (count) of agencies in each rating category (1, 2, and 3) in the same year multiplied by 100.

Statistical Analysis

A one-way analysis of variance (ANOVA), Pearson chi-square, Cochran–Mantel–Haenszel test, and ordered logistic regression modeling were performed using SAS version 9.4 to test for differences in and between study variables and to determine associations between mode of adoption, DRE designation, and type of *Food Code* adopters. Tests of statistical significance were set at $p \leq .05$. In addition, given the mode of adoption, the odds (likelihood) of a DRE designation or type of *Food Code* adopter designation was compared.

Results

The mode of adoption is presented in Table 1. Of the 64 regulatory agencies studied (Figure 1), 40.62% (26) adopted the *Food Code* by reference while 59.38% (38) did not ($\chi^2 > 0.05$). Of those found to adopt-by-reference, 23 referenced a specific edition of the *Food Code* while three were found to adopt open-ended, meaning the agency adopts each new edition of the *Food Code* by reference automatically as it is released. These three agencies were the Georgia Department of Agriculture, Mississippi Department of Health, and Pennsylvania Department of Agriculture.

Not all agencies adopted each of the three editions of the *Food Code* when available as newer versions during the period of 2005–2016 (Figure 2). Among the regulatory agen-

cies studied (N = 64), approximately 55% (35), 48% (31), and 67% (43) did not adopt the 2005, 2009, and 2013 *Food Codes*, respectively, when released as newer versions (Figure 2). The time until adoption of the 2013 *Food Code* ranged from 0–2 years, the 2009 *Food Code* from 2–6 years, and the 2005 *Food Code* from 2–10 years (Figure 2).

For agencies that did adopt an edition of the *Food Code*, the average time until adoption was approximately 1.4 years for the 2013 *Food Code*, 3.5 years for the 2009 *Food Code*, and 3.3 years for the 2005 *Food Code* (Table 2). The cumulative time (years) for each agency to adopt the given edition of the *Food Code* between 2005 and 2016 is shown in Table 3. Among the agencies that adopted, the cumulative time until adoption decreased over time. Agencies that never adopted the 2005, 2009, or 2013 edition of the *Food Code* were not included in Table 3. These agencies were the Arizona Department of Health Services, Connecticut Department of Public Health, Florida Department of Health, Indiana State Department of Health, Louisiana Department of Health and Hospitals, Massachusetts Department of Public Health, Minnesota Department of Agriculture, Minnesota Department of Health, and South Dakota Department of Health.

Figure 3 shows the frequency (percentage) of the DRE designations (short, medium, and long) among the agencies (N = 64) in the 6 years studied. Compared with 2008, the percentage of a short DRE designation (current edition of the *Food Code*) was lower in 2012 (9.38%), 2013 (26.56%), 2014 (7.81%), and 2015 (10.94%), and was approximately the same in 2016 (32.81%) (Figure 3). The agencies were less likely to base their food safety regulations on a current (short) compared with recent (medium) or older (long) edition of the *Food Code* in 3 out of the 6 years studied (Table 4). Between the agencies, the odds of adopting a current edition were significantly lower in 2012, 2014, and 2015 compared with 2008 (Table 4). There was no difference, however, in the odds of adopting a current, recent, or older edition in 2013 and 2016 compared with 2008 (Table 4). Regarding the overall adoption rating, 15 agencies (23.44%) were assigned a designation of current adopter, 26 (40.63%) moderate adopter, and 23 (35.94%) late adopter (Table 5).

TABLE **4**

State Regulatory Agency Odds of Adoption of Short Versus Medium or Long Duration Since Adoption of the Most Recent Edition (DRE) of the *Food Code*, 2012–2016*

DRE Designation by Year	Odds Ratio (*OR*)	95% Confidence Interval (*CI*)	*p*-Value
Short versus long (2012)	0.20	0.07, 0.58	.00
Short versus medium (2012)	0.23	0.08, 0.67	.01
Short versus long (2013)	0.75	0.32, 1.74	.50
Short versus medium (2013)	0.73	0.30, 1.79	.49
Short versus long (2014)	0.17	0.06, 0.53	.00
Short versus medium (2014)	0.17	0.06, 0.55	.00
Short versus long (2015)	0.27	0.10, 0.73	.01
Short versus medium (2015)	0.24	0.08, 0.66	.01
Short versus long (2016)	1.41	0.59, 3.36	.44
Short versus medium (2016)	0.73	0.31, 1.70	.47

Short = current; medium = recent; long = older.
*Year of comparison is 2008.

TABLE **5**

State Regulatory Agency *Food Code* Adopter Rating (N = 64)

Adopter	# (%)	Agency Abbreviation*
Current (1)	15 (23.44)	AL DPH, DE DPHSS, GA DPH, IL DPH, MI DOA, MS DOA, MS DOH, NE DOA, ND DOH, OH DOH, OK DOH, UT DAF, UT DOH, VA DOH, WY DOA
Moderate (2)	26 (40.63)	AK DEC, AR DOH, CA DPH, CO DHE, FL DOA, FL DBPR, GA DOA, ID DHW, IA DIA, KS DOA, MD DHMH, NH DHHS, NY DOA, NC DPH, OH DOA, OR HA, PA DOA, RI DOH, TN DOA, TX DSHS, VT DOH, VA DOA, WA DOH, WV DHHR, WI DOA, WI DHS
Late (3)	23 (35.94)	AZ DHS, CT DCP, CT DPH, DC DOH, FL DOH, HI DOH, IN DOH, KY CHFS, LA DHH, ME DOA, ME DHS, MA DPH, MN DOA, MN DOH, MO DHSS, MT DHHS, NV DHHS, NJ DHSS, NM ED, OR DOA, SC DHEC, SD DOH, TN DOH

*See Figure 1 for a list of full agency names and corresponding abbreviations.

Mode of Adoption and DRE Designations

The general association between the mode of adoption and DRE designations (short versus medium or long) was significant (Table 6). Agencies that adopt-by-reference (n = 156) had a higher probability of adopting a short DRE (current edition) (25.64% versus 16.23%; χ^2 = 8.30; p < .05) than agencies that adopt section-by-section (Table 6). Between the DRE designations, it appears that those agencies that adopt-by-reference had a higher probability of a medium DRE (recent edition) (39.74%) than short DRE (current edition) (25.64%) or long DRE (older edition) (34.64%). Conversely, those agencies that adopted section-by-section had a higher probability of a long DRE (older edition) (48.25%) than a short (current edition) (16.23%) or medium (recent edition) DRE (35.53%) (Table 6).

The logistic regression model showed significant association between mode of adoption and odds of the DRE designations (Table

TABLE **6**

State Regulatory Agency Mode of Adoption and Probability of a Short Versus Medium or Long Duration Since Adoption of the Most Recent Edition (DRE) of the *Food Code* During Study Period (*N* = 384)

Mode of Adoption	DRE Designation # (%)				Cochran–Mantel–Haenszel Statistics		
	Short	Medium	Long	Total	*df*	Value (χ^2)	Probability
Adopt-by-reference	40 (25.64)	62 (39.74)	54 (34.62)	156 (100)	2	8.30	0.01
Section-by-section	37 (16.23)	81 (35.53)	110 (48.25)	228 (100)			

Short = current; medium = recent; long = older.

TABLE **7**

State Regulatory Agency Odds of a Short Versus Medium or Long Duration Since Adoption of the Most Recent Edition (DRE) by Adopt-by-Reference in 2016* (*N* = 384)

DRE Designation by Adopt-by-Reference	Odds Ratio (*OR*)	95% Confidence Interval (*CI*)	*p*-Value
Short versus long	4.36	1.67, 11.42	.00
Medium versus long	4.83	2.10, 11.09	.00
Short versus medium	0.90	0.30, 2.69	.86
Short versus long (at year = 2016)	8.63	1.72, 43.36	.01
Medium versus long (at year = 2016)	6.19	1.33, 28.81	.02
Short versus medium (at year = 2016)	1.40	0.31, 6.23	.66

Short = current; medium = recent; long = older.
*Year of comparison is 2008.

TABLE **8**

State Regulatory Agency Odds of Being Rated a Current (Versus Late or Moderate) *Food Code* Adopter by Adopt-by-Reference During Study Period (*N* = 64)

Food Code Adopter	Odds Ratio (*OR*)	95% Confidence Interval (*CI*)	*p*-Value
Current versus late	3.32	0.82, 13.48	.09
Moderate versus late	2.75	0.78, 9.68	.12
Current versus moderate	1.21	0.32, 4.54	.78

7). Agencies that adopt-by-reference were more likely to be adopting a short DRE over long DRE (short DRE: odds ratio [*OR*] = 4.36, 95% confidence interval [*CI*] [1.67, 11.42], *p* = .00); however, the odds of adopting short DRE were the same as medium DRE (short DRE: *OR* = 0.90, 95% *CI* [0.30, 2.69], *p* = .86). In the stratified analysis by year, in 2016 compared with 2008, among agencies that adopt-by-reference, we observed a similar pattern for short DRE over long DRE (short DRE: *OR* = 8.63, 95% *CI* [1.72, 43.36], *p* = .01); the odds of short DRE over medium was also the same (short DRE: *OR* = 1.40, 95% *CI* [0.31, 6.23], *p* = .66) (Table 7).

Modes of Adoption and *Food Code* Adopter

The logistic regression model showed no significant difference in the odds of being a current, moderate, or late adopter, regardless of an agency's mode of adoption (current adopter: *OR* = 3.32, 95% *CI* [0.82, 13.48], *p* = .09) or (current adopter: *OR* = 1.21, 95% *CI* [0.32, 4.54], *p* = .78) (Table 8).

Discussion

More than 3,000 state, local, tribal, and territorial regulatory agencies have primary responsibility to regulate the more than 1 million food establishments in the U.S. (FDA, 2020b; Grossman, 2014). Frequent and timely adoption of the most recent edition of the *Food Code* by regulatory agencies signals a commitment to the use of current science-based interventions for the control of foodborne illness risk factors in retail and food service establishments (U.S. Department of Health and Human Services, 2013). The results of this study suggest a need for more frequent and timely adoption of each new edition of the *Food Code*. For agencies that adopted the 2005, 2009, or 2013 edition of the *Food Code* within the 4-year period of that edition's release, the average amount of time until adoption was approximately three years. This finding suggests timely adoption of the *Food Code* among those agencies that adopt an edition within the 4-year period of

the edition's release. Furthermore, this finding must be viewed in light of the results that show many agencies never adopted the 2005, 2009, or 2013 edition of the *Food Code* within the 4-year period of the edition's release. Failing to stay up-to-date with current editions of the *Food Code* can impede the implementation of up-to-date food safety interventions at retail and food service establishments, as well as impact regulatory agency eligibility for federal training, grants, cooperative agreements, and other federal resources (FDA, 2020a).

In general, agencies that adopt-by-reference adopted current (≤4 years from most recently published edition of the *Food Code*) and recent editions (>4 years but ≤8 years from the publication of the current edition) of the *Food Code* while those that adopt section-by-section adopted older editions (>8 years from the publication of the current edition). Regardless of an agency's mode of adoption, however, there was no difference in an agency being rated a current, moderate, or late adopter. While it was expected that less than one half of the agencies studied would adopt-by-reference, it was unexpected that only 3 of the 26 agencies (11.54%) found to adopt-by-reference did so in an open-ended manner and adopted each new edition of the *Food Code* by reference automatically as it was released.

The majority of agencies found to adopt-by-reference referenced a specific edition of the *Food Code* and were more likely to adopt a current or recent edition of the *Food Code* as compared with agencies that adopt section-by-section. This finding suggests that agencies that adopt-by-reference have consistently kept their retail food regulations up-to-date with the current or recent edition of the *Food Code*. Identifying a specific edition being incorporated by reference adds specificity; however, Bremer (2013) notes that such specificity also creates challenges for agencies to keep their regulations current with revisions made to "reflect evolving technical knowledge." Continued efforts are needed to move agencies that adopt section-by-section to adopt recent or current codes. Likewise, efforts should be made to support agencies that adopt-by-reference to improve timely adoption of current editions of the *Food Code*.

Limitations to this study include lack of a specific date within a given publication year that a new edition of the *Food Code* is made available, as well as a lack of data for years 2009, 2010, or 2011. These limitations potentially reduced the power of the model to detect significant trends in *Food Code* adoption in 2016 compared with 2008. Due to the repeated observations in this study design, however, this longitudinal study provides explanatory advantages over a cross-sectional design.

Conclusion

This study found a significant relationship between mode of *Food Code* adoption and frequency of *Food Code* adoption over time. In general, agencies that adopt-by-reference adopted current and recent editions, while agencies that adopt section-by-section adopted older editions. A possible explanation for variations in timely adoption by agencies given their modes of adoption might be due to differences that exist in the rules, procedures, authority, and legislative cycles within jurisdictions, as well as state legislative professionalism, dominant norms, and values (Dilger, Krause, & Moffett, 1995; Squire, 2007). Therefore, future studies should explore the impact of legislative professionalism on the relationships between mode of adoption and adoption frequency. Future studies should incorporate a more robust sampling design, taking into account the difference between year of adoption and effective date, and consider potential changes in mode of adoption within the study period. Perhaps, when considered together, these factors could provide further insight into the similarities and differences in state agency adoption frequency. By understanding the variables that affect *Food Code* adoption, more targeted efforts and resources can be leveraged to assist jurisdictions with maintaining up-to-date food safety controls within their retail food regulations.

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Did You Know?

September is National Food Safety Month. NEHA is currently planning multiple activities and resources to support the observance and highlight the importance of food safety, including webinars, blog posts, and more. Please stay tuned at www.neha.org for more information.

Natural Disaster Emergency Response to Private Well User Needs: Evaluation of a Pilot Outreach Approach

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Abstract **After a flood, private well users are recommended to disinfect their well to eliminate potential microbial contamination but research gaps exist on user implementation of recommended procedures. This study evaluated a distance education class on well disinfection after severe flooding that was piloted by the Texas A&M AgriLife Extension Service. Participants submitted a well water sample for microbial analysis and completed pre- and post-class surveys. Water samples tested positive for total coliforms among 33% of well users with an income >$85,000, 85.7% with an income between $45,000 and $85,000, and 75% with an income <$45,000. Comparing participant responses on pre- and post-class surveys indicated 88% of participants improved knowledge of disinfection procedures and 46% improved well disinfection technical knowledge; however, 59% of participants who did not learn the technical steps reported increased confidence in independent well disinfection post-class. Online tools such as chlorine dose calculators could improve disinfection outcomes for those with a limited understanding of technical concepts. Evaluation of this education program provides a preliminary understanding of educational needs and highlights the potential value of distance education classes to facilitate well disinfection after natural disasters.**

Introduction

The drinking water quality of private wells is not included in the protections of the Safe Drinking Water Act, thereby leaving well users solely responsible for their water safety (Tiemann, 2017). Well stewardship comprises voluntary activities that involve water testing, treatment, and maintenance, and is generally minimal across the U.S. under both routine and emergency conditions (Gilliland et al., 2020; Malecki, Schultz, Severtson, Anderson, & VanDerslice, 2017; Pieper, Krometis, Gallagher, Benham, & Edwards, 2015; Ridpath et al., 2016). As a result, illnesses related to well water contamination have been observed (Auld, MacIver, & Klaassen, 2004; Craun et al., 2010; Wallender, Ailes, Yoder, Roberts, & Brunkard, 2014).

Microbial contamination can be introduced to private wells during flooding events, resulting in unsafe drinking water (Dai et al., 2019; Eccles, Checkley, Sjogren, Barkema, & Bertazzon, 2017; Van Biersel, Carlson, & Milner, 2007). With predicted increases in flooding risk and resulting contamination, it is imperative well users take actions to ensure their well water safety, especially in circumstances where access to recovery resources and/or well water services could be limited (Kohn et al., 2012; National Groundwater Association, 2019; Pieper et al., 2020). Knowledge of maintenance and treatment protocols is recognized as a precursor to stewardship actions (Kreutzwiser et al., 2011). A lack of information and resources has been reported to inhibit well user recovery actions postflood (Gilliland et al., 2020), but well water education has been found to motivate well users to test and conduct well maintenance (Bauder, 1993; Renaud, Gagnon, Michaud, & Boivin, 2011).

Well disinfection (also known as shock chlorination) is a commonly promoted well water recovery strategy for eliminating water microbial contamination (Pieper et al., 2020; U.S. Environmental Protection Agency [U.S. EPA], 2019). In brief, well disinfection includes the delivery of chlorine disinfectant into wells to inactivate pathogens that can cause illness upon consumption or exposure (U.S. EPA, 2019). This process usually

TABLE **1**

Household Sociodemographics of Study Participants

Demographic Variable	# (%)
Household race (n = 46)	
White	42 (91.3)
Two or more races	4 (8.7)
Ethnicity (n = 46)	
Non-Hispanic or Latino	40 (87.0)
Hispanic or Latino	6 (13.0)
Household highest educational attainment (n = 45)	
<Bachelor's degree	15 (33.3)
≥Bachelor's degree	29 (64.4)
Prefer not to answer	1 (2.2)
Household income (n = 45)	
<$45,000	12 (26.7)
$45,000–$85,000	14 (31.1)
>$85,000	6 (13.3)
Prefer not to answer	13 (28.9)
Recruitment mode (n = 61)	
Neighbors or family	16 (26.2)
Radio or newspaper articles	15 (24.6)
Social media (Twitter, Facebook) or e-mail	10 (16.4)
Texas A&M AgriLife Extension Service (staff or website)	9 (14.8)
Federal Emergency Management Agency	3 (4.9)
Two sources	8 (13.1)
Neighbors or family and social media	3 (4.9)
AgriLife Extension and media	2 (3.3)
AgriLife Extension and people	1 (1.6)
AgriLife Extension and social media	1 (1.6)
Neighbors or family and media	1 (1.6)

requires user knowledge of well system characteristics, including well depth and diameter, static water level, and wellhead location. The essential technical knowledge required for well disinfection includes chlorine dose calculations and pH adjustments to ensure functional disinfection. Prior research has evaluated the effectiveness of well disinfection (Eykelbosh, 2013; Pieper et al., 2020), but research gaps exist on how well users implement published guidelines.

The aim of this study was to evaluate the impact of a pilot disinfection class on well user knowledge on where to access resources, knowledge and application of disinfection protocols in a classroom setting, and reported self-confidence of independently conducting well disinfection.

Methods

In response to extreme flooding in October 2018, the Texas Well Owner Network (TWON), part of the Texas A&M AgriLife Extension Service, coordinated a low-cost ($10) well water microbial screening event. This event was offered on November 5 and 6, 2018, at four AgriLife Extension county offices in flood-impacted, rural counties: Burnet, Llano, Mason, and San Saba. The event was promoted through the TWON and Texas Water Resource Institutes networks (e.g., websites, e-mail listservs, social media accounts) and through news media outlets (e.g., newspapers, television, and radio). Participants independently collected well water samples from a faucet as close to the well as possible after 2 min of flushing, and then brought samples to the local extension office. Samples were processed within 30 hr of collection and the presence of total coliforms and *E. coli* were detected using the IDEXX Colilert method.

Well Disinfection Class Description and Setting

On November 8, 2018, screening results were returned at a 1.5-hr class on well disinfection presented using a Web-conferencing platform at the AgriLife Extension county offices. This class was held approximately 19 days after flooding subsided (Lower Colorado River Authority, 2020) and 3 days after water sample screening. The class covered how to access well characteristics, flood-related microbial contaminants, and disinfection procedures. In addition, a variety of handouts were available for participants during the class. Personnel at each office were present to distribute sample results prior to the class, oversee and collect pre- and post-class surveys, and provide handouts after the class. In addition, staff assisted in answering attendee questions throughout the class.

Survey Design and Measures

Pre- and post-class surveys were given to all class participants to evaluate the class in improving knowledge of well disinfection. Evaluated areas included knowledge of where to access well maintenance resources, disinfection procedures, and perspectives on well disinfection. Survey information was also used to identify education needs and class structure preferences, as well as sociodemographic information. The surveys were developed in response to the flooding event and were not evaluated for validity and/or reliability prior to dissemination. The pre-survey was distributed after participants received their water screening results and before the presentation. The post-survey was distributed following the presentation. This work was conducted under Louisiana State University Health Sciences Center Institutional Review Board approval (IRB 9549).

TABLE **2**

Differences in Microbial Detection and Participant Information Needs by Annual Household Income

Variable	Annual Household Income			*p*-Value*
	<$45,000	$45,000–$85,000	>$85,000	
	# (%)	# (%)	# (%)	
Microbial detection	12	14	6	
Total coliforms detected	9 (75.0)	12 (85.7)	2 (33.3)	**.01**
E. coli detected	3 (25.0)	2 (14.3)	0 (0)	.1
Reported information needs	11	13	6	
Information about what to test well water for	6 (54.5)	5 (38.5)	4 (66.7)	.06
Well testing laboratories and contact information	3 (27.3)	5 (38.5)	2 (33.3)	.11
How to identify well issues after flood/disaster	3 (27.3)	5 (38.5)	1 (16.7)	.09
Information about well design and susceptibility	2 (18.2)	1 (7.7)	1 (16.7)	.16
Well maintenance providers and contact information	1 (9.1)	2 (15.4)	3 (50.0)	**.03**
Where to find information about your specific well (e.g., well depth, year of construction, etc.)	2 (18.2)	3 (23.1)	3 (50.0)	.05
How to disinfect well water	8 (72.7)	6 (46.2)	5 (83.3)	**.03**
How to prepare well before flood/other disaster	3 (27.3)	5 (38.5)	0 (0)	**.04**
Water treatment options	5 (45.5)	5 (38.5)	4 (66.7)	.06
Information about general well maintenance	6 (54.5)	8 (61.5)	3 (50.0)	.1

*Fisher's exact test. Bolded *p*-values indicate a statistically significant difference.

Statistical Analysis

Descriptive statistics were used to analyze measures collected from the pre- and post-class surveys. Wilcoxon sign-rank tests and McNemar's tests (exact McNemar's for small sample sizes) were used to evaluate class impacts on assessed outcomes. Chi-square tests of independence and Fisher's exact tests were used to identify associations between outcomes and sociodemographics. Significance level was defined as $\alpha < .05$. All statistical analyses were conducted using SAS version 9.4.

Results

A total of 138 participants attended the education class at the four county locations and 62 participants filled out at least one survey (44.9% response rate). Both a pre- and post-class survey were completed by 52 participants (37.7%). Survey question-specific response rates ranged from 62.3–98.4%, with only 14.8% of participants completing the free response question regarding suggestions for class improvement.

Sociodemographics and Study Recruitment

Class participants (n = 46) mainly self-reported as White (91.3%), with 13.0% identifying as Hispanic or Latino (Table 1). The majority of participants (n = 45) reported holding a bachelor's degree or higher (64.4%) and one third reported making an income between $45,000 and $85,000 (31.1%). Two participants reported a primary household language other than English.

Study participants (n = 61) reported learning about the education class through multiple outlets: 26.2% reported hearing from neighbors or family, 24.6% from radio or newspaper, 16.4% from Internet sources (e.g., Twitter, Facebook, or e-mail), 14.8% from the Texas A&M AgriLife Extension via its staff or website, and 4.9% from the Federal Emergency Management Agency. Almost one fifth (13.1%) of participants learned of the class through two or more sources, most commonly from neighbors or family and Internet sources (4.9%).

Water Sample Microbial Detection

Overall, 78.3% of wells (n = 60) tested positive for total coliforms and 18.3% were positive for *E. coli*. Water samples from well users who reported an income >$85,000 ($n$ = 6) were significantly less likely to test positive for total coliforms (33.3%), as compared with those with an income <$45,000 ($n$ = 12, 75.0%) or between $45,000 and $85,000 ($n$ = 14, 85.7%); p = .01; Table 2).

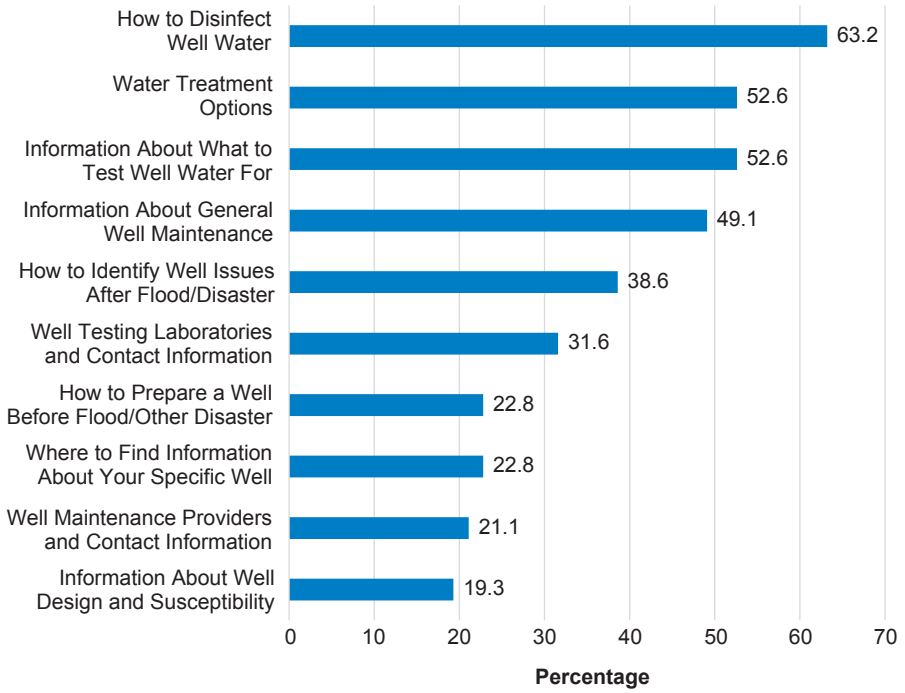
Class Content Preferences

Participants (n = 57) reported on topics they preferred to learn from the class. Most participants preferred to learn independent well disinfection (63.2%), what to test well water for (52.6%), water treatment options (52.6%), and general well maintenance information (49.1%) from the class (Figure 1).

Those with an income between $45,000 and $85,000 ($n$ = 13, 46.2%) were significantly less likely to report independent well disinfection as a class content preference compared with those who had an income <$45,000 ($n$ = 12, 72.7%)

FIGURE **1**

Class Content Preferences of Class Participants (*n* = 57)



or >$85,000 ($n$ = 6, 83.3%; p = .03; Table 2). Of the six participants who preferred to learn information on well maintenance providers, three reported an annual household income >$85,000 and one reported an annual household income <$45,000. Information requests on recommended well water tests and well treatment options were uniform across income brackets (p = .06 and p = .06, respectively).

Impact of the Class on Ability to Locate Resources

Before the class, 44.9% of participants (n = 49) perceived well recovery information and resources to have been available after the flood. Self-assessed participant (n = 53 for all but testing where n = 52) ability to locate well stewardship resources was limited: 32.1% of participants knew how to locate information on well system characteristics, while similar knowledge was reported by 26.4% about well treatment systems, 38.5% for well water testing, and 32.1% for disinfection procedures (Table 3). Reported knowledge of locating well water treatment and testing resources was observed to be higher post-class (92.0%; n = 51).

Impact of the Class on Well Disinfection Knowledge

Class attendees were asked two test questions on class content both pre- and post-class to evaluate knowledge gained.

Disinfection Protocols With Well Damage

Participants (n = 43) were asked, "Should you try to shock chlorinate your well system if you see damage to the well such as cracks or openings to the environment?" Prior to the class, 23.3% of participants correctly answered the question, 74.4% of participants marked "don't know," and one participant marked an incorrect answer (Table 4). The class presentation specified that well damage (e.g., cracks or corrosion in the well casing) should be fixed prior to disinfection.

After the class, 88.4% of the participants (n = 43) answered the question correctly, 7.0% reported "don't know," and 4.7% answered incorrectly (Table 4). Those who reported an incorrect answer or "don't know" response on the pre-class survey (n = 33) were significantly more likely to answer the question correctly after the class (12.1% incorrect versus 87.9% correct; p < .0001). Of those who marked "don't know" prior to the class (n = 32), 87.5% answered the question correctly after the class. One participant who answered the question correctly before the class responded with the incorrect answer to the same question after the class.

Calculating Well Disinfection Chlorine Dose

Participants' ability to calculate a chlorine dose for well disinfection was evaluated. Participants were given the following scenario: "Use the table below to determine the amount of chlorine bleach needed to shock chlorinate a 150-ft well with a 6-in. well casing and a static water level of 100 ft." A standard chlorine dose table was provided. Prior to the class (n = 37), only two participants (5.4%) answered this question correctly (Table 4). Specifically, 64.9% marked "don't know" and 29.7% answered the question incorrectly. Of those who answered incorrectly pre-class (n = 11), 27.2% used static water level as the water depth variable and 72.7% did not account for static water level when determining water depth.

The same scenario was given on the post-class survey (n = 37). After the class, 45.9% of participants correctly answered the question, 45.9% incorrectly answered, and 8.1% marked "don't know" (Table 4). Of those who answered incorrectly post-class (n = 17), 41.2% used static water level as the water depth variable and 58.8% did not account for static water level when determining water depth. One half (50%) of those who marked "don't know" on the pre-class survey (n = 24) correctly answered the question post-class. Overall, the post-survey (n = 37) reflected that 40.5% participants learned how to calculate a chlorine dose after the class. Those who reported an incorrect answer or "don't know" response on the pre-class survey (n = 35) were significantly less likely to correctly answer the question on the post-class survey (54.3% incorrect versus 43.2% correct, p = .0003).

Assessed Knowledge Compared With Self-Perceptions

Participants (n = 51) reported being significantly more comfortable independently disinfecting their well water after the class (45.3% before versus 74.5% after; p < .0001; Table 3). Comfort in ensuring drinking water safety postflood (n = 50) was significantly higher post-class (32.7% before versus 90.0% after; p

TABLE **3**

Participant Agreement With Well Maintenance and Class-Related Statements Ranked on a 5-Point Likert Scale

Statement	#	Disagree	Neutral	Agree	Don't Know	*p*-Value
		# (%)	# (%)	# (%)	# (%)	
Pre-class survey						
Information and resources were available to help address our well recovery needs after the flood.	49	2 (4.1)	8 (16.3)	22 (44.9)	17 (34.7)	–
I am comfortable shock chlorinating my well by myself.	53	17 (32.1)	2 (3.8)	24 (45.3)	10 (18.9)	–
I am comfortable ensuring the safety of my drinking water after floods.	52	14 (26.9)	8 (15.4)	17 (32.7)	13 (25.0)	–
I know where to find information about my specific well.	53	12 (22.6)	5 (9.4)	17 (32.1)	19 (35.8)	–
I know where to find information and resources related to well treatment systems.	53	13 (24.5)	9 (17.0)	14 (26.4)	17 (32.1)	–
I know where to find information for well testing.	52	9 (17.3)	10 (19.2)	20 (38.5)	13 (25.0)	–
I know where to find information about how to shock chlorinate my well.	53	14 (26.4)	8 (15.1)	17 (32.1)	14 (26.4)	–
Post-class survey						
This class made me more comfortable in shock chlorinating my well by myself.	51	3 (5.9)	8 (15.7)	38 (74.5)	2 (3.9)	**<.0001**[a]
I know where to find information and resources related to well water treatment and testing.	51	0 (0)	4 (7.8)	46 (90.2)	1 (2.0)	–
This class covered the information I came here for.	49	1 (2.0)	8 (16.3)	39 (79.6)	1 (2.0)	–
I would recommend this class to a friend or neighbor.	51	0 (0)	6 (11.8)	43 (84.3)	2 (3.9)	–
I would prefer to take this class online.	50	12 (24.0)	15 (30.0)	16 (32.0)	7 (14)	–
This class made me more comfortable ensuring the safety of my drinking water after floods.	50	0 (0)	4 (8.0)	45 (90.0)	1 (2.0)	**<.0001**[b]
I feel that this class changed my attitude on the importance of well maintenance.	51	0 (0)	10 (19.6)	38 (74.5)	3 (5.9)	–
I think the length of the class should be shorter.	51	10 (19.6)	32 (62.7)	4 (7.8)	5 (9.8)	–
I would like to have seen the disinfection process being conducted at a well.	50	6 (12)	23 (46.0)	20 (40.0)	1 (2.0)	–
I would have liked more handouts.	49	14 (28.6)	21 (42.9)	12 (24.5)	2 (4.1)	–
The question/answer session of this class is helpful.	51	1 (2.0)	10 (19.6)	38 (74.5)	2 (3.9)	–
The lecture presentation of this class is helpful.	51	0 (0)	6 (11.8)	43 (84.3)	2 (3.9)	–
I feel that this class could be improved.	50	12 (24.0)	22 (44.0)	11 (22.0)	5 (10.0)	–

Note. Disagree = Likert scale 1–2; Neutral = Likert scale 3; Agree = Likert scale 4–5. Bolded *p*-values indicate a statistically significant difference.

[a]Wilcoxon signed-rank test comparing the difference between "I am comfortable shock chlorinating my well myself" in the pre-class survey and "This class made me more comfortable in shock chlorinating my well by myself" in the post-class survey.

[b]Wilcoxon signed-rank test comparing the difference between "I am comfortable ensuring the safety of my drinking water after floods" in the pre-class survey and "This class made me more comfortable ensuring the safety of my drinking water after floods" in the post-class survey.

< .0001). Participants who correctly calculated a bleach dose after the class were significantly more likely to report an increased confidence in independent well disinfection as compared with those who did not correctly calculate a bleach dose (77.8% versus 59.1%; $p = .02$; Table 5). The majority of participants who were unsure or unable to calculate the correct bleach dose reported the class increased their comfort in independently disinfecting their well (59.1% agree versus 13.6% disagree, 22.7% neutral, 4.6% don't know; Table 5).

TABLE **4**

Changes in Assessed Participant Well Disinfection Knowledge From Class Content

Pre-Class Survey Answers of Content Knowledge Question	# (%)	Post-Class Survey Answer			*p*-Value[a]
		Don't Know	Incorrect	Correct	
		# (%)	# (%)	# (%)	
Disinfection with well damage present[b]	43	3 (7.0)	2 (4.7)	38 (88.4)	**<.0001**
Don't know	32 (74.4)	3 (9.4)	1 (3.1)	28 (87.5)	
Incorrect	1 (2.3)	0 (0)	0 (0)	1 (100)	
Correct	10 (23.3)	0 (0)	1 (10.0)	9 (90.0)	
Calculation of a chlorine bleach dose[c]	37	3 (8.1)	17 (45.9)	17 (45.9)	**.0003**
Don't know	24 (64.9)	3 (12.5)	9 (37.5)	12 (50.0)	
Incorrect	11 (29.7)	0 (0)	7 (63.6)	4 (36.4)	
Correct	2 (5.4)	0 (0)	1 (50.0)	1 (50.0)	

Note. Bolded *p*-values indicate a statistically significant difference.

[a]Exact McNemar's test, "don't know," and incorrect responses collapsed into one response.

[b]Answers to question asked in both pre- and post-class surveys: "Should you try to shock chlorinate your well system if you see damage to the well such as cracks or openings to the environment?"

[c]Answers to scenario given in both pre- and post-class surveys: "To the best of your knowledge, please use the table below to determine the amount of chlorine bleach needed to shock chlorinate a 150-ft well with a 6-in. well casing and a static water level of 100 ft." A standard chlorine dose table was provided.

Participant Class Preferences, Opinions, and Suggestions

Overall, participants agreed they would recommend the class to others (n = 51, 84.3%). Most reported the class covered their respective information needs (n = 51, 79.6%) and found the presentation and question/answer session helpful (n = 51, 84.3% and 74.5%, respectively; Table 3). Only 7.8% of participants (n = 51) preferred a shorter class (62.7% were neutral) and 24.5% (n = 49) would have liked more handouts (42.9% were neutral). A large portion of the class would have preferred a live demonstration of well disinfection (40.0%), but 46.0% were neutral about viewing the disinfection process at a well. Eleven participants (22.0%) felt the class could be improved. Suggested improvements included more handouts and fixing technical issues (e.g., larger screen, better sound quality).

Discussion

To our knowledge, this study is the first to evaluate a user education class on emergency well disinfection practices. This TWON education class aimed to develop an understanding of disinfection to mobilize knowledge needs and resources education to affected well users. Recommendations for how to improve class outreach, class content, delivery, and evaluation are discussed in the following sections.

Outreach

The findings of the evaluation of this pilot class suggest modifications to the recruitment strategy are necessary for emergency response preparation. Similar to previous findings, participants with low incomes had higher detection of microbial contamination (Smith et al., 2014), indicating this group would most benefit from well disinfection, and therefore this class. Difficulties in accessing the low-income population are compounded when in a rural area, as in this study (Texas Department of State Health Services, 2020). Previous research suggests increased advertising, especially sharing recruitment announcements with schools and churches, and including the low costs of participation on advertisements can help overcome recruitment barriers to accessing low income, rural populations (Friedman, Foster, Bergeron, Tanner, & Kim, 2015; Murimi & Harpel, 2010).

Class Content

Through this pilot class, participants reported learning well disinfection protocols and how to access resources. A lack of access to needed resources has been identified as a barrier to recovery efforts (Gilliland et al., 2020) and these results suggest that content included in this class could help to overcome this barrier. Increased knowledge of a technical skill needed for chlorine dose calculation was observed among 40% of participants; however, 50% of participants were not able to calculate a correct dose. One of the primary challenges for this particular class was simplifying the technical concepts behind dose calculation in such a way that it could be rapidly understood and correctly applied. In the pilot class, key terms (i.e., static water level, water depth in well, and total well depth) and the steps to find static water level were clearly defined. More than one half of study participants, however, still did not grasp this topic. Therefore, instead of well users relying on technical knowledge for postflood well disinfection, it might be advisable to use online tools and resources that simplify technical content. For example, instructors can demonstrate to well users how to look up best-estimate chlorine doses based on their specific (or estimated) well system characteristics using online calculators (Eykelbosh, 2013). Online videos can be used to reinforce

TABLE **5**

Participant Perceptions of Well Maintenance Ability Compared With Tested Knowledge Post-Class

Post-Class Tested Knowledge	#	Comfortable Independently Shock Chlorinating Well					Comfortable Ensuring Water Safety Postcontamination Event				
		Disagree	Neutral	Agree	Don't Know	*p*-Value[a]	Disagree	Neutral	Agree	Don't Know	*p*-Value[a]
		# (%)	# (%)	# (%)	# (%)		# (%)	# (%)	# (%)	# (%)	
Disinfection with well damage present[b]	43					.07					.05
Participant unable or unsure	6	0 (0)	1 (16.7)	4 (66.7)	1 (16.7)		0 (0)	1 (16.7)	4 (66.7)	1 (16.7)	
Participant able	37	3 (8.1)	7 (18.9)	26 (70.3)	1 (2.7)		0 (0)	3 (8.3)	33 (91.7)	0 (0)	
Calculation of a chlorine bleach dose[c]	40					**.02**					.16
Participant unable or unsure	22	3 (13.6)	5 (22.7)	13 (59.1)	1 (4.6)		0 (0)	3 (13.6)	18 (81.8)	1 (4.6)	
Participant able	18	0 (0)	3 (16.7)	14 (77.8)	1 (5.6)		0 (0)	1 (5.6)	17 (94.4)	0 (0)	

Note. Bolded *p*-values indicate a statistically significant difference.

[a]Fisher's exact test.

[b]Based on answers to question asked in post-class survey: "Should you try to shock chlorinate your well system if you see damage to the well such as cracks or openings to the environment?"

[c]Based on answers to scenario given in post-class survey: "To the best of your knowledge, please use the table below to determine the amount of chlorine bleach needed to shock chlorinate a 150-ft well with a 6-in. well casing and a static water level of 100 ft." A standard chlorine dose table was provided.

learning, although such services might be limited with disruptions to power and Internet access in the postdisaster period (Gilliland et al., 2020).

Recommendations for Improving Class Content and Delivery

Class content should meet the local population's knowledge needs, be delivered in a way that is succinct but thorough, and match the comprehension level of those attending (Morris, Wilson, & Kelly, 2016). In this study group, only one half of participants correctly calculated a bleach dose after the class, despite the higher education level of participants. There are a variety of reasons that could underlie this finding. The process of calculating a chlorine dose was the most challenging concept class participants were exposed to, and subsequently tested on, during the class. The identification of the correct chlorine dose for disinfection has been observed to be limited among lay persons (Levy et al., 2014).

Knowledge of well depth and casing diameter is important for well disinfection. One participant indicated they did not know their well depth, which is a barrier to well disinfection that has been reported in previous literature (Gilliland et al., 2020). One solution to this lack of knowledge is to hold a preclass workshop to help participants locate their well characteristics through various resources. Chlorine doses for each participant's well can then be calculated with help from proctors during class, thereby facilitating effective future well maintenance.

Recommendations for Improving Study Design and Class Evaluation

As with all education programs, future well disinfection classes should continue to be evaluated. Participants were given resource material highlighting all of the necessary steps to well disinfection to inform future use. Encouraging participants to use this information while completing the post-class survey will test if these resources can be accurately interpreted, and the content question results will more likely mimic participant behavior in the real world with access to these materials.

For the sake of brevity, this survey only evaluated two components of the entire lesson. To more thoroughly assess the clarity of different topics presented, questions targeting specific topics can be used to evaluate the class, which in turn would help fine-tune presentations and resource distribution on each topic. Reviewing answers to the questions with the participants will allow participants to inform class presenters as to why they did not understand specific material. In this way, one might be able to differentiate problems based on technical difficulties (e.g., sound difficulties) versus content presentation challenges.

Asking participants if they know their well depth can gauge previous knowledge of their well system. Restructuring survey questions to explicitly reflect positive changes, rewording potentially biasing questions, and adding questions to more completely assess learning will also be beneficial to future evaluations. Results from a question about participant perception of current well water quality was removed from analysis because participants viewed the results for their water sample before filling out the pre-survey. Revising the wording of some questions will reduce par-

ticipant misinterpretation or clarify responses. For example, 74.5% of participants agreed the class changed their attitude on the importance of well maintenance; however, it was unclear whether the change was positive or negative.

Study Limitations

Possible bias within the study results might have arisen from selection bias from the study recruitment method and the nature of self-reported data. Reported information needs, perceptions, and content learning might have been biased due to the requirement of attending the education class to receive results, results being distributed before participants were surveyed, and for reasons inherent in the class improvement suggestions listed by participants (e.g., stand closer to the microphone, use a bigger viewing screen). Furthermore, low sample size and missing responses for some questions might have biased the results.

Conclusion

This pilot class on well disinfection education, developed rapidly as an emergency-recovery response to a flooding event, increased the resource access and disinfection knowledge of attendees. Results suggest class attendees learned information necessary to overcome flood recovery barriers. Technical components of well disinfection could be better implemented by using chlorine dose calculators that are available online. With improvements to the class content and delivery, this class can serve as a foundation for future education classes to reduce safe water access barriers within rural, flood-affected populations. These results underscore the importance of class evaluations to measure outcomes and assess knowledge gaps.

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Did You Know?

In support of environmental health professionals during the COVID-19 pandemic, NEHA continues to add to its COVID-19 page at www.neha.org/covid-19. The page provides resources for environmental health professionals, guidance resources, articles, and more. You can also find a list of NEHA resources that include the COVID-19 EH Response Online Community, Just-in-Time From NEHA Video Series, and COVID-19: Essential Functions of the Environmental Health Workforce Live Chat Series.

Did You Know?

September is National Preparedness Month. This year's theme is "Disasters Don't Wait. Make Your Plan Today." Make a plan to participate in this year's events and visit www.ready.gov/september for more information and resources.

School-Based Private Well Testing Outreach Event for Arsenic and Boron in New Jersey

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Abstract **Arsenic and boron can naturally occur in well water and chronic exposure to both is associated with a wide variety of health effects. In 2016, two New Jersey townships were targeted for a school-based outreach and testing event because the population relies on private well water for potable use, the aquifer is known to be at risk for arsenic and boron contamination, and young children are particularly vulnerable. Within 1 week, 376 homes submitted water samples. The results showed 94 homes (25%) exceeded the New Jersey arsenic maximum contaminant level and 18 homes (5%) exceeded the U.S. Environmental Protection Agency boron health advisory for children. A short survey attached to sample bottles provided information about reasons for testing and asked if a treatment method was installed. School-based recruitment for private well testing was an efficient public health outreach method to quickly obtain many private well samples and is a promising model for future private well outreach.**

Introduction

Arsenic can naturally occur in groundwater through the erosion of natural rock formations, or from anthropogenic sources such as past use of pesticides and waste discharges from glass and electronics production. In New Jersey, arsenic naturally and predominantly occurs in specific geologic settings and can dissolve into groundwater under specific geochemical environments (Serfes, Spayd, & Herman, 2005). Chronic exposure to arsenic in drinking water has been attributed to a variety of health effects (National Research Council, 1999, 2001). Arsenic is a known human carcinogen and individuals exposed through drinking water are at increased risk for a range of cancers including bladder, lung, liver, kidney, skin, and prostate (Aballay, Diaz, Francisca, & Muñoz, 2012; Feki-Tounsi et al., 2013; Ferreccio et al., 2013; Ferrís, Berbel, Alonso-López, Garcia, & Ortega, 2013; Liu-Mares et al., 2013; Smith et al., 1992; Steinmaus et al., 2013). Chronic exposure to arsenic in drinking water is also associated with other serious health problems including skin lesions, cardiovascular disorders, neuropathy, diabetes, and decreased IQ and cognitive issues in children (Navas-Acien, Silbergeld, Pastor-Barriuso, & Guallar, 2008; Smith, 2013; Tsuji, Garry, Perez, & Chang, 2015; Wasserman et al., 2014, 2016).

The New Jersey drinking water maximum contaminant level (MCL) for arsenic is the most protective arsenic drinking water standard in the world at 5 µg/L, one half the federal MCL of 10 µg/L. Although public water systems are required to monitor for arsenic and reduce levels when arsenic exceeds state standards, private well owners are solely responsible for monitoring and treating their own well water. Urinary arsenic levels in the U.S. population served by public water have declined since the federal arsenic standard was changed in 2006 from 50 µg/L to 10 µg/L; however, arsenic exposure did not decrease among private well owners (Nigra et al., 2017; Welch, Smit, Cardenas, Hystad, & Kile, 2018). As private well owners nationwide are not seeing the same reduction in arsenic exposure as residents who drink public water, more efforts are needed to encourage private well testing and treatment, which is especially critical in New Jersey because approximately 1 million residents use private wells (Maupin et al., 2014).

Boron, like arsenic, also occurs naturally and they can co-occur in wells in the Newark Basin, a geologic province in New Jersey and Pennsylvania (Senior & Sloto, 2006). The New Jersey Geological and Water Survey (NJGWS) has identified boron levels in well water up to 24,000 µg/L. Evaporite deposition and hydrothermal remobilization from magmatic activity might have introduced boron into the region (Senior & Sloto, 2006). Although the U.S. Environmental Protection Agency (U.S. EPA) decided not to regu-

late boron in drinking water due to limited national occurrence, they suggest that states with localized occurrences of boron consider whether state-level guidance could be necessary (U.S. EPA, 2008a). In 2008, the U.S. EPA set the boron Longer-Term Health Advisory for children at 2 mg/L or 2,000 µg/L; the primary health concerns from exposure to boron are testicular toxicity and infertility in males, and developmental effects for unborn babies, infants, and children (U.S. EPA, 2008b).

In water, arsenic and boron are colorless, odorless, and tasteless, and testing is the only way to identify their presence. The New Jersey Private Well Testing Act (PWTA) N.J.S.A. 58:12A-26 et seq. requires testing raw (untreated) water from private wells whenever transferring a residential property by contract of sale or every 5 years if leasing (State of New Jersey Department of Environmental Protection, 2002). Among other contaminants, PWTA requires testing for arsenic, gross alpha, nitrate, total coliform, iron, and manganese. As of 2014, approximately 35,000 private wells were tested for arsenic via the New Jersey regulation; 8.9% of those wells contained levels of arsenic above the New Jersey MCL of 5 µg/L. Hunterdon County had the highest rate of arsenic exceedance, with 16.3% of tested wells exceeding the New Jersey MCL. Furthermore, testing in some areas within Hunterdon County had >60% of tested wells exceeding the MCL.

In 2006, the U.S. Geological Survey issued a report on work conducted to determine the source of arsenic, boron, and fluoride near an industrial facility in the Newark Basin in Montgomery County, Pennsylvania (Senior & Sloto, 2006). Naturally occurring mineralization in the local bedrock aquifer was identified as a source and it was noted that arsenic had a strong and positive correlation with boron. Concurrently, boron in water from several irrigation wells in three New Jersey counties in the Newark Basin was identified as the cause for damage to a variety of plants sensitive to boron at levels >1,000 µg/L. In response to these findings, in 2009 NJGWS began testing for boron in wells with high arsenic levels in the Newark Basin.

In 2010, NJGWS conducted a preliminary school-based outreach event for arsenic testing in the same two townships as the most recent outreach event reported here. In 2010, approximately 830 water-testing bottles with sampling instructions were distributed to students. A small fee ($10 in one township and $15 in the other) was collected to cover analytical costs. The 2010 event had 375 bottles returned (45% return rate), of which 111 (30%) were found to exceed the arsenic drinking water standard. In the 2010 outreach event, one resident whose well water arsenic level was 65 µg/L had a hair test analysis that showed high concentrations of both arsenic and boron. Follow-up testing of this well found 18,000 µg/L boron in the resident's well water. A door-to-door survey of 15 houses in the area found all 15 homes above the New Jersey arsenic MCL (5.6–65.0 µg/L) and 4 homes above the boron U.S. EPA health advisory level for children (2,179–7,710 µg/L).

In 2015, the Centers for Disease Control and Prevention (CDC) awarded a grant to the New Jersey Departments of Health and Environmental Protection through the CDC's Safe Water for Community Health Program (Safe WATCH) to improve the effectiveness and efficiency of private well programs in New Jersey. Efforts have largely focused on improving outreach and testing for private well contaminants of concern, including arsenic and the understudied, unregulated drinking water contaminant boron. The New Jersey team identified two townships as targets for an outreach program because they have nearly 100% private well use, households at risk for arsenic and boron contamination, and the interest and availability for township partnerships. Due to the success of the 2010 school-based outreach event and the new student population 6 years later, it was decided to repeat the school-based outreach event in 2016.

Methods

Program Location and Partners

The two New Jersey townships targeted in this study are in an area almost entirely served by private wells and known to have elevated levels of arsenic and boron in private well water. The townships are rural and suburban communities in Hunterdon County, which is 50 miles west of New York City. They are neighboring communities with household incomes higher than the New Jersey average and do not have any public water coverage (U.S. Census Bureau, 2016). Previous PWTA data highlight that Township A might have greater geological vulnerability to well water arsenic contamination than Township B. From the previous private well testing event in 2010, partnerships with project stakeholders including the environmental commissions, K–8 school boards, and science teachers of both townships were reestablished.

Event Logistics

During spring 2016, 830 sample bottles were organized into shopping bags grouped by classroom and distributed to the elementary and middle schools in both townships. The team provided additional bottles at both town halls to reach residents without school-aged children. They also invited teachers served by private wells to participate. Classroom lessons on private wells, hydrogeology of the area, and the health effects of arsenic and boron were provided to all sixth-, seventh-, and eighth-grade students.

Sampling and Testing

A program flyer (Figure 1) announced the free water testing with sampling instructions. A detachable form for parents to fill out their contact information and four survey questions were attached with a rubber band to each sample bottle (Figure 2). Step-by-step sampling instructions were illustrated in a series of easy-to-follow pictures instructing participants to: run their cold-water kitchen tap for 10 min, label and fill the sample bottle with cold water, screw the cap on tightly, reattach the completed survey, and return within the next 2 days to their homeroom teacher. To maximize participation, students were allowed an extra 2 days to return the bottles. Four days after giving the bottles to students, filled bottles with completed forms were collected and delivered to the laboratory for analysis. Due to the nature of arsenic and boron analysis, the samples did not require any form of preservation before delivery to the lab. Analyses of samples by inductively coupled plasma mass spectrometry (ICP-MS) took place at a commercial laboratory.

Reporting Test Results

The New Jersey team sent test results to participants via e-mail if it was provided; otherwise, they sent results by postal mail. Result letters included test results, the New Jersey arsenic MCL, the U.S. EPA boron advisory

level for children for comparison, and treatment recommendations based on specific contamination levels. Team members kept the reporting of individual results confidential but presented aggregated results to the respective township stakeholders.

Survey

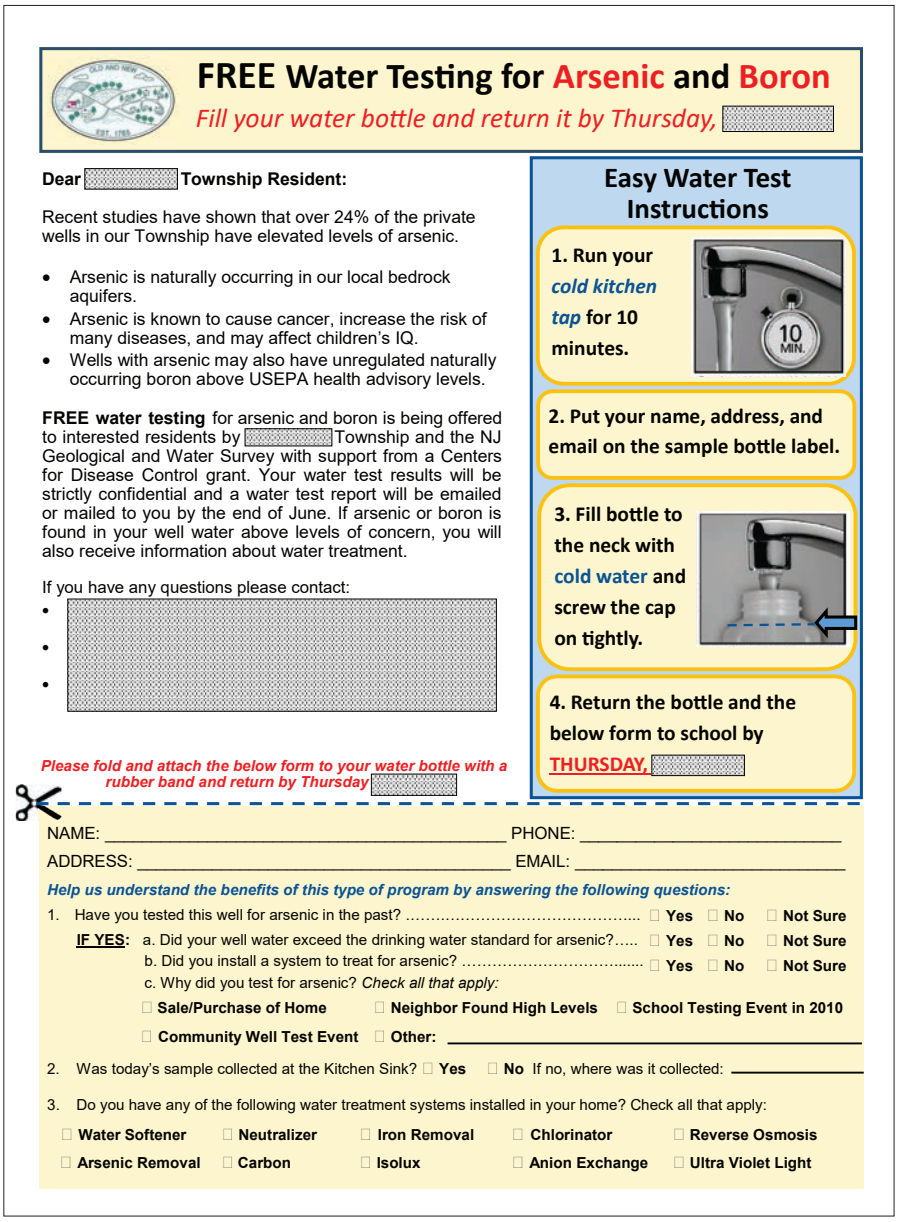
The survey asked participants about the sampling location, if they had tested for arsenic in the past, why they tested, if tests ever exceeded the New Jersey arsenic MCL, and if they had installed a water treatment method. In addition, it asked participants to indicate what water treatment they currently have installed in their home by "checking all that apply" from a list of common water treatment systems.

Data Analysis

Instructions asked participants to collect samples from the kitchen sink, which most closely represents the water used for cooking and drinking. Some households, however, took their sample from a different location. Three participants collected water samples from a tap immediately prior to or between arsenic treatment tanks. These three samples had nondetectable levels of arsenic and boron and were assumed to have nondetectable levels at the kitchen sink, and thus were included in the final analysis. Some households submitted more than one sample because they had multiple children in the school. Only one sample per household address was included in the final analyses. Use of the following priority criteria determined which duplicate sample to include in the final analyses: 1) sample taken at the kitchen sink (or other sample location reflective of household drinking water exposure), 2) highest arsenic concentration, and 3) highest boron concentration. Township data were analyzed individually and combined.

FIGURE **1**

Flyer With Water Sampling Instructions



FREE Water Testing for Arsenic and Boron

Fill your water bottle and return it by Thursday,

Dear Township Resident:

Recent studies have shown that over 24% of the private wells in our Township have elevated levels of arsenic.

- Arsenic is naturally occurring in our local bedrock aquifers.
- Arsenic is known to cause cancer, increase the risk of many diseases, and may affect children's IQ.
- Wells with arsenic may also have unregulated naturally occurring boron above USEPA health advisory levels.

FREE water testing for arsenic and boron is being offered to interested residents by Township and the NJ Geological and Water Survey with support from a Centers for Disease Control grant. Your water test results will be strictly confidential and a water test report will be emailed or mailed to you by the end of June. If arsenic or boron is found in your well water above levels of concern, you will also receive information about water treatment.

If you have any questions please contact:

Easy Water Test Instructions

1. Run your *cold kitchen tap* for 10 minutes.
2. Put your name, address, and email on the sample bottle label.
3. Fill bottle to the neck with cold water and screw the cap on tightly.
4. Return the bottle and the below form to school by THURSDAY,

Please fold and attach the below form to your water bottle with a rubber band and return by Thursday

NAME: _____ PHONE: _____

ADDRESS: _____ EMAIL: _____

Help us understand the benefits of this type of program by answering the following questions:

1. Have you tested this well for arsenic in the past? ☐ Yes ☐ No ☐ Not Sure
   IF YES: a. Did your well water exceed the drinking water standard for arsenic? ☐ Yes ☐ No ☐ Not Sure
   b. Did you install a system to treat for arsenic? ☐ Yes ☐ No ☐ Not Sure
   c. Why did you test for arsenic? *Check all that apply:*
   ☐ Sale/Purchase of Home ☐ Neighbor Found High Levels ☐ School Testing Event in 2010
   ☐ Community Well Test Event ☐ Other: _____
2. Was today's sample collected at the Kitchen Sink? ☐ Yes ☐ No If no, where was it collected: _____
3. Do you have any of the following water treatment systems installed in your home? Check all that apply:
   ☐ Water Softener ☐ Neutralizer ☐ Iron Removal ☐ Chlorinator ☐ Reverse Osmosis
   ☐ Arsenic Removal ☐ Carbon ☐ Isolux ☐ Anion Exchange ☐ Ultra Violet Light

Results

The students returned 358 of the 830 distributed sample bottles (43% return rate). A total of 428 water samples were collected from the two townships, including samples collected from teachers and town hall attendees, with 45 household duplicate samples and 7 water samples submitted without a name or address. Removing these duplicate and blank samples from analyses resulted in 376 unique households tested. Among the unique wells tested, 94 (25%) exceeded the New Jersey arsenic MCL of 5 µg/L, 32 (8.5%) exceeded the federal arsenic MCL of 10 µg/L, 18 (5%) exceeded the U.S. EPA boron health advisory for children of 2,000 µg/L, and 12 (3%) exceeded both arsenic and boron health levels. Within the two townships, there is a geologic hotspot of approximately 19 square miles with high levels of boron. Within this area, 19 of 121 (16%) households exceeded the boron health advisory, 55 (45%) exceeded the New Jersey arsenic MCL, and 10 (8%) exceeded both arsenic and boron health levels. In Township A, 193 wells were tested, with 69 (36%) and 14 (7%) exceedances for arsenic and boron, respectively. Township B had 183 wells tested, with 25 (14%) and 4 (2%) exceedances for arsenic and boron, respectively (Figure 3).

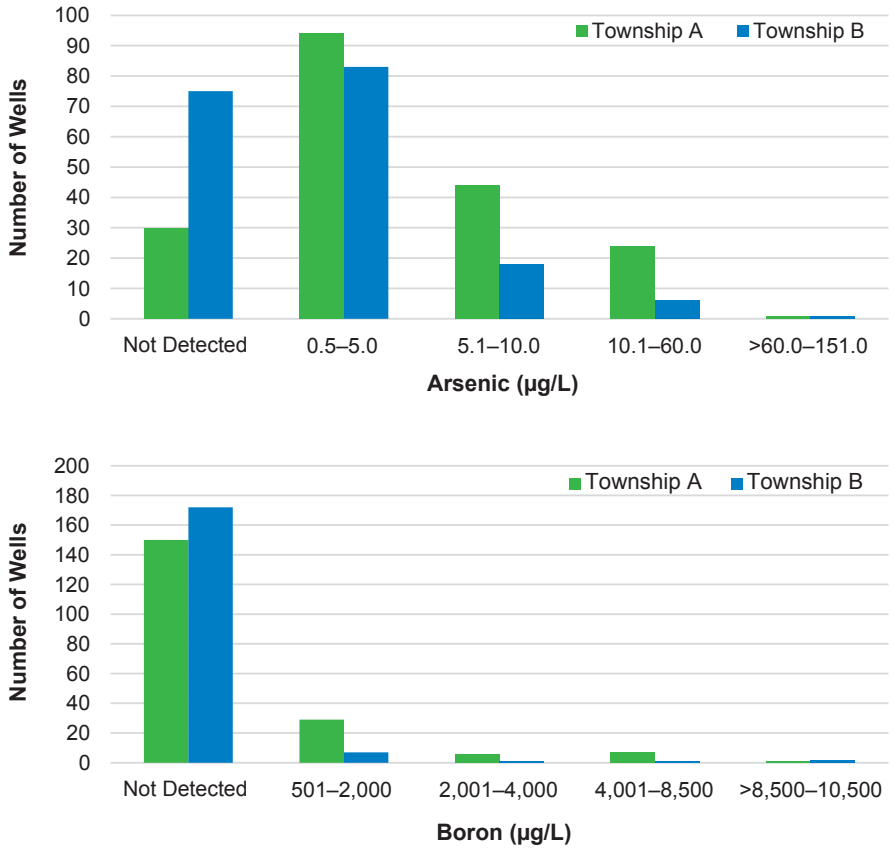
FIGURE **2**

Sample Bottle With Flyer Attached

Photo courtesy of Steven Spayd.

FIGURE **3**

Arsenic and Boron Well Testing Results for Two Townships in New Jersey



Note. The New Jersey drinking water maximum contaminant level for arsenic is 5 µg/L. The U.S. Environmental Protection Agency Longer-Term Health Advisory for boron for children is 2,000 µg/L.

Of the 376 household wells tested, 190 (50%) respondents self-reported their wells were previously tested for arsenic, 82 (22%) were not previously tested, and 104 (28%) did not know or did not respond. Among the 190 respondents who self-reported their wells were previously tested for arsenic, 50 (26%) exceeded the New Jersey arsenic MCL in this testing event. Of these 190 people who had tested for arsenic, 19 indicated that they had tested during the 2010 school-based outreach project. Self-reports from 49 wells stated a previous arsenic exceedance. Of these, 34 (69%) wells did not exceed the New Jersey arsenic MCL at this testing event while 15 (31%) wells still exceeded the New Jersey arsenic MCL at the kitchen sink. Of the 49 wells with a self-reported previous arsenic exceedance, 31 (63%) reported having arsenic removal treatment in place. Of the 31 houses with treatment, 4 (13%) still exceeded the New Jersey arsenic MCL at the kitchen sink. No households had water treatment to remove boron.

Among the 94 households that exceeded the New Jersey arsenic MCL, only 50 (53%) self-reported they had previously tested their wells for arsenic and 15 (16%) had self-reported their wells had previously exceeded the New Jersey arsenic MCL. Of the 282 respondents whose household wells did not exceed the New Jersey arsenic MCL, 140 (50%) self-reported previous arsenic testing and 34 (12%) self-reported a previous arsenic exceedance. In total, 37 respondents self-reported they have arsenic removal treatment installed for their well water, with 31 (84%) households testing below and 6 (16%) households exceeding the New Jersey arsenic MCL.

The survey asked participants to indicate all the reasons why they had tested for arsenic in the past. Therefore, there were 223 responses from 203 households. The most common reasons for testing were home sale, which is a PWTA requirement (98, 44%); community event (64, 29%); other reasons not listed (33, 15%); school-based testing event (19, 8%); and neighbor with high arsenic levels (9, 4%).

There were 47 respondents who self-reported that they previously tested for and exceeded the New Jersey MCL. Of these respondents, 18 (38%) reported testing due to the sale of the home with 100% having arsenic removal treatment installed (Figure 4). Other specified reasons for previous testing included a community testing event (14, 30%; with 79% having arsenic removal treatment installed), neighborhood testing result (6, 13%; with 57% having arsenic removal treatment installed), and 2010 school-based event (2, 4%; with 50% having arsenic removal treatment installed).

Discussion

This school-based outreach event resulted in arsenic and boron testing for 376 unique private wells, with sampling completed in <1 week. The sampling event identified 94 homes exceeding the New Jersey arsenic MCL and 18 exceeding the U.S. EPA boron health advisory for children. By targeting outreach to communities with high arsenic vulnerability and high private well usage, this event identified a 25% exceedance of the New Jersey arsenic MCL, nearly 3 times greater than the statewide exceedance.

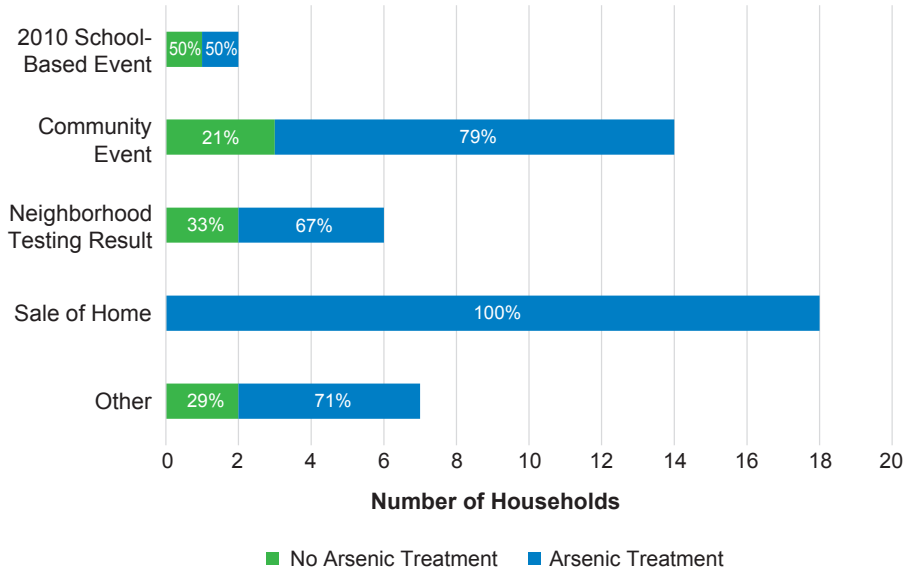
Young children are particularly vulnerable to the health effects of arsenic and boron; therefore, a school-based model for outreach that targets households known to have young children increases the public health impact of the outreach. It is possible that by performing outreach among school-aged children, the outreach event also potentially reaches households with vulnerable populations such as pregnant women and infants. Only 19 homes (5%) participated in both the 2010 and 2016 school-based outreach events, highlighting that this event reached a significantly new portion of the vulnerable population.

The success of this outreach event is attributed to the involvement of multiple community partners including the township administration, the environmental commission, school board officials, principals, and teachers. This school-based outreach model largely followed the principles of community-based participatory research in which messaging and outreach came from project stakeholders, and the students themselves motivated their household participation.

A survey of private well users in New Jersey found that although implementation of PWTA allowed more identification of wells with arsenic, challenges remain for improving subsequent treatment installation, maintenance, and monitoring (Flanagan et al., 2016). Of the 94 households that exceeded the New Jersey arsenic MCL, more than one half (50, 53%) reported previous arsenic testing. Additionally, of 47 respondents reporting having both previously tested for and exceeded the state arsenic MCL, 15 (32%) still exceeded. Notably, well water in 6 of 37 (16%) households with arsenic removal treatment still exceeded the state arsenic MCL at the kitchen sink. Arsenic water treatment systems require yearly testing and maintenance to ensure they are working properly, so it is likely that some of these systems need servicing (Rockafellow-Baldoni et al., 2018). The findings suggest a need for public health interventions, including encouragement of treatment installation as well as maintenance and monitoring of the treatment systems. A follow-up survey is planned to evaluate if any actions were taken by those who received results exceeding MCL and/or health guidance.

FIGURE **4**

Reasons for Previously Testing by Arsenic Treatment Installation Among Respondents Who Reported a Previous Arsenic Exceedance (*n* = 47)



Residents with arsenic in their drinking water are encouraged to install an appropriate water treatment method. Point-of-entry treatment systems are the most protective of public health and can effectively remove arsenic from every tap in the home (Spayd, 2007; Spayd, Robson, & Buckley, 2015). Furthermore, the preferred treatment media technology for arsenic removal in New Jersey is a two-tank, whole-house adsorption system (Spayd, 2007). Despite the state arsenic MCL being 5 µg/L, some homeowners choose to follow the MCL goal of 0 µg/L and install an arsenic treatment system even though their arsenic concentration is below the New Jersey MCL.

Respondents who indicated home sale as the reason they previously tested for arsenic reported installation of an arsenic treatment method (100%) more often than respondents who selected the other reasons for testing (≤79%). When private well testing is required during a real estate transaction, the expense of treatment installation can seem more reasonable given all the other expenses associated with the purchase of a new home. Financing is available to New Jersey homeowners with a private well that violates the state's Primary Drinking Water Standards (New Jersey Housing and Mortgage Finance Agency, 2020).

A local ordinance in Hopewell Township (Mercer County, New Jersey) requires whole-house arsenic treatment following a PWTA arsenic exceedance before issuing a certificate of occupancy. This public health measure is estimated to significantly reduce the risk of bladder and lung cancer occurrences related to arsenic exposure in drinking water (Rockafellow-Baldoni et al., 2018). Based on the success and estimated public health impact of this local ordinance, other towns with arsenic exceedances should consider adopting a similar ordinance.

Boron is an unregulated drinking water contaminant and it is highly unlikely that a homeowner would have tested for this con-

taminant independent of this outreach event. Furthermore, traditional water treatment methods do not effectively remove boron and NJGWS testing of local drinking water has shown that reverse osmosis removes only approximately 15% of the boron. NJGWS suggests that successful point-of-use boron removal includes reverse osmosis followed by mixed bed deionization (or boron-specific resin) with a circulation pump, followed by a neutralizer and granular activated carbon block filter before the point-of-use tap. This treatment method, while effective at reducing boron below the U.S. EPA health advisory, is expensive and does not provide whole-house coverage. An investigation of the private well and physically blocking the boron water-bearing zone might be the most effective and protective means of boron reduction. Further research can shed light on the geologic source of boron contamination in the Newark Basin and cost-effective treatment methods.

Limitations

Though instructions asked participants to collect their sample from the kitchen sink to represent their drinking water, some collected their sample from different locations. Thus, some participants might have collected their sample at a pretreatment faucet without reporting it on their survey, causing their result to exceed the New Jersey arsenic MCL. This factor could add a potential bias to the results; however, the impact of this factor would be small. Additionally, recall bias might have influenced the self-reports we analyzed for the survey findings. Participation bias might also exist, as this effort was targeted toward residents who have school-aged children and thus our sample population is not representative of the entire townships.

Conclusion

This school-based private well testing event was successful in sampling private well water from 376 homes in 1 week and identifying 94 (25%) homes with well water in exceedance of the New Jersey arsenic MCL, 18 (5%) homes exceeding the U.S. EPA boron health advisory for children, and 12 (3%) homes exceeding both the arsenic and boron health levels. Collaboration with the community, school administrators, teachers, and students to promote the opportunity for people to have their well tested helped this event reach a younger and more vulnerable population of school-aged children. With the addition of a simple survey, the New Jersey team gained a better understanding of the testing, treatment, and treatment maintenance behaviors among participants. The number of samples collected in 1 week demonstrates the efficiency and effectiveness of this recruiting method. Other communities, local health departments, and environmental groups could benefit from following a similar outreach approach targeting contaminants of concern, focusing on vulnerable populations, and leveraging community stakeholders to improve success of private well programs.

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Did You Know?

You can access NEHA's policy and position statements at www.neha.org/publications/position-papers. NEHA's latest position statement focuses on racism and environmental health. Other recent statements cover COVID-19, adoption and implementation of the current Food and Drug Administration *Food Code*, cottage foods, clean energy, ear piercing guns and microblading, and mosquito control.

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BUILDING CAPACITY

Darryl Booth, MBA

Building Capacity by Piloting Virtual Inspections

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

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

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

Protecting the public's health during a worldwide pandemic is prompting health agencies to revisit and revise many daily practices. Even while local environmental health professionals are assisting with the COVID-19 response—either through running testing centers, answering public concerns, or educating permit holders—the same environmental health responsibilities remain. Plan review, inspections, complaint investigations, renewals, fee collection, etc. continue in some form or will again soon.

By many estimates, numerous industries will experience five or more years of digital innovation in the first year of the COVID-19 pandemic. This estimate means to me that what was once a "nice to have" is now an imperative. An easy example is the schools that had to pivot to an online curriculum in just weeks. Telemedicine is another example.

When the National Environmental Health Association (NEHA) advertised a new offering—Virtual Inspections During COVID-19 Pandemic—through its COVID-19: Essential Functions of the Environmental Health Workforce Live Chat Series that promised a practical study of virtual inspections, I signed up immediately and marked my calendar. I was not disappointed.

What once seemed impossible, such as conducting an inspection without actually being in the facility, is actually being done in the field. And the practice, with realistic expectations, may even continue after the virus is no longer a threat. Why is that? It has everything to do with reduced budgets and shifting expectations.

Laura Wildey, NEHA senior program analyst in food safety, explained that NEHA was receiving a lot of questions about virtual inspections and whether or not other jurisdictions were having success. "Through this live chat series offering, we worked to connect those jurisdictions to avoid recreating the wheel," stated Wildey.

The virtual inspection live chat series featured five active agencies, each with either statewide or local environmental health responsibilities.

Virtual Inspections

A virtual inspection connects the inspector in the office with the facility operator via phone, computer, or tablet to talk with each other and to see the layout and operations of the facility.

Software

Interestingly, there are many options out there. Mentioned in the webinar were FaceTime (limited to Apple devices), Google Duo, Google Hangouts, Zoom, Skype, Microsoft Teams, and Webex. Most of the software programs are free for voice and video, although other capabilities (like recording to the cloud) vary.

What software should you use? There were two essential considerations: 1) is the software compatible with the inspector and operator equipment? and 2) is the software familiar to the participants? Ask and then try to use the app that is already on the operator's phone.

How Does It Work?

Most recommended was an early invitation with written instructions that explained what was being proposed. Most operators really appreciated the opportunity to move their projects forward.

Schedule an advance meeting to check out the software, sound quality, video quality, and Wi-Fi. Request an orientation (i.e., visual tour) of the facility, which gives everybody some practice and boosts confidence. It is also important to realize that a virtual inspection is not always possible and you should have a plan B.

Set an appointment and be sure to include the specifics for the chosen software. FaceTime, for example, just needs a phone number. For other software, exchange the username or meeting link in advance.

At the agreed upon date and time, connect with the facility operator and begin the inspection.

You Don't Know What You Don't Know

The NEHA live chat series was great because practitioners described their own recent results and anecdotes. What emerged was invaluable! Here are a few key takeaways:

- Begin with the written instructions for operators and procedures for inspectors from other successful agencies.
- Ask the operator to have an assistant hold and point the camera. The assistant must be able to follow instructions such as move left, move up, get closer, and back away. The operator must hear and answer questions.
- Remember that a virtual inspection could have more than two parties. A corporate representative, trainee, or translator might join the inspection.
- Start at the facility entrance and ask for a walk-through. Work clockwise in each area to assure coverage.
- Ask the operator to use a digital thermometer as it is easier to read on a video screen.
- Create a new inspection type in your inspection software to differentiate between a virtual inspection and an in-person inspection.
- Have realistic expectations and budget for breaks as this work can be tiring.

Concerns and Questions

The environmental health professionals that attended the live chat series had some questions that are important to note.

- **Question:** Does a virtual inspection meet the legal obligations of the agency?
  Answer: In some cases, no. In other cases, it is uncertain. Some agencies sought a legal opinion. Others planned to conduct an in-person inspection as soon as possible.
- **Question:** How can a signature be captured?
  Answer: Some jurisdictions e-mailed the inspection report with instructions to print, sign, and return the report. Others simply annotated the inspection record, indicating that the operator confirmed receipt verbally.
- **Question:** Did the agency attempt to record the inspection audio and video?
  Answer: It might be valuable to "screen grab" static images or to save the entire recording to the cloud. In most cases, however, the agencies did not attempt a recording of the entire inspection. As mentioned before, not every app has this capability.
- **Question:** Did the virtual inspection take more time?
  Answer: The panel cited examples of both longer and shorter inspections.
- **Question:** Will the agencies continue with virtual inspections after COVID-19 restrictions lift?
  Answer: The panel gave a mixed reply. Some said no. Others explained that the practice might continue, especially in rural areas served by the state where travel can be prohibitive.

Considering Your Own Pilot?

First, navigate to NEHA's COVID-19: Essential Functions of the Environmental Health Workforce Live Chat Series web page at https://emergency-neha.org/covid19/live-chat-series and watch the recording of the Virtual Inspections During COVID-19 Pandemic live chat.

Second, bookmark and visit https://emergency-neha.org/covid19/, a late-breaking resource for environmental health professionals. The written procedures published by the panelists were extremely useful.

Finally, think about proposing a pilot of your own. If not virtual inspections, then for other service areas. There might never be a better time.

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DIRECT FROM AEHAP


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Student Recruitment and Engagement in the COVID-19 Era

Editor's Note: In an effort to promote the growth of the environmental health profession and the academic programs that fuel that growth, NEHA has teamed up with the Association of Environmental Health Academic Programs (AEHAP) to publish two columns a year in the *Journal*. AEHAP's mission is to support environmental health education to ensure the optimal health of people and the environment. The organization works hand in hand with the National Environmental Health Science and Protection Accreditation Council (EHAC) to accredit, market, and promote EHAC-accredited environmental health degree programs.

This column provides AEHAP with the opportunity to share current trends within undergraduate and graduate environmental health programs, as well as efforts to further the environmental health field and its available resources and information.

Jamie Hisel is the president of AEHAP and a clinical faculty member at Eastern Kentucky University. Clint Pinion is the past-president of AEHAP and an associate professor at Eastern Kentucky University.

There is no denying that the COVID-19 pandemic has had a tremendous impact on virtually every facet of our lives. In particular, higher education has suffered a significant blow. Across the U.S., universities and academic institutions made tough decisions to keep their students, faculty, and staff safe in the face of COVID-19. Some completely shut their doors, some offered alternative delivery methods, and most shifted completely to online instruction. While many shifted online, it is important to note that faculty were forced to simply move content online and were not afforded the opportunity to research or learn effective online pedagogy (Crawford et al., 2020). This rapid shift also highlighted those "poorly resourced institutions and socially disadvantaged learners where limited access to technology and the Internet" impacted the student's ability to learn or effectively engage in the online environment (Zhong, 2020).

As educators, we know this might not have been our finest teaching moment; however, it has pushed open the door of online learning in many areas that many had held firmly closed prior to COVID-19. We were catapulted, whether ready or willing, into a new format that forced our hands to try new and innovative techniques to engage our students. While so much is still unknown about our future, it is important for higher education to learn from our shortcomings and take this opportunity to grow. With this column, we review how environmental health programs can use the current pandemic to recruit and engage students to grow their programs despite the challenges.

Environmental health programs have a unique advantage in the face of COVID-19. The pandemic and subsequent response highlights the importance of environmental health in our world. In these unprecedented times, as our national and state officials were declaring nationwide emergencies and stay-at-home orders, it was largely at the guidance and recommendation of our public and environmental health professionals. In recent history, never has so much emphasis been placed on public and environmental health. So how do we, as environmental health academic programs, use current events to our advantage and engage our current students and attract future professionals?

Social Media

The use of social media has grown tremendously over the last decade. According to Kemp (2020), there are roughly 3.8 billion social media users across the globe and that number is expected to grow. With its exponential growth, it is not surprising that social media has become an important tool and marketing platform for a myriad of businesses, including higher education. Using social media is an excellent way for programs to engage with students using a relatable voice and message on the platforms they use every day. Many social media platforms have the potential to reach hundreds of thousands of prospective

students with minimal effort and cost to the program. When you compare this method to more traditional methods of recruitment—such as vendor events where departments pay an exhibitor fee, have giveaways, and send an individual to the event in order to yield contact with a couple hundred prospective students—it seems that social media engagement is a much more cost-effective method. While we know and understand in-person events are effective, it is becoming increasingly difficult to attend all the necessary events to reach the number of prospective students that a paid social media advertisement could reach. It is particularly important for environmental health programs to increase social media activity in the COVID-19 era as it is unlikely we will even be able to engage at in-person events in the near future. Relying on digital media will be crucial in spreading our message to potential students.

Current Social Media Usage Among Environmental Health Programs

According to a recent report from the National Environmental Health Science and Protection Accreditation Council (EHAC, 2019), "social media tools paled in comparison to methods employing face to face contact by both faculty and fellow students." Facebook was reported as useful by several undergraduate and graduate degree programs; however, YouTube and Twitter were among the least reported recruitment tools with no mention of Instagram or any other social media platforms. Are EHAC programs missing the mark? Are we missing out on this important and cost-effective recruitment and engagement opportunity? If we want to grow our programs, retain and engage our students, meet prospective students, and be more present, we must improve our usage of social media. Social media is an important tool, especially in this era, and we need to use it to our advantage.

Tips on Effectively and Efficiently Using Social Media

While social media platforms are key marketing strategies for entire universities, it is important for individual programs to take the initiative to develop and use their own platforms to get their message out and drive student engagement. The key to an interactive and effective social media presence is to have a strategic plan. Programs must create good content that resonates with students and shines a positive light on what the program can offer. Highlighting student activities, successful alumni, faculty stories and research, internships, and employment opportunities are among just a few of the ways environmental health programs can utilize social media. Utilizing student workers and graduate assistants to assist with social media messaging and posts can also be beneficial for programs. Doing so frees up faculty and staff, allowing the messages to come from individuals in the targeted age group we are trying to reach.

Examples of Social Media Usage: Facebook

In May 2020, Eastern Kentucky University (EKU), an EHAC-accredited program, created a graduation montage video honoring 2020 graduates. The video featured pictures and personal statements from students detailing their time in the Environmental Health Science (EHS) program. Once the video was posted, it received a huge organic response from students, friends, family, and alumni. The department wanted to utilize the video to reach an even broader audience and the post was boosted to target 18–24-year old individuals in the university's service region. With the sponsored post, the video reached over 6,000 people with over 2,700 views and nearly 500 ThruPlays of the entire video. While just one example, it definitely shows how powerful social media can be in reaching and engaging current and prospective students.

Support for Incoming Students

With increasing concern over university budgets, especially after the abrupt disruption the COVID-19 response caused this spring, it is more important now than ever to reach out to incoming students. The EHS Department at EKU contemplated how they could begin relationship building with incoming first-year and transfer students in the COVID-19 era. Such relationships are an important determinant of academic outcomes and retention of students. In fact, Ingraham and coauthors (2018) cite that building authentic relationships with students, modeling caring behaviors, and practicing mutual respect can lead to improved academic outcomes for students. The EKU EHS faculty created individualized messages for all incoming first-year and transfer undergraduate students. The video messages include an introduction from a faculty member and contact information for questions regarding coursework and campus life. The videos were created using Zoom and a free, online editing platform.

While the current pandemic has caused significant challenges for higher education, we are fortunate that it came during a time in which we have the technological advances in place to rise above the challenges and continue to grow our programs and engage our students. The Association of Environmental Health Academic Programs challenge its environmental health programs to be creative and innovative during this time. Let us continue to use social media and technology to get our message out there!

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DIRECT FROM ATSDR

The Anniston Community Health Survey

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

Caroline Cusack is an epidemiologist at ATSDR. Marian Pavuk is a lead epidemiologist at ATSDR. Nina Dutton and Tara Serio are Oak Ridge Institute for Science and Education (ORISE) fellows at ATSDR. Eric Yang is currently a statistical analyst at Aspen Dental Management, Inc.

Background

The city of Anniston is located in northeastern Alabama. According to 2018 U.S. Census estimates, the total population in Anniston was nearly 22,000, with Blacks comprising the majority race (50%). Anniston is the site of a production facility that produced polychlorinated biphenyls (PCBs) from 1929–1971. In 1935, the facility was purchased by the Monsanto Company that owned and operated the plant until 1997. PCB production in the Anniston plant ceased in 1971 with a ban on PCB manufacturing in the U.S. occurring shortly thereafter in 1977 (Agency for Toxic Substances and Disease Registry [ATSDR], 2006).

The term PCB refers to any of the 209 PCB configurations, known as congeners, with 1–10 chlorine atoms attached to a molecule composed of two benzene rings (biphenyl). There are no known natural sources of PCBs in the environment. Although some PCBs are volatile and can exist as a vapor in air, PCBs have no known smell or taste. PCBs were widely used as coolant fluids in transformers, capacitors, and electric motors, and in numerous other industrial applications because they are good insulators and do not burn easily. Many commercial PCB mixtures were known in the U.S. by the trade name Aroclor (ATSDR, 2019).

In general, PCBs are lipophilic and are stored in adipose tissue, serum, blood plasma, and human milk (Brown & Lawton, 1984). PCBs are persistent, bioaccumulative and have half-lives greater than 10 years (Ritter et al., 2011). Health effects that have been associated with exposure to PCBs include acne-like skin conditions in adults and neurobehavioral and immunological changes in children. Additionally, PCBs are known to cause cancer in animals (ATSDR, 2019).

During historical production, PCBs could have dispersed in Anniston via air transport (Hermanson & Johnson, 2007) and movement of contaminated soils and water (Alabama Department of Public Health [ADPH], 1996; ATSDR, 2000a, 2000b). During the years of PCB production in Anniston, there were no federal or state regulations governing the manufacture, sale, distribution, disposal, or cleanup of PCBs. An estimated 1 million pounds of PCB-containing solid and liquid waste was deposited in unlined and uncapped landfills south and west of the Monsanto facility (ADPH, 1996). The Anniston community was concerned about all health outcomes, especially cancer, that could possibly impact their health.

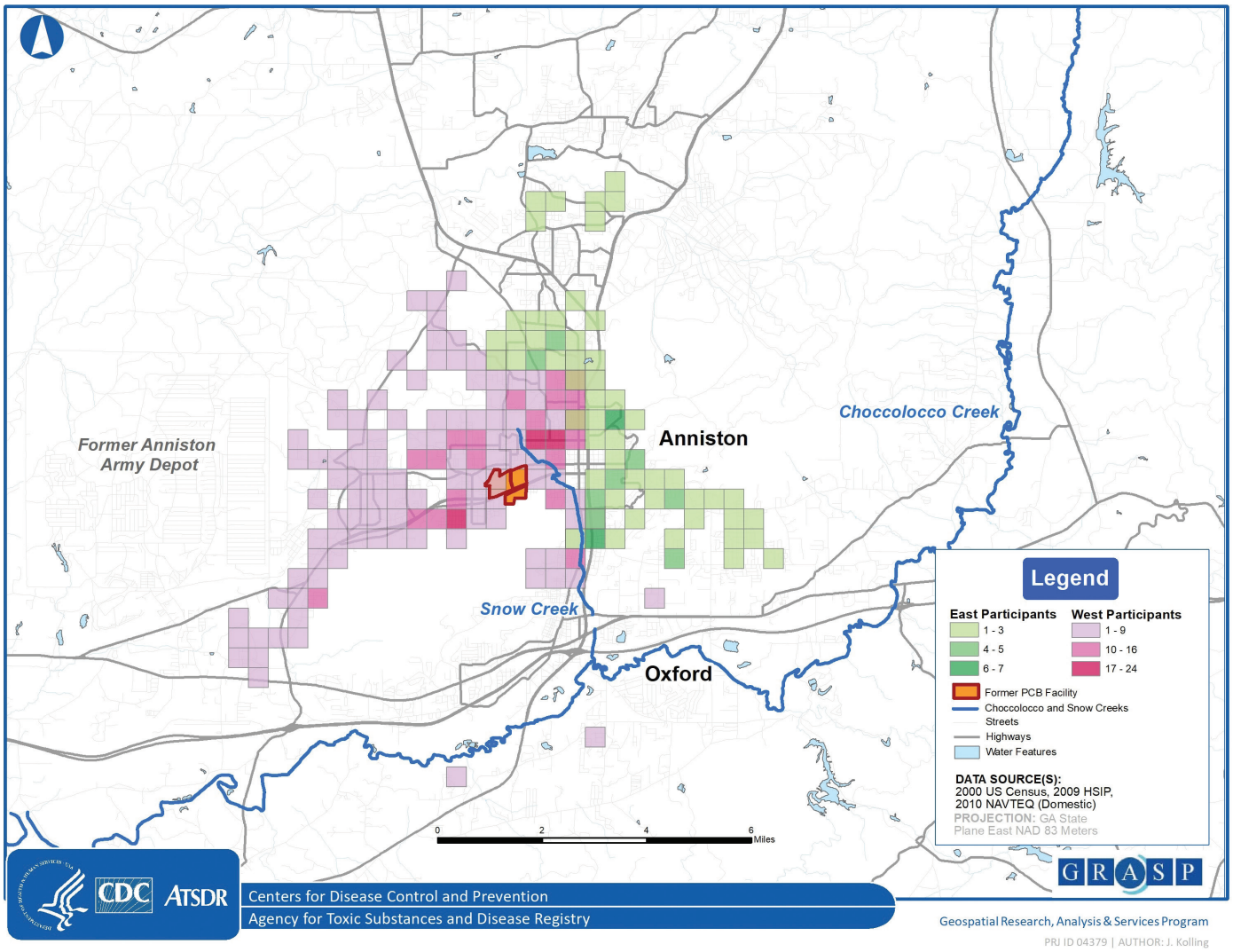
In 2003, the Agency for Toxic Substances and Disease Registry (ATSDR) funded the Anniston Environmental Health Research Consortium (AEHRC), a university and community partnership charged to address the community health concerns about PCBs in Anniston. Through a cooperative agreement with Jacksonville State University and the University of Alabama at Birmingham, the Anniston Community Health Survey (ACHS I) was conducted in 2005–2007. The follow-up study, ACHS II, was funded by the National Institutes of Health (2011–2017) and was conducted in 2014.

ACHS I and ACHS II Program Overview

Under the guidance of AEHRC, the cross-sectional ACHS I study was conducted in

FIGURE **1**

Anniston Community Health Survey (ACHS I) Density of Participants From East and West Anniston



2005–2007 to explore exposure to PCBs and organochlorine pesticides and health outcomes among residents of Anniston. A two-stage stratified random sampling was used to select 3,202 households from a list of residential addresses within the Anniston city limits. Addresses were intentionally oversampled in west Anniston where the former PCB manufacturing facility was located (Figure 1). Oversampling of west Anniston's eligible participants facilitated enrollment of more residents who lived closer to the plant and thus had a higher potential for PCB exposure. Of the addresses identified, 489 were vacant or nonresidential and 890 could not be reached after multiple contact attempts. Contact was made with a member of each of the remaining 1,823 targeted households and 713 declined to participate and 1,110 consented to participate (61% participation rate). Among each of the 1,110 consenting households, one adult resident was randomly selected to complete the survey.

A survey questionnaire was administered by trained interviewers in participant homes or a local study office. The questionnaire was used to collect information on demographics including residential history and residential proximity to the facility, general and sex-specific health histories, current medications, dietary information (including past consumption of meat from locally raised livestock, local fish, home-grown vegetables, and clay), occupational exposures, lifestyle behaviors (e.g., smoking and alcohol consumption), perceptions about environmental PCB contamination and exposure, and knowledge of the litigation against Monsanto.

Fasting blood was collected for analyses of glucose and lipids, the major 35 ortho-substituted PCB congeners, and 9 pesticides and herbicides. The PCB congeners and pesticides were measured in serum using high-resolution gas chromatography/isotope-dilution high-resolution mass spectrometry (Sjödin et

al., 2004). Serum total lipids were calculated with the enzymatic summation method using triglyceride and total cholesterol measurements (Bernert, Turner, Patterson, & Needham, 2007). Blood analysis was completed at the Centers for Disease Control and Prevention's National Center for Environmental Health, Division of Laboratory Sciences in Atlanta, Georgia.

The Anniston Community Health Survey: Follow-Up and Dioxin Analyses (ACHS II) was the follow-up study to ACHS I. Of the 1,110 ACHS I participants, 765 were eligible for ACHS II. Of the remaining 580 participants, 438 were successfully contacted and 359 provided questionnaire and medication data and had their PCBs measured for the second time (57% participation rate). Dioxin-like compound measurements were successfully performed in 338 of the ACHS II participants.

Study Accomplishments

ACHS I and II were designed to examine serum PCB concentrations and a variety of health outcomes (e.g., diabetes, hypertension, stroke, kidney and liver disease, autoimmune diseases) in residents of Anniston, Alabama. The overall goal of ACHS I was to characterize PCB exposure by measuring PCB congeners in blood serum samples in residents living in close proximity to the former PCB production facility and to provide percentile distributions of ΣPCBs and individual PCB congener profiles. The goal of ACHS II was to determine if the body burden of PCBs decreased over time. The follow-up study also collected more information about dietary and other practices that might have influenced exposure to PCBs, in addition to other analytes measured, including dioxins, pesticides, and metals.

For ACHS I, associations with serum PCB concentrations were observed for hypertension, elevated blood pressure, diabetes, and serum lipid profiles (Aminov, Haase, Pavuk, Carpenter, & Anniston Environmental Health Research Consortium, 2013; Goncharov, Bloom, Pavuk, Birman, & Carpenter, 2010; Goncharov, Pavuk, Foushee, & Carpenter, 2011; Silverstone et al., 2012). Compared with the general U.S. population, the summed serum concentrations of 35 ortho-substituted PCBs were about 3 times higher for Black ACHS participants and 2 times higher for White ACHS participants. Generally, the body burden of PCBs increased with age, regardless of race (Pavuk, Olson, Sjödin, et al., 2014).

The combined results of ACHS I and ACHS II indicate that age and race are important determinants of exposure to PCBs in Anniston residents. Additionally, the total years of residency in Anniston, specifically residency in west Anniston, is an indicator of the level of exposure to PCBs in that area. We conclude that the higher PCB exposure among Black participants compared with White participants likely reflect the influence of income and education levels, as well as residential and possibly dietary factors. (Pavuk, Olson, Wattigney, et al., 2014).

Individual PCB results with a cover letter explanation were mailed to each survey participant. For ACHS II, lipid levels, glucose and insulin, liver test, and thyroid hormone levels were also reported to participants. In both studies, participants were provided a toll-free number to ask ATSDR staff questions about their results and a phone number for their physician to ask questions or request additional literature.

As a result of continued interest and questions from the community, ATSDR prepared an Anniston Community Booklet summarizing 16 published journal articles and more than 40 frequently asked questions and answers, to be mailed to all study participants in spring 2020. The cleanup of surface soil on contaminated properties in Anniston, with replacement of surface soil, is an important action by the U.S. Environmental Protection Agency to reduce the potential for future contamination of local foods. Continuing education by the local health department or community groups to keep the community informed, in conjunction with or independent of ATSDR, could reduce anxiety concerning past exposures and minimize future exposures.

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ACCREDITED ENVIRONMENTAL HEALTH SCIENCE AND PROTECTION PROGRAMS

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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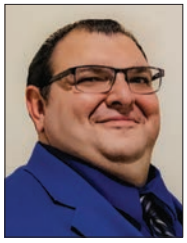

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Modernizing the Foodborne Outbreak Contributing Factors: The Key to Prevention

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

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

David Nicholas is a chief epidemiologist with the New York State Department of Health. Beth Wittry is an environmental health officer with the Water, Food, and Environmental Health Services Branch within CDC.

Foodborne outbreak investigations can be complex, involving investigators from epidemiology, environmental health, and laboratory disciplines. Typically, one role of environmental health investigators is identifying the conditions that enabled or amplified the outbreak (i.e., the factors that contributed to the outbreak). These contributing factors fall into three categories: contamination, proliferation, and survival (Figure 1). For example, if a restaurant worker with norovirus contaminates food with norovirus while preparing it and causes an outbreak, this contamination by the worker is a contributing factor to the outbreak.

Contributing Factor Data Critical to Understanding and Preventing Foodborne Illness Outbreaks

High quality data on outbreak contributing factors help identify food safety failures in the outbreak environment. These data can be used to develop and implement immediate interventions to prevent further illness. When aggregated across all outbreaks in the U.S., these data can help inform new policies to prevent more outbreaks. For example, in 2014, the Centers for Disease Control and Prevention (CDC) analyzed data from investigations of foodborne norovirus outbreaks. These data showed that infected food workers and bare-hand contact with ready-to-eat foods were primary contributing factors to norovirus outbreaks. CDC then developed and released specific recommendations for state and local governments and the restaurant industry on preventing these contributing factors and the outbreaks they cause (CDC, 2014; Hall, Wikswo, Pringle, Gould, & Parashar, 2014).

Contributing Factors List Based on Review of Outbreak Data

Since 1966, CDC has produced summaries of data obtained from foodborne outbreak investigations conducted by state health departments and reported to CDC (www.cdc.gov/fdoss/annual-reports). These summaries for outbreaks occurring from 1972–1997 included data on five contributing factor categories: improper storage or holding temperatures, inadequate cooking, contaminated equipment or working surfaces, food from unsafe sources, and poor personal hygiene. In 1998, CDC started including data on an expanded list of contributing factors in its outbreak summaries to include 15 contamination factors, 12 proliferation factors, and 5 survival factors. This expanded list was developed by federal and state food safety experts after analyses of data from hundreds of outbreak investigations (Bryan, 1978, 1988; Lynch, Painter, Woodruff, & Braden, 2006; Weingold, Guzewich, & Fudala, 1994). CDC reported on these contributing factors through 2008. Food safety experts again revised the list at that time,

FIGURE **1**

Portion of the Centers for Disease Control and Prevention's Contributing Factors Infographic

WHAT ARE CONTRIBUTING FACTORS?

Contributing factors are behaviors, practices, and environmental conditions that lead to outbreaks. Knowing the contributing factors can help us stop outbreaks and prevent future ones.

THERE ARE 3 TYPES OF CONTRIBUTING FACTORS	FOOD PREPARATION PRACTICES THAT CONTRIBUTE TO...	FOR EXAMPLE...
Contamination	Pathogens and other hazards getting into food	A sick food worker handles food with their bare hands
Proliferation	Pathogens in food growing faster	Food is held in a refrigerator that is too warm
Survival	Pathogens surviving a process to kill or reduce them	Food is not cooked long enough or to a hot enough temperature

The full infographic is available at www.cdc.gov/nceh/ehs/publications/cf-infographic.html.

Quick Links

- Foodborne Disease Outbreak Surveillance System (FDOSS): www.cdc.gov/fdoss/index.html
- National Environmental Assessment Reporting System (NEARS): www.cdc.gov/nceh/ehs/nears/index.htm
- Environmental Assessment Training Series (EATS): www.cdc.gov/nceh/ehs/elearn/eats/index.html

albeit minimally, and that list has been in place since 2009.

Recent Revisions to Contributing Factors List Provide Better Data From Outbreak Investigations

In 2018, CDC and New York State Department of Health spearheaded a workgroup to revise and improve the contributing factor list. This workgroup was expanded in 2019, prompted by emerging trends in food preparation and by feedback from investigators on needed changes and inconsistencies across states in interpretation and reporting of contributing factors.

The workgroup was comprised of federal and state food safety experts in both epidemiology and environmental health from CDC, Minnesota, New Hampshire, New York, Tennessee, and Wisconsin. Representatives came from CDC's Foodborne Disease Outbreak Surveillance System (FDOSS) and National Environmental Assessment Reporting System (NEARS) that collect epidemiological data and environmental health data on foodborne outbreaks, respectively.

The workgroup collaborated through a data-driven and science-based process to identify and develop needed revisions (Table 1) that can be categorized into four themes:

1. **Consideration of food supply chain:** Since most outbreaks occur in restaurants, many of the contributing factor definitions were specific to restaurant-related outbreaks and referenced retail federal food safety provisions. Contributing factors, however, can apply throughout the food chain—farms, manufacturers, processors, distributors, and point of preparation, including the home and point of sale. The emerging technique of whole genome sequencing, used to identify foodborne pathogens in specimens from people and in samples from food and the environment, provides the power to identify and confirm the point of contamination in foodborne outbreaks more precisely than ever before. Thus, the contributing factors were revised to allow investigators to specifically indicate the point of contamination, proliferation, and survival, and retail references were removed.
2. **Review of emerging trends:** The workgroup consulted with food scientists and reviewed trends in food processes and in foods and processes associated with outbreaks. These reviews led the workgroup to add, remove, and revise contributing factors to be more comprehensive. For example, because of the rise in the sale of unpasteurized products and in outbreaks caused by them, the workgroup added a survival contributing factor (i.e., no attempt made to inactivate the contaminant).
3. **Review of data:** Through review of contributing factor data, the workgroup identified situations in which a reported contributing factor was scientifically or practically inapplicable to the outbreak. Thus, the workgroup revised multiple contributing factor definitions to improve their clarity and reduce confusion. The data review also identified several overlapping contributing factors. For example, there were two factors focused on proliferation caused by food being held at improper temperatures for a prolonged time period. Thus, the workgroup dropped these two factors and cre-

ated a new one that encompassed the two scenarios (i.e., allowing foods to remain out of temperature control for a prolonged period during food service or display).

4. **Feedback from investigators:** The workgroup solicited feedback from outbreak investigators who reported that contributing factor definitions were unclear, challenging to classify, and inconsistent. They also expressed the need for additional guidance. Thus, the workgroup revised the contributing factor definitions and guidance, as well as added clarifying examples for each factor.

Revised Contributing Factors List Implementation in 2021

CDC will ask state and local investigators to begin using the new definitions and guidance in 2021 (National Outbreak Reporting System/NEARS Guidance for Contributing Factors in Foodborne Outbreak Reports). CDC's Environmental Assessment Training Series shows users how to identify outbreak contributing factors and provides practice in an interactive, virtual outbreak environment. In response to requests from investigators, CDC will also provide additional training on contributing factor identification. NEARS is another tool that can help environmental health investigators identify contributing factors.

The described revisions have improved and modernized the contributing factors, enabling investigators to identify contributing factors more easily during investigations. This progress will ultimately lead to higher quality foodborne outbreak and contributing factor data, prevention of future outbreaks, and improved food safety.

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- Nicole Hedeen and Amy Saupe, Minnesota Department of Health;
- Rachel Klos, Wisconsin Department of Health Services; and
- Zachary McCormick, New Hampshire Department of Health and Human Services.

TABLE **1**

Updated List of Contributing Factors That Will Be Implemented in January 2021

#	Description
Contamination Factors	
C1	Toxin or chemical agent naturally part of tissue in food
C2	Poisonous substance or infectious agent intentionally added to food to cause illness (does not include injury)
C3	Poisonous substance accidentally/inadvertently added to food
C4	Ingredients toxic in large amounts accidentally added to food
C5	Container or equipment used to hold or convey food was made with toxic substances
C6	(New) Food contaminated by animal or environmental source at point of final preparation/sale
C7	(New) Food contaminated by animal or environmental source before arriving at point of final preparation (pre- or post-harvest)
C8	Cross-contamination of foods, excluding infectious food workers/handlers
C9	Contamination from infectious food worker/handler through bare-hand contact with food
C10	Contamination from infectious food worker/handler through glove-hand contact with food
C11	Contamination from infectious food worker/handler through unknown type of hand contact with food or indirect contact with food
C12	Contamination from infectious nonfood worker/handler through direct or indirect contact with food
C13	Other source of contamination (specify)
Proliferation Factors (Bacterial and Fungal Outbreaks Only)	
P1	(Revised) Allowing foods to remain out of temperature control for a prolonged period during preparation
P2	(Revised) Allowing foods to remain out of temperature control for a prolonged period during food service or display
P3	Inadequate cold holding temperature due to malfunctioning refrigeration equipment
P4	Inadequate cold holding temperature due to an improper practice
P5	Inadequate hot holding temperature due to malfunctioning equipment
P6	Inadequate hot holding temperature due to an improper practice
P7	Improper cooling of food
P8	Extended refrigeration of food for an unsafe amount of time, relative to the food product and pathogen
P9	Inadequate reduced oxygen packaging (ROP) of food
P10	(Revised) Inadequate nontemperature dependent processes (e.g., acidification, water activity, fermentation) applied to a food to prevent pathogens from multiplying
P11	Other situations that promoted or allowed microbial growth or toxic production (specify)
Survival Factors (Bacterial, Viral, Parasitic, or Fungal Outbreaks Only)	
S1	Inadequate time and temperature control during initial cooking/thermal processing of food
S2	Inadequate time and temperature during reheating of food
S3	Inadequate time and temperature control during freezing of food designed for pathogen destruction
S4	(Revised) Inadequate nontemperature dependent processes (e.g., acidification, water activity, fermentation) applied to a food to prevent pathogens from surviving
S5	(New) No attempt was made to inactivate the contaminant through initial cooking/thermal processing, freezing, or chemical processes
S6	Other process failures that permit pathogen survival (specify)

Note. New and revised factors have been labeled.

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EH CALENDAR

Editor's Note: Due to the coronavirus disease 2019 (COVID-19) pandemic, many conferences and events are being canceled as organizers assess health and safety issues, as well as take into consideration current state and local orders related to social distancing and gatherings. As such, the status of the conferences listed below might not be correct. Attendees are encouraged to check the websites for each conference listing for the latest information. Any cancellations that occurred prior to the time of press have been noted below.

UPCOMING NATIONAL ENVIRONMENTAL HEALTH ASSOCIATION (NEHA) CONFERENCES

July 12–15, 2021: NEHA 2021 Annual Educational Conference & Exhibition, Spokane, WA, www.neha.org/aec

NEHA AFFILIATE AND REGIONAL LISTINGS

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

Iowa
October 13–15, 2020: Fall Conference, Iowa Environmental Health Association, West Des Moines, IA, www.ieha.net/FallConference2020

Kansas
CANCELED: **September 15–17, 2020: Fall Conference**, Kansas Environmental Health Association, Manhattan, KS, www.keha.us

Missouri
October 19–21. 2020: Annual Education Conference, Missouri Environmental Health Association, Springfield, MO, https://mehamo.org

North Carolina
October 7–9, 2020: Fall Educational Virtual Conference, North Carolina Public Health Association, https://ncpha.memberclicks.net

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

Utah
October 6–9, 2020: Fall Conference, Utah Environmental Health Association, Ogden, UT, www.ueha.org/events.html

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

TOPICAL LISTINGS

Recreational Water
October 15–16, 2020: 2020 Virtual World Aquatic Health Conference, Pool & Hot Tub Alliance, www.wahc.phta.org

Water Quality
January 20–22, 2021: *Legionella* Conference 2020, NSF Health Sciences and NEHA, Chicago, IL, www.legionellaconference.org

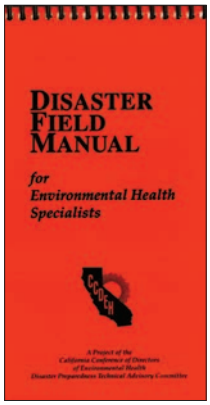
RESOURCE CORNER

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

NEHA BOOKSTORE
www.neha.org/store

Disaster Field Manual for Environmental Health Specialists

California Association of Environmental Health Administrators (2012)

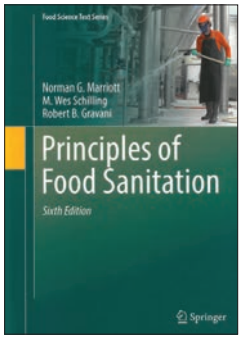


This manual serves as a useful field guide for environmental health professionals following a major disaster. It provides an excellent overview of key response and recovery options to be considered as prompt and informed decisions are made to protect the public's health and safety. Some of the topics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

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

Principles of Food Sanitation (6th Edition)

Norman G. Marriott, M. Wes Schilling, and Robert B. Gravani (2018)

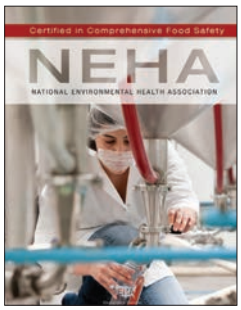


Now in its 6th edition, this highly acclaimed book provides sanitation information needed to ensure hygienic practices and safe food for food industry professionals and students. It addresses the principles related to contamination, cleaning compounds, sanitizers, and cleaning equipment. It also presents specific directions for applying these concepts to attain hygienic conditions in food processing or preparation operations. The new edition includes updated chapters on the fundamentals of food sanitation, as well as new information on contamination sources and hygiene, HACCP, waste handling disposal, biosecurity, allergens, quality assurance, pest control, and sanitation management principles. Study reference for NEHA's Registered Environmental Health Specialist/Registered Sanitarian and Certified Professional–Food Safety credential exams.

437 pages / Hardback
Member: $84 / Nonmember: $89

Certified in Comprehensive Food Safety Manual

National Environmental Health Association (2014)

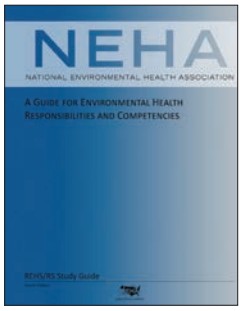


The Food Safety Modernization Act has recast the food safety landscape, including the role of the food safety professional. To position this field for the future, NEHA is proud to offer the Certified in Comprehensive Food Safety (CCFS) credential. CCFS is a mid-level credential for food safety professionals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

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

REHS/RS Study Guide (4th Edition)

National Environmental Health Association (2014)



The Registered Environmental Health Specialist/Registered Sanitarian (REHS/RS) credential is NEHA's premier credential. This study guide provides a tool for individuals to prepare for the REHS/RS exam and has been revised and updated to reflect changes and advancements in technologies and theories in the environmental health and protection field. The study guide covers the following topic areas: general environmental health; statutes and regulations; food protection; potable water; wastewater; solid and hazardous waste; zoonoses, vectors, pests, and poisonous plants; radiation protection; occupational safety and health; air quality; environmental noise; housing sanitation; institutions and licensed establishments; swimming pools and recreational facilities; and disaster sanitation.

308 pages / Paperback
Member: $149 / Nonmember: $179

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NEHA **NEWS**

Note of Thanks to Departing Board Members

The National Environmental Health Association (NEHA) is fortunate to have members who are willing to volunteer their time and energy to NEHA through positions within its board of directors and on committees and work groups, as well as serve as subject matter experts, trainers, and peer reviewers. We would be remiss if we didn't acknowledge the dedication, hard work, and efforts of three members of NEHA's board of directors on the occasion of their departure from the board: Immediate Past-President Vince Radke, Region 1 Vice-President Matthew Reighter, and Region 5 Vice-President Tom Vyles.

Immediate Past-President Vince Radke leaves the board after 5 years of dedicated service and leadership. Radke states, "I have tried to be a good steward for the members of NEHA and for the NEHA staff and board of directors. I will let the members, staff, and board be the judge if I was a good steward or not." He has been a member of NEHA since 1980 and will continue to be a member to improve the health and well-being of people in our communities. In the coming year, Radke will serve as the president of the NEHA past presidents affiliate.

"I have had the privilege to serve the people in environmental health and public health at the local, state, tribal, territorial, federal, and international levels," Radke explains. He has served as president of the National Capital Area Environmental Health Association (NCAEHA) and the Virginia Environmental Health Association. He also served as a NEHA technical advisor in the areas of food safety and emergency preparedness and response.

Radke has been recognized and awarded numerous times for his hard work, dedication, and passion for the profession. He received the Order of the Bifurcated Needle from the World Health Organization in 1980 for his work in the 1970s on the global smallpox eradication program. He was honored twice in 1998 and 1999 with the Jerrold M. Michael Award from NCAEHA. Radke was the recipient of the Secretary's Award for Distinguished Service from the U. S. Department of Health and Human Services for his work during Hurricanes Katrina, Rita, and Wilma. He was awarded the Distinguished Service and Professional Achievement Award from the Environmental Section of the American Public Health Association. In 2011 he received the U.S. Environmental Protection Agency's Bronze Medal Award. In 2013 he received both the Walter F. Snyder Award from NSF International and NEHA and the NEHA Past Presidents Award. And in 2015, Radke was honored to receive the Excellence in Leadership Award from the National Center for Environmental Health at the Centers for Disease Control and Prevention.

"I was able to accomplish what I did because I had good people along the journey," reflects Radke. "Therefore, I leave you with a quote I used when I started my NEHA presidency. It is an old African proverb: If you wish to go quickly, go alone. If you wish to go far, go together."

Region 1 Vice-President Matthew Reighter leaves the board after 3 years of dedicated service and leadership. Over the past 2 years, he served as chair of the Global Engagement and Strategy Committee. In addition, he served as a committee member for the Affiliate Engagement, Credentialing, and Nominations and Elections committees.

Reighter worked as an environmental health specialist for more than 8 years in California prior to taking a role with Starbucks as a quality assurance manager. In this position he was responsible for the regulatory compliance and safety of new beverage innovation projects. Currently, he manages a small team that is responsible for the implementation and sustainment of continuous improvement initiatives within Starbucks' product quality assurance department. While working in California, he served 6 years on the California Environmental Health Association (CEHA) board of directors and served as president from 2015–2016. He was also on the board for the Southern Chapter of CEHA.

"Serving on NEHA's board has given me the opportunity to broaden my environmental health network while allowing me to give back to a profession that more often than not isn't given the credit it deserves," states Reighter. "It's a bittersweet end to nearly 12 years of service to the environmental health profession between my stints with NEHA and CEHA. I wouldn't change a thing and even though I'm stepping away from a board position, that service will never end. The connections and friendships I have been able to cultivate over that time are irreplaceable and the experiences have helped me develop into the professional I am today. I highly recommend that environmental health professionals who are looking for ways to support the profession or to take the next steps in their careers consider getting involved with an environmental health association at the local, state, or national level."

Region 5 Vice-President Tom Vyles leaves the board after 3 years of dedicated service and leadership. He is presently the environmental health manager with the Town of Flower Mound in Texas. The town is a medium-sized municipality in the Dallas/Fort Worth metroplex. Most of Vyles other outside work involves recreational water stan-

dards. He is currently on the Council of Public Health Consultants with NSF International and is the NSF Standard 50 chairperson. He is also a member of the Council for the Model Aquatic Health Code and the Pool & Hot Tub Alliance's Recreational Water Standards Committee.

"Serving on the NEHA board of directors was a big career highlight," reflects Vyles. "It gave me an opportunity to work with and meet some fantastic people. I will miss traveling around my region to various conferences and meeting new people."

NEPHIP Goes Remote During COVID-19 Pandemic

By Christine Ortiz Gumina, MPH (ppd@neha.org)

NEHA administers the National Environmental Public Health Internship Program (NEPHIP) that is supported by a cooperative agreement (CDC-RFAOT18- 1802) with the Centers for Disease Control and Prevention. NEPHIP's objective is to encourage environmental health students, through a 10-week in-person travel internship, to consider careers at local, state, or tribal environmental public health departments following graduation. Through this internship program, students are exposed to the exciting career opportunities, benefits, and challenges of working with environmental public health agencies throughout the U.S.

Students who apply must be from a National Environmental Health Science and Protection Accreditation Council (EHAC)-accredited environmental health academic program. Selected students receive a base stipend to cover expenses with an additional relocation stipend available to support costs if the student relocates for the internship. NEHA's role in NEPHIP is to help build new relationships between accredited environmental health academic programs and local, state, and tribal environmental public health departments.

To be considered as a host, health departments or environmental health programs must meet several different criteria that include:

- providing opportunities for student interns to experience multiple environmental health programs and activities throughout the internship,
- providing short-term work and experiences with other governmental health agencies, and
- identifying and assisting the student in completing an independent project that focuses on solving a current or future environmental health problem.

Students enrolled at EHAC-accredited environmental health academic programs who are junior or senior undergraduates or graduates are eligible for this program. The criteria for students are the submission of an unofficial transcript with at least 1 year of environmental health intensive courses with a minimum GPA of 3.0 in environmental health coursework, two essay responses prompted by NEHA, and a letter of recommendation from an academic staff member from their currently enrolled program.

The internships typically start in early June with students traveling to various locations around the country including Alaska, Florida, Rhode Island, and Texas, to name a few. In early March 2020 it became clear that the current COVID-19 pandemic would possibly affect the summer 2020 NEPHIP student program. Health departments were struggling to respond and were overwhelmed. Universities and colleges were closing their doors to protect staff and students. NEPHIP's lead project coordinator, Christine Ortiz Gumina, leveraged partnerships between the selected host health departments, directors of environmental health programs, and EHAC Director Leslie Mitchell to come together to provide a robust remote internship that would allow students to continue to work with remote capable health departments throughout the summer.

At the time of writing, the internships are still underway and we look forward to sharing student experiences and assessing how the remote internships were perceived by the students and the host health departments. Please check out www.neha.org/professional-development/students/internships for the latest information on this program.

NEHA History Project

In early 2020, then NEHA President Dr. Priscilla Oliver appointed a committee to study and review the rich history of NEHA, as well as that of the environmental health field. This committee, working in collaboration with NEHA Historian Dick Pantages, is comprised of luminaries within the environmental health profession and includes NEHA members, past presidents, and others. Dr. Leon Vinci serves as the chairperson for the committee. In light of the many advances and new innovations that have occurred in environmental health over recent decades, Dr. Oliver felt it important to establish a think tank to examine where we have been and what we have accomplished, which will position our profession to look to the future.

"It was my goal as NEHA president to create and maintain a culture of 'One NEHA' in our professional organization," stated Dr. Oliver. "Upon going to the 2019 annual meeting of the American Public Health Association (APHA) in Philadelphia, Pennsylvania, I met Dr. Jay Glasser. He gave me a marketing leaflet on the APHA History Project. He inspired me to create the NEHA History Project. I was attracted to an all-inclusive web-based platform for all of NEHA and the possibility of including all states and affiliates. Little did I know there was a great need to pull the fragments of our history together and to involve the distinguished history makers of our profession. We are fully engaged in this endeavor and have organized well. Dr. Vinci has been a great chairperson in developing and maintaining the group and keeping us on target. The 'One NEHA' is being achieved."

This unique committee is charged with making the important history of NEHA and environmental health available to all members of the association, as well as other practitioners, students, and the general public. The members of the committee come from many different areas of the U.S. and represent a variety of environmental health

NEHA **NEWS**

professions. The committee includes distinguished individuals from academia such as Dr. Jack Hatlen and Dr. Herman Koren. Several NEHA past presidents serve on the committee, including Bob Custard, Diane Eastman, Dr. Amer El-Ahraf, Dr. Carolyn Harvey, Harry Grenawitzke, Dr. Priscilla Oliver, Vince Radke, and Chris Wiant. NEHA past presidents Dick Pantages and Dr. Welford Roberts serve on the committee as NEHA historian and assistant historian, respectively. Retired RADM Webb Young represents the uniformed services and Drs. Robert Powitz and Leon Vinci represent the private sector. Rounding out the committee in an ex officio capacity are NEHA President Sandra Long, NEHA First Vice-President Dr. Gary Brown, NEHA Executive Director Dr. David Dyjack, NEHA *Journal of Environmental Health* Managing Editor Kristen Ruby-Cisneros, and NEHA Executive Assistant Lindsi Darnell. "I am so proud to have such a distinguished collection of current and past NEHA leaders from across the country working on this project," commented Dr. Oliver.

The NEHA History Project Committee convened and began deliberations in March 2020. To date, accomplishments include gathering data and historical documents, assembling older tools-of-the-trade, collecting historical artifacts, and reviewing records. Using the previously published *Environmental Health 1937–1987, Fifty Years of Professional Development With the National Association of Sanitarians/National Environmental Health Association* (affectionately referred to as the "Green Book"), a work plan has been established to compile a similar written document. The committee worked to digitalize the Green Book as not many copies are in circulation and it can now be accessed online at www.neha.org/sites/default/files/flipping_book/environmental-health-1937-1987/index.html.

Other products and innovations planned by the committee include the establishment of an electronic platform for easy information access and a home location for a collection of historical artifacts. Dr. Oliver has also invited all NEHA affiliates to participate in and contribute to the project. Innovations from the field, changes in environmental health practice, and the vital role of the affiliates over the years are areas of additional importance that the committee will address. "Environmental health history is your history," stated Dr. Vinci. "We are writing our own history."

By approval of the NEHA board on July 14, 2020, the NEHA History Project Committee was renamed the NEHA History Project Task Force. All forms of input, ideas, and history are welcome and we invite you to share that with the task force. Also, we encourage individuals to reach out if they are interested in joining the task force. For more information, please contact Dr. Vinci at lfv6@aol.com.

Save the Date

NATIONAL ENVIRONMENTAL HEALTH ASSOCIATION

AEC 2021

84th Annual Educational Conference & Exhibition

Spokane, WA • July 12-15

Together a Safer and Healthier Tomorrow

Annual Educational Conference & Exhibition
Spokane Convention Center • Spokane, Washington
Conference - July 12–15 • Pre-Con Workshops - July 10–12

CALL FOR ABSTRACTS

NEHA is currently accepting abstract submissions that discuss the latest advancements in environmental health in both the private and public sectors. Seize this opportunity to share your knowledge with an audience of engaged environmental health professionals for the benefit of a world striving for a safer and healthier tomorrow.

DEADLINE FOR ABSTRACT SUBMISSIONS IS OCTOBER 2

For more details, visit:

neha.org/aec/abstracts

NEHA's Annual Financial Statement

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January 30, 2020

To the Board of Directors
National Environmental Health Association

We have audited the financial statements of National Environmental Health Association (the "Association") as of and for the year ended December 31, 2019 and have issued our report thereon dated January 30, 2020. Professional standards require that we provide you with the following information related to our audit.

Our Responsibility Under U.S. Generally Accepted Auditing Standards

As stated in our engagement letter dated September 20, 2019, our responsibility, as described by professional standards, is to express an opinion about whether the financial statements prepared by management with your oversight are fairly presented, in all material respects, in conformity with U.S. generally accepted accounting principles. Our audit of the financial statements does not relieve you or management of your responsibilities. Our responsibility is to plan and perform the audit to obtain reasonable, but not absolute, assurance that the financial statements are free of material misstatement.

As part of our audit, we considered the internal control of the Association. Such considerations were solely for the purpose of determining our audit procedures and not to provide any assurance concerning such internal control.

We are responsible for communicating significant matters related to the audit that are, in our professional judgment, relevant to your responsibilities in overseeing the financial reporting process. However, we are not required to design procedures specifically to identify such matters.

Our audit of the Association's financial statements has also been conducted in accordance with *Government Auditing Standards*, issued by the Comptroller General of the United States. Under *Government Auditing Standards*, we are obligated to communicate certain matters that come to our attention related to our audit to those responsible for the governance of the Association, including compliance with certain provisions of laws, regulations, contracts, and grant agreements; certain instances of error or fraud; illegal acts applicable to government agencies; and significant deficiencies in internal control that we identify during our audit. Toward this end, we issued a separate letter dated January 30, 2020, regarding our consideration of the Association's internal control over financial reporting and on our tests of its compliance with certain provisions of laws, regulations, contracts, and grant agreements.

Planned Scope and Timing of the Audit

We performed the audit according to the planned scope and timing previously communicated to you in our meeting about planning matters on September 20, 2019.

PRAXITY

To the Board of Directors
National Environmental Health Association

January 30, 2020

Significant Audit Findings

Qualitative Aspects of Accounting Practices

Management is responsible for the selection and use of appropriate accounting policies. In accordance with the terms of our engagement letter, we will advise management about the appropriateness of accounting policies and their application. The significant accounting policies used by the Association are described in Note 2 to the financial statements. As described in Note 2, during the year ended September 30, 2019, the Association adopted Accounting Standards Update (ASU) No. 2016-14, *Not-for-Profit Entities (Topic 958): Presentation of Financial Statements of Not-for-Profit Entities.*

We noted no transactions entered into by the Association during the year for which there is a lack of authoritative guidance or consensus. We noted no significant transactions that have been recognized in the financial statements in a different period than when the transaction occurred.

Accounting estimates are an integral part of the financial statements prepared by management and are based on management's knowledge and experience about past and current events and assumptions about future events. Certain accounting estimates are particularly sensitive because of their significance to the financial statements and because of the possibility that future events affecting them may differ significantly from those expected. There were no significant balances, amounts, or disclosures in the financial statements based on sensitive management estimates.

The disclosures in the financial statements are neutral, consistent, and clear.

Difficulties Encountered in Performing the Audit

We encountered no significant difficulties in dealing with management in performing and completing our audit.

Disagreements with Management

For the purpose of this letter, professional standards define a disagreement with management as a financial accounting, reporting, or auditing matter, whether or not resolved to our satisfaction, that could be significant to the financial statements or the auditor's report.

We are pleased to report that no such disagreements arose during the course of our audit.

Corrected and Uncorrected Misstatements

Professional standards require us to accumulate all known and likely misstatements identified during the audit, other than those that are trivial, and communicate them to the appropriate level of management.

We did not detect any misstatements as a result of audit procedures.

Significant Findings or Issues

We generally discuss a variety of matters, including the application of accounting principles and auditing standards, business conditions affecting the Association, and business plans and strategies that may affect the risks of material misstatement, with management each year prior to our retention as the Association's auditors. However, these discussions occurred in the normal course of our professional relationship, and our responses were not a condition of our retention.

To the Board of Directors
National Environmental Health Association

January 30, 2020

Management Representations

We have requested certain representations from management that are included in the management representation letter dated January 30, 2020.

Management Consultations with Other Independent Accountants

In some cases, management may decide to consult with other accountants about auditing and accounting matters, similar to obtaining a "second opinion" on certain situations. If a consultation involves application of an accounting principle to the Association's financial statements or a determination of the type of auditor's opinion that may be expressed on those statements, our professional standards require the consulting accountant to check with us to determine that the consultant has all the relevant facts. To our knowledge, there were no such consultations with other accountants.

Very truly yours,

Plante & Moran, PLLC

Ryan D Sells

Ryan Sells, CPA

National Environmental Health Association

Statement of Activities and Changes in Net Assets

Year Ended September 30, 2019
(with comparative totals for 2018)

	2019			2018
	Without Donor Restrictions	With Donor Restrictions	Total	Total
Revenue and Gains				
Program and partnership development	$ 2,148,242	$ -	$ 2,148,242	$ 1,688,144
Annual Education Conference	941,288	-	941,288	1,271,869
Credentialing and education	768,780	-	768,780	794,630
Membership dues	500,565	-	500,565	492,183
Journal of environmental health	149,546	-	149,546	131,942
Contributions	19,614	7,191	26,805	10,461
CDC/NEHA ICLB conference	-	-	-	161,249
Hurricane supplemental	2,396,756	-	2,396,756	42,196
Publications	40,474	-	40,474	24,295
Entrepreneurial Zone	1,706,298	-	1,706,298	1,232,004
Investment income - Net	57,613	460	58,073	63,070
Miscellaneous income	32,245	-	32,245	19,413
Total revenue and gains	8,761,421	7,651	8,769,072	5,931,456
Expenses				
Program services:				
Grants, contracts, and subawards	4,682,035	-	4,682,035	1,704,198
Special projects	2,635,017	-	2,635,017	2,416,729
Total program services	7,317,052	-	7,317,052	4,120,927
Support services - Management and general	1,031,230	-	1,031,230	1,281,774
Total expenses	8,348,282	-	8,348,282	5,402,701
Increase in Net Assets	413,139	7,651	420,790	528,755
Net Assets - Beginning of year	2,145,232	91,223	2,236,455	1,707,700
Net Assets - End of year	$ 2,558,371	$ 98,874	$ 2,657,245	$ 2,236,455

The information in this statement is derived from audited financials; the entire audited report can be obtained by contacting NEHA.

DirecTalk
continued from page 58

threats and many are being thrown into circumstances for which they are not trained and educated. Training and travel budgets are being slashed or outright suspended.

Alternately, there are many opportunities created by COVID-19 that merit serious consideration. New emphasis on telework, remote inspections, and reduced corporate travel costs are among the issues worth a second glance. While we are at it, I humbly believe our educational institutions could do us a solid by revitalizing conversations around the obligations of modern civil society. Let's start with why real men should wear masks and practice physical distancing during a pandemic. Let's look at the economic and personal benefits of a healthcare enterprise that provides preventive services at low or no cost. Let's explore why local environmental health programs are foundational to life as we know it and why what happens in China matters to those of us who live in Maryland, or Nebraska, or Saipan. Climate change is largely man-made and not inevitable.

Robin's nest pre-raven (left) and post-raven (right). Photos courtesy of David Dyjack.

The people who forged our new nation in the 18th and 19th centuries were bold, courageous, and independent. Americans admire those qualities. Regretfully, the moment has arrived for us to embrace a new national identity that is fashioned from a contemporary fabric. One that recognizes and values diversity, equity, and inclusion. One that increases investments in prevention from 2% of healthcare costs to 4–5%. One where we recognize in an increasingly crowded biosphere that we are indeed our brother's keeper in that a disease anywhere is a disease everywhere.

When the raven flies nearby, avian scouts cry out an alarm to alert their community to the presence of the menace. Tiny birds act as a collective to ward off the leviathan. Our raven is old thinking. This scout is sounding the alarm.

Dave

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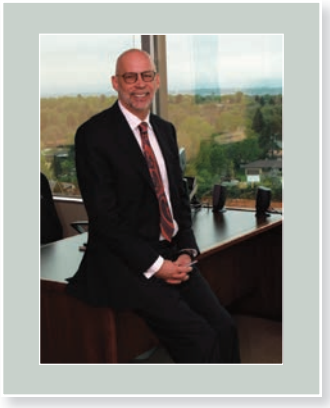
DirecTalk MUSINGS FROM THE 10TH FLOOR



David Dyjack, DrPH, CIH

The Raven

Savagery, pure and simple. The raven seemed unfazed by the cloud of the victim's angry and agitated family members as it inserted its beak into a nesting cavity of much smaller birds and brusquely removed a tiny, wriggling pink mass. The winged beast causally flew off to dismember and digest its meal. I endured the spectacle of the raven returning again and again over a 2-hour period to eat multiple baby birds. Edgar Alan Poe is smirking somewhere in the ether.

Darwinism can be painfully disquieting. Contemporary developments in environmental health and more broadly in public health, however, are by contrast not natural selection at work. Hostile residents, political ineptness, and mixed messages from elected leadership are not inevitable manifestations of evolution. Prevailing societal attitudes that have given rise to >150,000 COVID-19 deaths in the U.S. (as of press) are the spawn of our European forefathers.

American immigrants in the 18th and 19th centuries were by all accounts a tough bunch—independent, resourceful, rugged, and determined. Those are darn fine qualities for humans with a penchant for clearing and living off the land. Those same attributes in 21st century America, while laudable in certain circumstances and in measured doses, are literally killing us, devastating the economy, and dismantling the fabric of society.

Just before Memorial Day weekend I drove virtually nonstop for 13 hours from Maryland to Florida to deposit my wife Angela at our daughters' home where she quarantined while waiting for the birth of our first grandchild.

> *The moment has arrived for us to embrace a new national identity.*

Route 95 on the eastern seaboard is a boring and monotonous excuse for a road, punctuated by intermittent scenes of feral swine foraging in the leaf litter. Wild pigs are modestly amusing when observed at a distance but the further we traveled south, the more disturbed I became. I intermittently stopped for fuel and stretch breaks and noticed an increasingly more perplexing sight—people not wearing face coverings, ignoring physical distancing recommendations, and gathering in large groups. Whiskey. Tango. Foxtrot.

The contrast to Maryland was palpable where face coverings are required to enter public buildings and public health authorities are generally respected. By the time we arrived in Orlando, it seemed like I landed on a foreign planet. I estimated that approximately 40–50% of the shoppers in a well-recognized Orlando grocery store were oblivious to basic COVID-19 public health recommendations. I mentioned to my family that I had a bad feeling about the lackadaisical impression Floridians were sending me.

Since Memorial Day, Alabama, Arizona, Florida, Louisiana, and Texas have suffered a COVID-19 resurgence with discussions of returning to lockdown resurfacing. The same independent, rugged, and determined sensibilities that characterized the birth of this nation are now eroding away our foundations. There are numerous reports of local and state health officials being harassed and threatened by gun carrying, rowdy, independent residents who feel their rights and financial well-being are being compromised by underpaid public servants. According to my friends at the National Association of County and City Health Officials, over 20 of their members have recently quit or retired in large measure due to threats to them or their families.

In entrepreneurial circles it is generally understood that people who are gifted at starting companies are not so great once the enterprise begins to mature from infancy to middle age. The adrenaline surge of new ideas and rush to the market must increasingly be substituted with professionals who create value chains, analyze performance reports, and endure investor scrutiny. Our country is no longer reliant on a "pull yourself up by your bootstraps" mentality. To be successful over the long haul we should increasingly embrace altruism in its purest form. The good of the nation and the individuals who resides in it must take precedent over a "don't tell me what to do" sentiment.

I have spoken to many of our association members over the last several weeks and what I am hearing is appalling. Some have not had a down day since the beginning of the outbreak. Others have accrued hundreds of comp time hours that they will never be able to enjoy. Some are resigning because of

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