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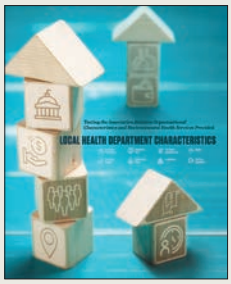

This month's cover article, "Organizational Characteristics of Local Health Departments and Environmental Health Services and Activities," explores the association between organizational characteristics of local health departments and the environmental health services rendered in the community. The study identified eight different organizational characteristics to determine their association to 34 environmental health services. While all the available organizational characteristics had association with some of the environmental health services, the variation of environmental health services provided in communities could also be explained by a combination of factors such as fee generation, community needs, type of governance, and population size.

See page 20.

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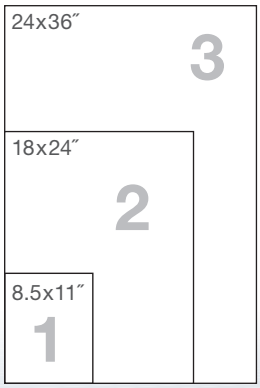

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PRESIDENT'S MESSAGE

Adam London,
MPA, RS, DAAS

Gone Starfishin'

When my son Samuel was about five years old, his favorite things in the whole world were starfish. He was absolutely fascinated by these unique marine invertebrates. I don't know what triggered this affection, but it seemed to consume him for many months. For those of you who are parents, I'm sure you have similar stories of children obsessed with seemingly random interests. We had crayon-colored pictures of starfish on the refrigerator, on his walls, on the floor—everywhere. Instead of cartoons, he would ask us to show him starfish videos from the Internet. I was glad that he had taken an interest in nature and science, but I was a bit perplexed when he asked me to take him "starfishing" at the pond.

As you may know, we live in Michigan—ground zero for the world's largest accumulation of freshwater. No starfish. I explained to Sam that starfish only live in the salty oceans. I even offered to take him to the zoo to see the starfish in their aquariums. He frowned with disappointment and told me that maybe people think there are no starfish in the pond because nobody took the time to look. You can probably guess where this story is going. We grabbed a bucket, pulled on our boots, and headed to the pond for a starfishing expedition.

Perhaps to nobody's surprise (except for Sam's), we did not discover a new species of freshwater starfish. We did, however, find three painted turtles, a dead bluegill, a snail with a really cool shell, some colorful mushrooms, an old pocketknife, and a whole bunch of mallard ducklings. We also discovered some new trails, an old treehouse, and a couple other little boys (with their dad in tow) looking for snakes. Sam joined in the snake hunt and made a couple of new friends. Despite getting skunked in the starfish category, I think we both discovered several lessons learned.

I believe there are many untapped ways for environmental health to improve the world around us if we are willing to be curious.

Believe it or not, there is a moral behind the story of the starfishing trip that applies to all of us. As environmental health professionals, I have noticed that we tend to do two things: 1) complain about being too closely bound to our "three-legged stool" of food, water, and wastewater; and 2) cling to that three-legged stool with all our might. I have heard many variations of these tendencies from environmental health professionals from every corner of the country. We hold fast to the programs we are familiar with while lacking the resources to investigate other problems. Meanwhile, we are surrounded by a world full of illness and injury and we are somewhat reluctant to apply our environmental health expertise to these issues unless they appear related to food safety, water quality, or wastewater management. To be clear, these three issue domains are incredibly important and should always be central to our profession. We should continue to make those issues priorities while also aspiring to discover new opportunities. As a profession, we need to be intentional about looking for aspirational objectives. We may or may not achieve the original mission, but we may discover unexpected opportunities and meet new friends and allies.

As an example, for the longest time we have complained that all the money is in healthcare delivery and that society does not truly invest in prevention. We have accepted this assumption as an unmovable parameter of the way things are. This assumption is the "starfish don't live in freshwater" problem. The problem with this assumption is that it excludes the possibility of change and extinguishes any hope for creative problem solving. Regardless of your opinions about the Affordable Care Act, most people support its requirement for hospitals to conduct community health needs assessments and to invest a portion of their revenue into population health initiatives for the advancement of community benefits. For many of us, the ability to apply environmental health solutions where regulation is nonexistent has been limited by lack of government funding. The availability of these community benefit dollars from healthcare systems represents

one opportunity for environmental health to make a case for new interventions.

My challenge for you this month is to resist homeostasis and find out how your area is spending community benefit dollars and how you might inform the process with environmental health knowledge. Keep in mind that you might not find the solutions you are looking for, but you could find resources and connections that can help solve other problems. Go starfishing—who knows what you'll find!

I believe there are many untapped ways for environmental health to improve the world around us if we are willing to be curious. I hope as you read this issue of the *Journal of Environmental Health*, you will learn something that will inspire you to think of new solutions. I also hope you can join us in Anaheim, California, for the NEHA 2018 Annual Educational Conference & Exhibition and HUD Healthy Homes Conference, June 25–28. Conference and hotel information are now available on NEHA's website at www.neha.org/aec. Bring your family if you can—I'm probably going to bring Sam. He's a few years older now and the starfish phase has passed, but rumor has it that Anaheim isn't too far from the Pacific Ocean. Maybe I can talk him into another starfishing trip!

adamelondon@gmail.com

Did You Know?

Registration will open on April 10 for NEHA's second Enhancing Environmental Health Knowledge (EEK): Vectors and Public Health Pests Virtual Conference, May 15–16. The EEK Virtual Conference is designed to enhance the knowledge of environmental health professionals to help them respond to environmental events of public health concern, as well as bring professionals together to exchange information and discover new solutions to issues in vectors and public health pests. The virtual conference is free to attend. Learn more at www.neha.org/eh-topics/vectors-and-pest-control-0/eek-virtual-conference-2018.

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Rapid Identification of a Cooling Tower-Associated Legionnaires' Disease Outbreak Supported by Polymerase Chain Reaction Testing of Environmental Samples, New York City, 2014–2015

Isaac Benowitz, MD
Epidemic Intelligence Service, Centers for Disease Control and Prevention

Robert Fitzhenry, PhD
Christopher Boyd
New York City Department of Health and Mental Hygiene

Michelle Dickinson, MPH
New York State Department of Health

Michael Levy, ScD
Montefiore Medical Center

Ying Lin
New York City Department of Health and Mental Hygiene

Elizabeth Nazarian, MT (ASCP)
New York State Department of Health

Belinda Ostrowsky, MPH, MD
Montefiore Medical Center

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Jennifer Rakeman, PhD
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Amy Saylors
New York State Department of Health

Elena Shamoonian
Montefiore Medical Center

Terry-Ann Smith, MS
Sharon Balter, MD
New York City Department of Health and Mental Hygiene

Abstract

We investigated an outbreak of eight Legionnaires' disease cases among persons living in an urban residential community of 60,000 people. Possible environmental sources included two active cooling towers (air-conditioning units for large buildings) <1 km from patient residences, a market misting system, a community-wide water system used for heating and cooling, and potable water. To support a timely public health response, we used real-time polymerase chain reaction (PCR) to identify *Legionella* DNA in environmental samples within hours of specimen collection. We detected *L. pneumophila* serogroup 1 DNA only at a power plant cooling tower, supporting the decision to order remediation before culture results were available. An isolate from a power plant cooling tower sample was indistinguishable from a patient isolate by pulsed-field gel electrophoresis, suggesting the cooling tower was the outbreak source. PCR results were available <1 day after sample collection, and culture results were available as early as 5 days after plating. PCR is a valuable tool for identifying *Legionella* DNA in environmental samples in outbreak settings.

Introduction

Legionnaires' disease (LD) is a severe pneumonia that can be accompanied by gastrointestinal and neurologic symptoms. Risk factors include smoking, age >50 years, and comorbidities. Onset occurs 2–10 days after exposure to *Legionella*, a genus of intracellular gram-negative bacteria found in water and soil. *L. pneumophila* serogroup 1 (LP1) causes 65–90% of cases for which there is a bacterial isolate (Bennett, Dolin, & Blaser, 2014). The majority of cases are diagnosed by urine antigen test (UAT), a rapid test that is highly sensitive and highly specific for LP1 and is widely available in acute care settings. Identification of the environmental source relies on comparison of patient isolates and environmental isolates by molecular techniques. Culture of respiratory specimens is necessary to obtain patient isolates, but LD patients might not produce sputum, specimens are not routinely cultured on *Legionella*-specific media, and specimens are less likely to yield positive culture results if they are collected after a patient has begun antibiotic therapy.

LD outbreaks have occurred from exposure to bioaerosols from cooling towers, decorative fountains, hot tubs, market misting systems, and potable water systems in hospitals, hotels, and residential buildings (Cunha, Burillo, & Bouza, 2016; Fraser et al., 1977; Haupt et al., 2012; Mahoney et al., 1992). Cooling towers have caused large community outbreaks including an outbreak with 334 cases in Portugal in 2014 and an outbreak with 449 confirmed cases in Spain in 2001, and likely have caused many sporadic cases (Bhopal & Fallon, 1991; García-Fulgueiras et al., 2003; Shivaji et al., 2014). Bioaerosols from cooling towers can travel substantial distances and have caused illness among persons up to 11.6 km away from a source (White et al., 2013). Recovery of a bacterial isolate by culture is the standard for identification of *Legionella* in the environment. PCR can detect *Legionella* DNA, but does not indicate the presence of viable bacteria or provide a quantitative measure of the degree of contamination.

An estimated 8,000–18,000 cases of LD requiring hospitalization occur annually in the U.S. (Marston et al., 1997). Approximately

200–300 cases are reported annually in New York City; the age-adjusted incidence rate rose from 0.6/100,000 population during 2000 to 2.5/100,000 population during 2014, peaking at 3.4/100,000 population during 2013 (New York City Department of Health and Mental Hygiene [DOHMH], 2015a). This rise might be due to increased use of UAT by healthcare providers, an increase in the population at risk, or changes in the number and maintenance of cooling towers and their colonization by *Legionella* (Farnham, Alleyne, Cimini, & Balter, 2014). During 2000–2013, Bronx County had between 7–72 cases/year (crude rate 0.5–5.2 cases/100,000 population/year).

Clinical laboratories in New York City report positive *Legionella* test results to the New York City Department of Health and Mental Hygiene (DOHMH). For each case, DOHMH personnel review medical records to confirm illness and interview the patient or a close relative to determine possible *Legionella* exposure sources at home, work, healthcare settings, or associated with travel. Identification of a cluster of cases in space and time without a common building exposure indicates an outdoor exposure to a cooling tower or other outdoor aerosol source. An epidemiologist reviews all cases for common exposures and we also detect clusters at the city-, county-, and neighborhood- (multiple ZIP code) levels with a weekly automated system that compares the number of cases diagnosed in the past 4 weeks with that period and the prior and following 4-week periods in the previous 5 years, a modified historical limits method (Levin-Rector, Wilson, Fine, & Greene, 2015).

In December 2014 we identified a cluster of LD cases through a combination of epidemiologist review and automated cluster detection. All cases were located in Co-op City, a 1.3-square-kilometer residential neighborhood in northeastern Bronx County that is home to 60,000 persons, many retired, living in 15,372 residential units, including 14,900 apartments in 35 high-rise towers (24–33 floors) and 472 townhouses in 7 groups. All of Co-op City is contained within ZIP code 10475.

On December 1, 2014, the automated system reported nine cases among persons living in Bronx County (a larger area surrounding Co-op City) over the prior 4 weeks. Review of the four completed interviews found no common building exposures but found that two patients resided in Co-op City. On December 22, the automated system reported 12 cases among persons living in Bronx County over the prior 4 weeks, including four cases in Co-op City. We investigated to determine the magnitude and source, and to prevent further illness.

Methods

Case Surveillance

We defined an outbreak-associated case as LD diagnosed by UAT or culture and radiographic evidence of pneumonia in a person who lived in Co-op City with illness onset during November 2014–January 2015. Initial investigations found no common buildings visited by five patients.

On January 6, 2015, we alerted healthcare providers in New York City about the increase in cases in Bronx County and asked them to collect respiratory tract specimens to culture for *Legionella* from patients with respiratory symptoms, consider treating those patients for LD, and send isolates to the New York City Public Health Laboratory (PHL) (DOHMH, 2015b). We asked hospital infection control staff to identify stored respiratory tract specimens from recent patients with respiratory symptoms and to culture these specimens for *Legionella*. DOHMH held a community meeting in Co-op City on January 13 and issued a press release to inform the community about this investigation.

Environmental Investigation

At the time, there was no definitive source of information on the locations of cooling towers in New York City. We identified possible environmental sources in Co-op City—including cooling towers, markets with misting systems, and decorative fountains—by using environmental assessments, patient interviews, review of satellite imagery, and field visits. We also identified cooling towers in city administrative data for building owners who had requested a financial credit for wastewater reduction.

We collected samples at all identified environmental sources. Water and swab samples were collected at multiple points in cooling towers and the other suspected sources; pH, chlorine, and temperature were also tested. At cooling towers, we sampled from the surface of the cooling tower water pool, which could reflect aerosol content, and from stagnant water and biofilm, which are thought most likely to harbor bacterial overgrowth. Water samples were stored in 500 mL sterile containers treated with sodium thiosulfate (0.5 mL of a 0.1 N solution). We reviewed cooling tower maintenance practices for any deficiencies.

Samples were split between PHL and the New York State Department of Health Wadsworth Center (WC). Health department security staff transported samples by car overnight to WC for next-day testing. Environmental samples were screened for *Legionella* DNA at WC by a previously described real-time PCR assay to detect and differentiate *Legionella* species, *L. pneumophila*, and *L. pneumophila* serogroups 1–16; the assay includes an internal control for inhibitory substances. Validation testing suggested that a negative PCR result does not need to be confirmed with bacterial culture (Mérault et al., 2011; Nazarian, Bopp, Saylors, Limberger, & Musser, 2008).

Samples in which *Legionella* DNA was detected were processed and cultured starting on the same day, at WC and PHL, to obtain *Legionella* isolates. Environmental isolates and patient isolates were serogrouped by direct fluorescent antibody testing and typed by pulsed-field gel electrophoresis (PFGE) by Sfi1 digest (Sabrià et al., 2001). PFGE patterns of patient isolates and environmental LP1 isolates were compared using BioNumerics software.

Results

Case Surveillance

We identified eight cases in Co-op City through routine surveillance. Illness onset ranged from November 4–December 28, 2014, and diagnosis ranged from November 9, 2014–January 6, 2015. New cases were reported to the health department in every week of December; the last case was reported on January 8. All patients were male. Seven (88%) were smokers. Four (50%) had underlying comorbidities including diabetes, cardiovascular disease, chronic hepatitis C, chronic kidney disease, asthma, hypertension, and HIV. The mean age was 57.5 years (range 29–69 years). All were hospitalized, and none died. Sputum from one patient grew *Legionella* and an isolate was sent to PHL. Two (25%) lived in the same building.

Surveillance is ongoing in New York City and no additional cases have been subsequently reported in residents of Co-op City in the following 6 months after the last case described here.

Environmental Investigation

We located two active cooling towers in Co-op City, both within 1 km of all case patient homes. One cooling tower was located at a 40-megawatt power plant and had five cells, including two that ran year round and three that ran during April–October each year. A second cooling tower was located on top of a shopping mall and had one cell that ran year round. We also identified an inactive cooling tower.

Environmental assessment of the residential complexes revealed a community-wide closed-loop water system that ran to all Co-op City housing units and passed hot or cold water over coils for heating or cooling, resupplied by municipal water. One market had a vegetable misting system, but no patients had visited that market. We sampled all of these sites, apartments where two patients lived, and the municipal water supply. We found no decorative fountains or whirlpool spas in Co-op City.

PCR screening detected LP1 at the power plant cooling tower and *L. pneumophila* serogroup 6 (LP6) at the power plant cooling tower and at the mall cooling tower. The community-wide closed-loop water system, market misting system, residential housing, and municipal water had no detectable *Legionella* DNA, with all results received <1 day after specimen collection (Table 1).

After PCR detected LP1 at the power plant cooling tower, which was also the only known source with a wide aerosol distribution that could account for all cases, we proceeded to require its shutdown and remediation. On January 9, the same day LP1 DNA was detected by PCR, a health commissioner order was sent to power plant staff and the cooling tower was shut down; remediation began January 12 after development of a remediation plan. After three rounds of shock disinfection, no further LP1 grew in samples collected on January 26. The power plant cooling tower resumed operation on January 26 during extreme cold weather, as the plant power was needed to provide power and heat to the community.

Culture, isolation, and typing were completed later: LP1 grew in samples from the power plant cooling tower and LP6 grew in samples from the power plant cooling tower and the mall cooling tower, with results received on January 14, 5 days after PCR results. Samples from other locations were not placed in culture after testing negative by PCR. LP1 from the power plant cooling tower was indistinguishable from the patient isolate by PFGE (Figure 1, lanes 3–5).

TABLE **1**

Detection of *Legionella pneumophila* in Environmental Samples, New York City, 2014–2015

Sampling Location	PCR*	Culture*	Serogroup
Power plant cooling towers	29/30	27/30	LP1, LP6
Shopping mall cooling tower	8/10	1/8	LP6
Residential housing (two apartments)	0/23	–	–
Community-wide closed-loop water system	0/4	–	–
Vegetable misting system in market	0/5	–	–
Public potable water supply	0/2	–	–

PCR = polymerase chain reaction; LP1 = *L. pneumophila* serogroup 1; LP6 = *L. pneumophila* serogroup 6.
*Results are number of positive samples divided by total samples tested. Only specimens positive or inconclusive for *L. pneumophila* by PCR were cultured; negative specimens were not cultured.

Legionella testing at the power plant cooling tower occurred once per year in the summer, most recently in July 2014, with no *Legionella* detected in 7 years of operation. Review of maintenance records from August–December 2014 revealed that staff had changed the disinfection biocide in August 2014 from a bromine-based pellet to a chlorine-based liquid, added over a 1-hr period daily with a target total chlorine level of 2–4 ppm. Samples collected 2 hr after the biocide was added were tested for total chlorine; however, the target range was not adjusted for the new biocide formulation and free chlorine was not routinely measured.

Following shutdown and remediation, no *Legionella* grew in follow-up samples collected from the power plant cooling tower every 2 weeks through March 18. Follow-up testing included monthly testing for *Legionella*; for counts >1,000 CFU/mL, remedial action was to be performed by dosing water with a chlorine-based compound equivalent to 5 mg/L of free residual chlorine for at least 1 hr, and then *Legionella* culture was to be performed every 3–7 days until two consecutive negative samples were obtained. DOHMH also recommended that the cooling tower at the mall be shut down and remediated out of an abundance of caution.

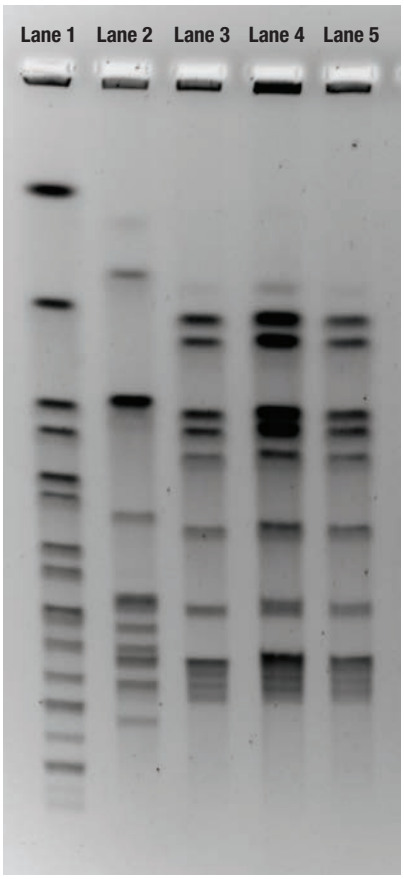
Discussion

We investigated an outbreak of eight Legionnaires' disease cases linked by environmental and laboratory data to an industrial cooling tower at a power plant. This investigation was notable for the use of PCR screening of environmental samples to implicate one cooling tower and support shutting it down for remediation, several days before culture results were available. The implicated cooling tower had a recent change in biocide formulation that might have allowed lower biocide levels and more favorable conditions for *Legionella* growth. Review of cooling tower maintenance plans found deficits; testing identified viable *Legionella* bacteria, both common findings in other cooling tower assessments in New York City and elsewhere (Mouchtouri, Goutziana, Kremastinou, & Hadjichristodoulou, 2010).

Industry guidelines illustrate best practices for testing and maintenance to prevent *Legionella* overgrowth; these interventions, however, might not remove *Legionella* (American Society of Heating, Refrigerating and Air-Conditioning Engineers, 2015; Cooling Technology Institute, 2008). Remediation at this cooling tower required shut-

FIGURE **1**

***Legionella pneumophila* Pulsed-Field Gel Electrophoresis Patterns (Sfi1 Digestion)**



From left to right: lane 1, molecular weight standard H9812; lane 2, historic case (clinical specimen); lane 3, outbreak case (clinical specimen); lane 4, power plant cooling tower (environmental sample 1); and lane 5, power plant cooling tower (environmental sample 2).

down for multiple days and implementation of a water safety plan with more monitoring and data collection to guide improvements in process control. We recommend that all cooling towers should have a written water safety plan and should test regularly to ensure adequate disinfection.

Multiple limitations to this investigation are noted. PCR detects DNA and does not indicate the presence of viable bacteria. Limited sampling from each environmental site might have led to a false negative result when other strains of *Legionella* were present. For patients, UAT primarily detects LP1 but has cross-reactivity for other serogroups; mixed infections are also possible. For seven (88%) cases, we did not have respiratory tract cultures or isolates, which means we do not have information on their strains or serogroups. We also might have missed cases of illness among persons who were not tested for *Legionella* infection or who did not live in Co-op City but were exposed there or nearby.

An increase in cases might reflect increased clinician awareness and testing practices following our health alert; however, only one case was diagnosed after that alert. Finally, during this investigation we were limited to testing those cooling towers that we were able to identify in administrative data or aerial imagery. In August 2015, after a large LD outbreak elsewhere in Bronx County caused by a cooling tower, the New York City Council enacted comprehensive rules for cooling tower registration, testing, and maintenance (City of New York, 2015). That registry identified four additional cooling towers in Co-op City that had not been identified through our initial source-finding methods, highlighting the need for registration systems or other investigative approaches to facilitate public health investigations.

Conclusion

While this outbreak progressed, we were identifying new cases weekly. We were concerned that deaths and more cases might occur before we could identify the source and take public health action. The power plant cooling tower was the most likely source of aerosol that could expose the entire community and we were prepared to require remediation there, but we wanted laboratory evidence of *Legionella* contamination before taking action. Waiting for culture results would have delayed action by several days.

We balanced the importance of rapid source control and remediation with the practical implications of shutting down, cleaning, and testing the power plant that was the sole power source for 60,000 persons, on short notice during a period of extreme cold weather. These actions were also expensive, as the cooling tower operators spent approximately $750,000/week for backup power during the shutdown period.

We were able to obtain PCR results <1 day after sample collection and the cooling tower was shut down 1 day later. Culture results, received as early as 5 days after plating, confirmed the PCR findings. The *Legionella* PCR assay used by WC has an analytic sensitivity of <1 CFU and a specificity of 100%; prior use found substantial agreement with culture (Nazarian et al., 2008). This PCR assay contains a target for inhibitory growth that makes it a valuable tool for screening before culture, because a negative result indicates culture is not needed. Negative PCR results at other possible sources strengthened the evidence for the power plant cooling tower as the source. Since this outbreak, we have incorporated PCR testing for environmental *Legionella* DNA into our protocol for LD investigations to more rapidly identify potential sources. We recommend that other jurisdictions also consider its use in outbreak settings.

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Note: Isaac Benowitz is now a medical officer with the Division of Healthcare Quality Promotion, Centers for Disease Control and Prevention, Atlanta, Georgia. Christopher Boyd is now general manager of the North America Building Water Health Program, NSF International, Ann Arbor, Michigan.

Corresponding Author: Isaac Benowitz, Medical Officer, Division of Healthcare Quality Promotion, Centers for Disease Control and Prevention, 1600 Clifton Road NE, MS A-31, Atlanta, GA 30329.
E-mail: ibenowitz@cdc.gov.

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Relationship Between Priority Violations, Foodborne Illness, and Patron Complaints in Washington, DC, Restaurants (2013–2015)

Temesgen A. Jemaneh, MSc, DrPH, REHS, CP-FS, ASP
District of Columbia Department of Health

Mark Minelli, MA, MPA, PhD
Central Michigan University

Abimbola Farinde, PhD, PharmD
Edward Paluch, PhD
Capella University

Abstract **Most foodborne illnesses reported to health departments originate from food service establishments. The District of Columbia Department of Health conducts periodic inspections to assess the risk of foodborne illness. The occurrence trends of priority violations and their relationships to foodborne illness and resident complaints have not yet been investigated in the District of Columbia. This research studied the relationship between foodborne illness complaints reported by patrons and observed priority violations in food establishments. This study used a nonexperimental quantitative methodology that relied on preexisting data, including food establishment inspection reports and health statistics. The results showed that observed priority violations in food establishment inspections in the District of Columbia were positively correlated with two Centers for Disease Control and Prevention-identified foodborne illness risk factors: poor personal hygiene and contaminated equipment. The study results showed that patron-generated foodborne illness complaints were significantly correlated with improper holding temperatures and contaminated equipment. This study can act as a motivator to reevaluate existing food safety inspection enforcement practices and thereby reduce foodborne illnesses in the District of Columbia.**

Introduction

Food safety is one of the most significant public health issues that needs to be addressed in every food production and processing complex, and it should be addressed along the entire food production chain from farm to fork. At any point during harvesting, producing, distributing, or serving, food is exposed to different contaminants and disease-causing microorganisms (Lee, Nelson, & Almanza, 2012). Foodborne illnesses are caused by different pathogens, including various bacteria, viruses, and parasites (Centers for Disease Control and Prevention [CDC], 2017a).

Recent research shows that over 53% of consumers prefer to go out to eat in restaurants than eat at home (Brar, 2016). Due to the increased number of individuals not eating at home, actors along the food production chain play a major role in the occurrence of different foodborne diseases (Pham, Jones, Dewey, Sargeant, & Marshall, 2012). Additionally, due to the consumption of imported food and drinks, increased recalls and foodborne illness outbreaks have occurred in the U.S. More than 250,000 foreign food-processing industries in 200 countries provide the U.S. with its food supply (Marler, 2013).

Foodborne illnesses have become a main concern of people all over the world (World Health Organization, 2016). In the U.S., foodborne illnesses were experienced by 48 million people and responsible for the deaths of 3,000 people annually (Manes, Liu, & Dworkin, 2013). Beside its public health burden, foodborne illnesses cost the U.S. government an estimated $15.2 billion annually (Waters et al., 2013). In the U.S., 58% of foodborne illnesses are caused by norovirus, 11% by nontyphoidal *Salmonella* species, 10% by *Clostridium perfringens*, and 9% by *Campylobacter* species (Hamade, 2015). Restaurant industries can have a significant impact on the prevention and control of foodborne illnesses by practicing minimum required food safety standards (Pham et al., 2012).

According to the Centers for Disease Control and Prevention (CDC), if two or more people get sick and the investigation validates its association with the same contaminated food or drink, then this event is called a foodborne disease outbreak (CDC, 2017b). It is very difficult to know the actual number of annual foodborne illnesses in the U.S. because health facilities only diagnose and report a fraction of illnesses.

Foodborne illnesses are closely linked to improper food safety practices that lead to the proliferation of pathogenic microorganisms (Hamade, 2015). In recent years, CDC and the Environmental Health Specialist Network (EHS-Net) collaborated on several research projects to understand the contrib-

uting factors for foodborne illnesses in restaurants and food establishments. In each study, sick employees, poor personal hygiene, and unsanitary food preparation practices greatly contributed to foodborne outbreaks (Brown, 2013). CDC documents five contributory factors in the occurrence of foodborne illness in restaurants: food items from unsafe sources, poor personal hygiene, inadequate cooking temperatures, improper cold or hot holding temperature of foods, and contaminated equipment or utensils (Food and Drug Administration [FDA], 2010).

To reduce the occurrence of foodborne illness, food service establishments are required to undertake standard food safety practices during food preparation, storage, and serving (Brar, 2016). In the U.S., there are close to one million food establishments, from owner-operated establishments to national chain restaurants, and more than 14.4 million employees working in this industry (National Restaurant Association, 2017). The District of Columbia alone has more than 5,500 food service establishments (District of Columbia Department of Health [DCDOH], n.d.).

Regulatory agencies enforce the food code in restaurants to uphold standard food safety practices that must be addressed in each food production and processing complex from farm to fork (Harris, 2015). The Health Licensing and Regulation Administration (HLRA) of the District of Columbia Department of Health (DCDOH) enforced the 2012 food code through its Food Safety and Hygiene Inspection Services Division (FSHISD) in existing food establishments to safeguard public health. The department conducted periodic inspections of the city's existing food establishments. These inspections help the department to evaluate food safety practice and to assess and categorize the risk of foodborne illness as a priority, priority foundation, or core violation.

There is lack of accurate statistics and limited scholarly research concerning the frequency of priority violations and its relationship to foodborne illness and resident complaints in the District of Columbia. This study is essential as research on the associations between observed priority violations, foodborne illnesses, and patron complaints. This research will generate scholarly documentation that might assist public health officials in drafting enhanced food code policies to improve public health in the District of Columbia.

The purpose of this study is to a) examine the relationship between CDC-identified foodborne illness risk factors and frequently observed priority violations in the District of Columbia, b) study patron-generated foodborne illness complaints and their possible association with foodborne illness risk factors in the District of Columbia, c) examine the association between the number of food establishment inspections and reported foodborne illnesses in the District of Columbia, and d) investigate the association between the number of observed priority violations in the presence or absence of a certified food protection manager (CFPM). Analysis of the association between the primary numerical variables provides public health officials with scientific evidence about the observed priority violations, foodborne illnesses in the city, and CDC-identified foodborne illness risk factors.

Methods

This study used a nonexperimental quantitative methodology that relied on preexisting data, including food establishment inspection reports and health statistics. The study was carried out in the four quadrants of Washington, DC. The population of this study was all food establishments in risk categories 2, 3, 4, and 5 that serve food to the public and are regulated by DCDOH. The food establishments were located in the eight wards of the city.

DCDOH categorized the existing food establishments in risk categories 1–5, which were determined by the function and scope of that particular food establishment to receive, process, and serve food and drink to the community. This study excluded risk category 1 food establishments, which primarily have prepackaged food items and no potentially hazardous food items (DCDOH, n.d.).

Descriptive and inferential statistical analyses were carried out and statistical tests were conducted using SPSS. For research questions, we conducted a two-tailed independent samples *t*-test (Emerson, 2015) to assess the associations between the frequently observed priority violations in District of Columbia food establishments and CDC-identified foodborne illness risk factors.

The District of Columbia food code identified certain provisions as priority violation items, priority foundation items, and core items. It defines priority items as "provisions whose application contributes directly to the elimination, prevention, or reduction to an acceptable level of hazards associated with foodborne illness" (DCDOH, 2012).

Data Collection and Analysis

The data collected from the DCDOH website were analyzed to test the hypotheses (Parylo, 2012). Routine and complaint food establishment inspection reports were retrieved from the DCDOH website. All 3 years of routine and complaint inspection reports from risk categories 2, 3, 4, and 5 food establishments were transferred to a Microsoft Excel spreadsheet. Random sampling of the city's food establishment inspection reports was taken from a 3-year period (2013–2015).

The study selected a total sample size of 120 routine and complaint inspection reports from risk categories 2, 3, 4, and 5 food establishments (60 inspection reports in the presence of a CFPM and 60 inspection reports in the absence of a CFPM). The data were used to determine the association between the presence of a CFPM and the number of observed priority violations during inspections of foodborne illness complaints and routine inspections.

In addition, the study collected a sample size of 150 resident-generated foodborne illness complaint inspection reports from risk categories 2, 3, 4, and 5 food establishments. The data were used to determine the associations between CDC-identified foodborne illness risk factors and the frequently observed priority violations in the District of Columbia food establishments. The data were also used to analyze the associations between patron-generated complaints, occurrence of foodborne illness, and observed priority violations in District of Columbia food establishment inspections. During data collection and analysis, the researchers excluded information on human participation and removed all identifiable information about the food establishments and inspectors.

Results and Discussion

The first sampled data set was limited to patron-generated foodborne illness complaint inspection reports from risk categories 2, 3, 4, and 5 from food establishments during 2013–2015. From the total of 150 inspection

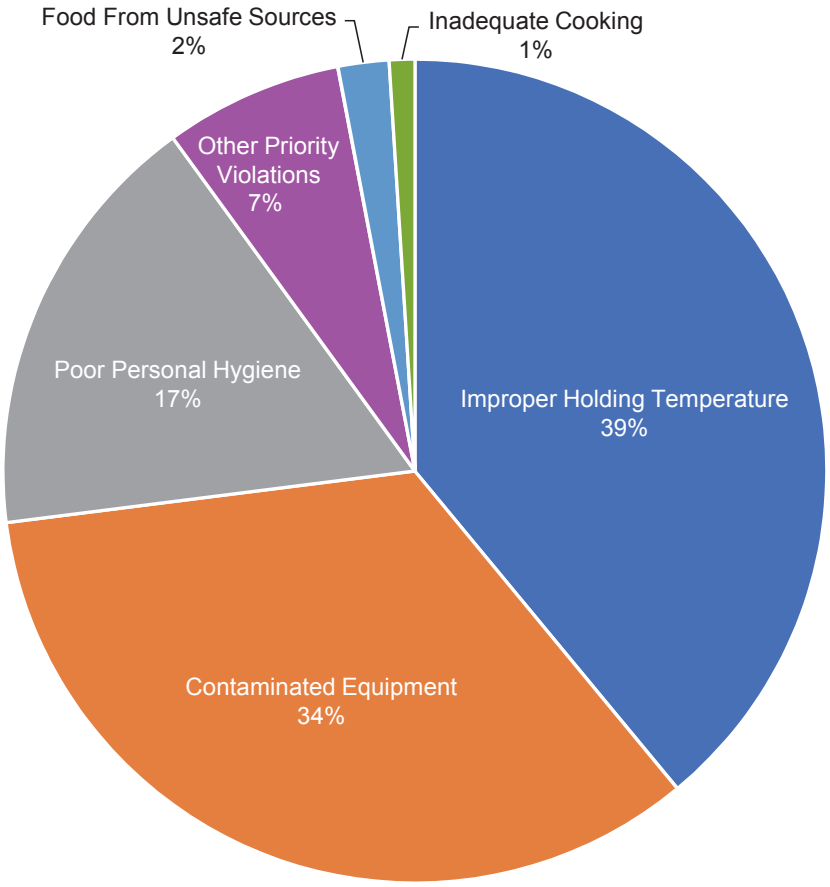
reports, there were 387 priority violations observed. Improper holding temperature accounted for 39% of violations, contaminated equipment/inadequate protection from contamination accounted for 34% of violations, poor personal hygiene accounted for 17% of violations, other priority violations accounted for 7% of violations, food from unsafe sources accounted for 2% of violations, and inadequate cooking accounted for 1% of violations (Figure 1).

From the total 60 inspection reports completed in the presence of a CFPM, there were a total of 50 observed priority violations. Improper holding temperature accounted for 42% of violations, contaminated equipment/inadequate protection from contamination accounted for 40% of violations, 12% of violations fell into the "other" category, and poor personal hygiene accounted for 6% of violations. There were no violations for both food from unsafe sources and inadequate cooking (Figure 2).

From the total 60 inspection reports completed in the absence of a CFPM, there were a total of 122 observed priority violations. Approximately 50% of violations were in the "other" category, improper holding temperature accounted for 25% of violations, contaminated equipment/inadequate protection from contamination accounted for 20% of violations, and poor personal hygiene accounted for 4% of violations. There were no violations for both food from unsafe sources and inadequate cooking (Figure 2).

FIGURE **1**

Observed Priority Violations From Patron-Generated Foodborne Illness Inspection Reports



Research Question 1

The first research question for this study was: Is there a statistically significant difference between the frequently observed priority violations in District of Columbia food establishments and CDC-identified foodborne illness risk factors? We performed correlation analysis to evaluate the hypothesis. Frequently observed priority violations in District of Columbia food establishments were positively correlated with poor personal hygiene ($r = .25$, $p < .05$). In addition, frequently observed priority violations in District of Columbia food establishments were positively correlated with contaminated equipment ($r = .17$, $p < .05$).

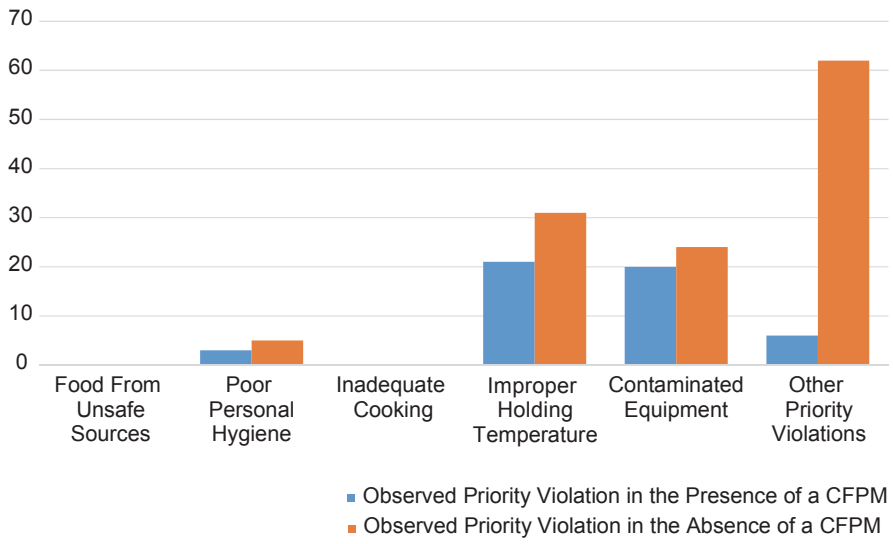
This study found that frequently observed priority violations in District of Columbia food establishments were positively correlated with poor personal hygiene, which is one of the five CDC-identified foodborne illness risk factors (Ghezzi & Ayoun, 2013). Thus, there is an association between frequently observed priority violations and poor personal hygiene in District of Columbia food establishments.

Edmonds and coauthors (2012) found that improper hand washing practices was the most observed violation in 76% of restaurants and approximately 50% of delicatessens. Poor personal hygiene was the highest observed violation rate in all three FDA studies (Arendt et al., 2013). According to Liu and coauthors (2013), recent investigations of foodborne illness outbreaks implicated poor personal hygiene of food employees in a large portion of the outbreaks. Gould and coauthors (2013) showed that poor personal hygiene is one of the contributing factors responsible for the occurrences of 165 (64%) foodborne illnesses.

This research found that frequently observed priority violations in the District of Columbia food establishments were positively correlated with contaminated equipment. Inadequate cleaning of food contact surfaces was linked to the occurrence of 32 foodborne illness outbreaks in the U.S. (Gould, Rosenblum, Nicholas, Phan, & Jones, 2013). Improper cleaning and sanitizing of food contact surfaces was the item most frequently observed as a violation in restaurants that is categorized under contaminated equipment or protection from contamination of CDC-identified risk factors for foodborne illness (FDA, 2010).

FIGURE **2**

Observed Priority Violations in the Presence and Absence of a Certified Food Protection Manager (CFPM)



Research Question 2

The second research question for this study was: Is there a statistically significant difference between patron-generated foodborne illness complaints and observed priority violations in District of Columbia food establishment inspections?

We performed a correlation analysis to evaluate this hypothesis. Patron-generated foodborne illness complaints were significantly correlated with improper holding temperatures ($r = -.27$, $p < .05$) and contaminated equipment ($r = -.30$, $p < .05$).

This study found that patron-generated foodborne illness complaints were significantly correlated with improper holding temperatures and contaminated equipment of foodborne illness risk factors. Thus, there was an association between patron-generated foodborne illness complaints, foodborne illness risk factors, and observed priority violations in District of Columbia food establishment inspections. Improper holding temperature was one of the most frequently observed CDC-identified foodborne illness risk factors.

Venuto and Garcia (2015) found that improper cold and hot holding temperature of foods was the major observed violation leading to the proliferation of pathogens in food service establishments. Proper cooling of cooked food or reheating potentially hazardous food, maintaining proper food temperature, and ensuring accurate date markings were most in need of attention to avoid improper holding foodborne illness risk factors (FDA, 2010).

Research Question 3

The third research question in this study was: Is there a statistically significant difference between the total amount of food establishment inspections in the years 2013–2015 and the number of reported foodborne illness in that same period in the District of Columbia?

In order to test the null hypotheses, the total number of annual inspections by DCDOH FSHISD was collected. Correlational analysis was performed to evaluate the hypothesis. This study found that there was no association between total annual food establishment inspections in the years 2013–2015 and number of reported foodborne illness in the District of Columbia. In previous studies, the effectiveness of food establishment inspections on the reduction of foodborne illness outbreaks was mixed. Several researchers found that there was no association between restaurant inspections and foodborne illness outbreaks; conversely, they also found that local environmental health inspection agencies that performed with a continuous compliance rate resulted in reductions of foodborne illnesses (Zablotsky Kufel et al., 2011). Regular food establishment inspections are a key strategy to ensure food safety in the community and to prevent imminent health hazards (Waters et al., 2013).

Research Question 4

The fourth research question for this study was: Is there a statistically significant difference between the presence of a CFPM during food establishment inspections and the number of observed priority violations?

An independent *t*-test was performed to test if there was an association between the presence of a CFPM and the number of observed priority violations during food establishment inspections. There was no significant difference in poor personal hygiene between restaurants that had a CFPM and restaurants that did not have a CFPM. Thus, there was no association between the presence of a CFPM and poor personal hygiene.

There was no significant difference in contaminated equipment between restaurants that had a CFPM and restaurants that did not. Thus, there was no association between the presence of a CFPM and contaminated equipment.

There was no significant difference in improper holding temperature between restaurants that had a CFPM and those that did not. Therefore, there was no association between the presence of a CFPM and improper holding temperature.

Trained CFPMs play a significant role in food safety practices. Poor food safety practices in restaurants lead to the occurrence of foodborne illnesses. In order to prevent such type of incidences, local regulatory agencies enforce food codes to ensure the presence of a certified food employee in food establishments (Kassa, Silverman, & Baroudi, 2010). Similarly, Cates and coauthors (2009) found that improper holding temperature violations in restaurants were equally likely in restaurants with a CFPM and in those without a CFPM.

This study found that there was an association between the presence of a CFPM and other priority violations observed in District of Columbia food establishment inspections. Murphy and coauthors (2011) explored the relationship between mandatory food safety training and inspection results of food service

establishments, revealing a significant difference between chain and independent restaurants. Cates and coauthors (2009) showed that there was no significant association between observed plumbing violations and the presence of a CFPM. Harris (2015) found that there was a significant difference, however, between observed violations and the presence of a CFPM.

Conclusions

Foodborne illness remains a significant public health burden and causes considerable social and economic consequences. There were several important findings in this study. Poor personal hygiene and contaminated equipment or inadequate protection from contamination have a significant impact on frequently observed priority violations in District of Columbia food establishments. This study found that patron-generated foodborne illness complaints were significantly correlated with improper holding temperature and contaminated equipment of foodborne illness risk factors.

Food establishment management needs to collaborate with regulatory agencies and other food safety training stakeholders to address these observed CDC-identified foodborne illness risk factors. Investigation into trends and occurrences of priority violations in food establishments helps regulatory agencies and food establishment managers take the necessary measures to improving food safety. Reduction in the occurrence of foodborne illness makes a strong contribution to the improvement of public health.

This study found that there was an association between the presence of a CFPM and other observed priority violations in District of Columbia food establishment inspections. This finding is congruent with other research. There is a strong relationship between mandatory food safety training and positive inspection results of food service establishments. Appropriate intervention is crucial to address the linkage between the foodborne illness agent and the responsible individual in a food service establishment. Mandatory food safety training of employees working in food establishments is a key component in the effort to minimize priority violations.

The study results provide basic findings for regulators and collaborators to take necessary measures to improve the quality of existing CFPM training programs, advance risk-based food establishment inspections, and promote social change in the food industry. Future research is needed to explore the food safety practice comparisons of ethnic-operated restaurants with nonethnic-operated restaurants and the association with the occurrence of foodborne illness. In addition to regular food establishments, there are different mobile and street food vendors in the District of Columbia. Future studies can be conducted to identify foodborne illness risk factors, their association with mobile food trucks, and the challenges inherent in enforcing the food code in the District of Columbia.

Corresponding Author: Temesgen Jemaneh, District of Columbia Department of Health, 12824 Middlevale Lane, Silver Spring, MD 20906. E-mail: temesgen.jemaneh@dc.gov.

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Organizational Characteristics of Local Health Departments and Environmental Health Services and Activities

Shailendra N. Banerjee, PhD
Division of Emergency and Environmental Health Services
National Center for Environmental Health
Centers for Disease Control and Prevention

Justin A. Gerding, MPH, REHS
John Sarisky, MPH, REHS
Environmental Health Services Branch
Division of Emergency and Environmental Health Services
National Center for Environmental Health
Centers for Disease Control and Prevention

Abstract **The main objective of this research was to ascertain the association between organizational characteristics of local health departments (LHDs) and environmental health (EH) services rendered in the community. Data used for the analysis were collected from LHDs by the National Association of County and City Health Officials for its 2013 national profile study of LHDs. We analyzed the data during 2016. Apart from understanding basic characteristics of LHDs in the nation, we introduced new measures of these characteristics, including "EH full-time equivalents" per 100,000 population and "other revenue" (revenues from fees and fines) per capita.**

The association of these and other organizational characteristics with EH services were measured using likelihood ratio χ^2 and *t*-tests. Out of 34 EH services considered, LHDs directly provided an average of 12 different services. As many as 41% of the 34 EH services were not available in more than 10% of the communities served by LHDs. About 70% of communities received some services from organizations other than LHDs. All the available organizational characteristics of LHDs had association with some of the EH services. Although we might assume an increase in per capita expenditure could result in an increase in LHDs' direct involvement in providing EH services, we found it to be true only for five (15%) of the EH services. The variation of EH services provided in communities could be explained by a combination of factors such as fee generation, community needs, type of governance, and population size.

Introduction

In 2012, the Institute of Medicine recommended a minimum package of public health services related to communicable and noncommunicable disease control, emergency preparedness and disaster response, and environmental health protections, among others (Leider, et al., 2015). This minimum package is termed the "foundational public health services" framework. Environmental public health, as a part of the framework, includes the provision of critical services in cities, counties, and states to protect and promote a safe and healthy environment for the public. This provision is accomplished through an array of environment health (EH) services aimed at preventing exposure to adverse environmental conditions in food, water, air, and other media.

Adverse environmental conditions are potential causes of illness, infections, and death in communities. An example of these adverse conditions was seen in exposures to lake water contamination in Tarrant County, Texas, in 2008 (Cantey et al., 2012). *Cryptosporidium* in the lake water led to an outbreak of gastrointestinal illness among persons who swallowed contaminated water while playing in the lake. Another example from Texas is food source contamination that caused a *Salmonella* outbreak among patrons of restaurants in 2008 (Mody et al., 2011). The patrons had eaten contaminated jalapeño peppers, which resulted in *Salmonella enterica* serotype Saintpaul infections.

The system and delivery of EH services vary across the nation. In Maryland, for example, EH services were conducted by the Maryland Department of Health and Mental Hygiene and the Maryland Department of the Environment at the state level (Resnick, Zablotsky, Nachman, & Burke, 2008). Most EH services were provided at the local level by county-based or city-based EH divisions housed within local health departments. In contrast, depending on the county, EH services in Iowa were administered by different offices, not all of which were part of the local public health department (Ramaswamy et al., 2012).

Studies of EH service delivery systems have noted variation in services and activi-

TABLE **1**

Local Health Department Organizational Characteristics and Environmental Health Services Provided in U.S. Communities, 2013

Organizational Characteristics	Environmental Health Services									
	Body Art (Tattoo)	Camp-grounds/ Recreational Vehicles	Chil-dren's Camps	Food Process-ing	Food Safety Education	Food Service Establish-ments	Groundwater Protection	Health-Related Facilities	Hotel/ Motel	Indoor Air Quality
Per capita expenditure ($)										
0–25	73.3			44.3	77.1	83.2		34.9		
25–50	72.0			36.7	79.6	82.9		33.9		
50–100	74.2			36.5	80.0	78.5		42.0		
≥100	82.6			40.2	87.6	87.1		44.0		
χ^2	8.4			7.6	11.7	8.3		10.9		
p-value	**.03**			**.05**	**<.01**	**.04**		**<.01**		
Per capita income ($)										
0–25	72.2		63.5					33.0		50.6
25–50	71.9		63.2					32.7		43.0
50–100	76.7		76.0					43.5		57.2
≥100	83.1		69.5					45.0		48.9
χ^2	10.1		15.9					17.2		12.9
p-value	**.02**		**<.01**					**<.01**		**<.01**
Per capita other revenue ($)										
0–5	70.1	57.7	64.7		77.5	79.8	47.1	34.3		47.7
5–10	81.8	71.7	73.0		87.9	91.8	57.0	44.1		58.4
10–50	82.6	78.0	75.9		86.2	87.6	57.7	41.5		51.0
≥50	68.9	56.7	78.4		88.2	71.3	41.5	40.1		27.0
χ^2	22.4	33.0	11.8		21.2	30.0	13.5	9.7		8.6
p-value	**<.01**	**<.01**	**<.01**		**<.01**	**<.01**	**<.01**	**.02**		**.04**
Full-time equivalents (per 100,000)										
0–1	52.4	44.0	54.9	35.8	59.9	61.0	32.7	28.9	50.1	38.3
1–3	74.5	65.2	72.5	40.9	88.7	91.4	43.9	42.5	72.3	32.8
3–5	78.9	66.8	71.2	48.1	90.5	94.2	45.4	39.2	73.9	50.7
5–7	86.0	68.5	74.5	42.0	91.3	95.2	58.7	44.9	69.4	61.4
≥7	88.1	76.2	80.8	48.4	91.7	97.4	68.4	50.6	73.3	57.2
χ^2	213.0	116.5	687.0	23.2	301.2	456.1	169.4	61.5	96.4	70.3
p-value	**<.01**	**<.01**	**<.01**	**<.01**	**<.01**	**<.01**	**<.01**	**<.01**	**<.01**	**<.01**

continued ▸

ties provided at local (e.g., county and city) and state levels. These studies indicated that EH services might correspond to local need and revenue generated by fees for service (Dyjack, Case, Marlow, Soret, & Montgomery, 2007; Resnick et al., 2008). EH services might also be intertwined with the delivery of other public health services, which vary across the nation and are affected by factors such as size of the jurisdiction and area served, governance structure, finances, and workforce structure (Mays et al., 2009).

Organizational capacity, such as fiscal resources and workforce, has been identified as an important construct in public health services and systems research, with emphasis placed on understanding its relationship with public health performance and outcomes

TABLE **1** *continued*

Local Health Department Organizational Characteristics and Environmental Health Services Provided in U.S. Communities, 2013

Organizational Characteristics	Environmental Health Services									
	Body Art (Tattoo)	Camp-grounds/ Recreational Vehicles	Chil-dren's Camps	Food Process-ing	Food Safety Education	Food Service Establish-ments	Groundwater Protection	Health-Related Facilities	Hotel/ Motel	Indoor Air Quality
Population size										
0–50,000		57.2		46.4		80.1	43.1		65.4	76.9
50,000–150,000		68.1		39.7		88.2	50.8		67.8	86.0
≥150,000		64.2		34.4		86.8	59.2		59.6	83.0
χ^2		15.7		19.0		24.0	33.9		6.2	22.9
p-value		**<.01**		**<.01**		**<.01**	**<.01**		**.04**	**<.01**
Governance type										
Local		62.9		40.3	79.0	81.3	51.5	37.9	60.4	53.4
Shared or state		54.0		51.2	84.6	90.1	33.0	45.2	82.1	25.4
χ^2		8.3		14.7	7.6	24.1	47.6	7.1	73.0	87.7
p-value		**<.01**		**<.01**	**<.01**	**<.01**	**<.01**	**<.01**	**<.01**	**<.01**
Jurisdiction										
City	90.6	80.3	85.9	66.0		97.6	57.8	49.3	79.6	67.0
County	70.4	58.1	64.4	39.1		81.0	44.6	37.8	63.2	42.9
Mixed	69.4	65.0	70.1	36.7		78.5	55.0	37.5	61.1	50.2
χ^2	56.3	34.2	56.9	69.5		84.9	24.9	13.2	28.5	51.7
p-value	**<.01**	**<.01**	**<.01**	**<.01**		**<.01**	**<.01**	**<.01**	**<.01**	**<.01**
Region										
Northeast	81.9	77.7	86.7	54.6	80.4	90.0	62.8	47.1	72.1	65.8
Midwest	64.4	47.7	48.5	33.7	74.8	73.0	45.1	24.2	49.3	47.6
South	83.0	69.0	76.1	44.0	88.5	93.6	42.8	53.5	78.5	37.9
East	49.0	58.1	63.3	44.9	72.3	72.5	46.3	31.1	57.0	44.1
χ^2	126.2	91.7	189.1	44.4	63.3	174.2	46.9	146.6	145.3	72.1
p-value	**<.01**	**<.01**	**<.01**	**<.01**	**<.01**	**<.01**	**<.01**	**<.01**	**<.01**	**<.01**

continued ▸

(Meyer, Davis, & Mays, 2012; Scutchfield, Marks, Perez, & Mays, 2007). In this study, we sought to expand on this research by identifying aspects of local health department (LHD) organizational capacity associated with EH services. The primary objective was to test the association between organizational characteristics and EH services to identify those characteristics that might be most associated with the provision of specific EH services.

Methods

Data for this study were collected by the National Association of County and City Health Officials (NACCHO) from LHDs in 2013 (NACCHO, 2014). We used these data to study local level public health infrastructure and EH practice; we analyzed the data during 2016. Among approximately 2,800 LHDs in the U.S., 2,532 were included in the study population. All LHDs in the study population were asked to complete questionnaires seeking information about organizational capacity such as funding, workforce, jurisdiction, governance, and activities or services provided. These were core questions. Weights were developed by NACCHO based on answers for the items from the core questionnaire to obtain national estimates. We used these weights for our analysis. NACCHO's profile report provides more details

TABLE **1** *continued*

Local Health Department Organizational Characteristics and Environmental Health Services Provided in U.S. Communities, 2013

Organizational Characteristics	Environmental Health Services								
	Lead Inspection	Private Drinking Water	Public Drinking Water	School/Day Care	Septic Systems	Smoke-Free Ordinances	Surface Water Protection	Swimming Pools (Public)	Vector Control
Per capita expenditure ($)									
0–25	66.9								
25–50	61.2								
50–100	69.8								
≥100	68.6								
χ^2	8.5								
p-value	**.04**								
Per capita income ($)									
0–25	64.0	65.3	33.1		74.3				
25–50	58.7	68.2	33.8		75.4				
50–100	72.5	71.5	42.3		81.3				
≥100	65.8	75.8	40.5		81.1				
χ^2	16.1	8.2	10.4		8.7				
p-value	**<.01**	**.04**	**.02**		**.03**				
Per capita other revenue ($)									
0–5		66.6	32.7	73.5	73.6	68.8	37.7	73.4	
5–10		76.9	46.9	81.4	86.9	76.9	46.8	88.7	
10–50		79.3	46.5	80.5	83.8	73.6	50.0	86.3	
≥50		73.1	37.4	61.7	71.3	86.8	31.3	57.6	
χ^2		19.9	26.8	12.0	30.0	8.6	14.6	43.6	
p-value		**<.01**	**<.01**	**<.01**	**<.01**	**.03**	**<.01**	**<.01**	
Full-time equivalents (per 100,000)									
0–1	51.7	45.8	27.6	59.1	53.3	56.3	28.3	58.1	42.4
1–3	64.4	58.9	38.4	84.8	60.4	74.4	34.5	86.1	55.8
3–5	74.9	69.8	40.3	84.1	85.3	75.1	37.1	91.0	69.3
5–7	73.5	80.2	42.0	82.4	90.8	77.5	49.6	87.8	77.6
≥7	75.7	87.4	50.0	86.5	92.2	84.0	55.5	92.0	73.6
χ^2	100.8	284.4	71.2	186.0	388.6	125.5	104.6	298.0	177.1
p-value	**<.01**	**<.01**	**<.01**	**<.01**	**<.01**	**<.01**	**<.01**	**<.01**	<.01

continued ▸

regarding the survey methodology (NACCHO, 2014). Overall, 2,000 LHDs completed the 2013 profile study survey, for a response rate of 79%.

We used available data to construct the following new variables representing organizational characteristics: per capita expenditure, per capita total income, per capita other revenue (revenues from fees and fines), and per capita environmental health full-time equivalents (EH FTE). These variables were derived for per unit population of LHDs for expenditure and income and per 100,000 population for EH FTE. Other variables representing organizational characteristics included population size served, governance type, jurisdiction, and region. Each of these organizational characteristics was used with a sufficient number of observations in appropriately constructed categories subdivided into two groups for services to test association

TABLE **1** *continued*

Local Health Department Organizational Characteristics and Environmental Health Services Provided in U.S. Communities, 2013

Organizational Characteristics	Environmental Health Services								
	Lead Inspection	Private Drinking Water	Public Drinking Water	School/Day Care	Septic Systems	Smoke-Free Ordinances	Surface Water Protection	Swimming Pools (Public)	Vector Control
Population size									
0–50,000		63.4	33.8		71.0	68.4	36.4	74.4	
50,000–150,000		68.6	41.1		77.8	71.3	41.6	83.9	
≥150,000		69.4	47.8		77.7	76.8	47.6	86.3	
χ^2		7.1	28.6		13.3	10.8	16.8	38.2	
p-value		**.03**	**<.01**		**<.01**	**<.01**	**<.01**	**<.01**	
Governance type									
Local	69.1	68.3		73.6	76.8	71.7	43.5	77.0	64.6
Shared or state	50.9	53.7		83.1	60.7	66.6	23.6	86.0	46.6
χ^2	42.4	30.0		19.5	46.7	4.0	56.0	18.7	42.0
p-value	**<.01**	**<.01**		**<.01**	**<.01**	**.04**	**<.01**	**<.01**	<.01
Jurisdiction									
City	80.6		31.6	83.6	90.5	81.8	50.1	94.2	79.4
County	61.8		38.6	74.8	70.3	68.9	36.3	76.1	57.5
Mixed	70.6		40.5	70.8	76.0	68.3	46.6	76.4	61.2
χ^2	45.7		6.6	16.2	64.9	23.4	26.7	66.8	51.8
p-value	**<.01**		**.04**	**<.01**	**<.01**	**<.01**	**<.01**	**<.01**	<.01
Region									
Northeast	81.5	70.5	42.4	78.2	87.0	74.8	57.1	89.3	72.3
Midwest	61.9	64.0	30.6	64.3	66.7	64.4	38.6	61.2	65.0
South	63.7	69.6	38.4	89.1	78.7	75.5	30.8	92.7	54.5
East	56.4	51.5	50.3	65.6	61.3	69.5	39.5	72.1	51.5
χ^2	63.2	30.6	41.1	163.5	95.3	25.5	74.3	272.3	47.2
p-value	**<.01**	**<.01**	**<.01**	**<.01**	**<.01**	**<.01**	**<.01**	**<.01**	<.01

Note. Table includes environmental health services provided by ≥30% of local health departments (LHDs). The table shows the percentages of LHDs providing these services directly or through contract. Only lower limits were included in a grouped range. The percentages are shown only for services with significant association with organizational characteristics. Mixed jurisdiction includes city–county, multicity, and multicounty.

Numbers in bold indicate statistical significance ($p < .05$).

(Table 1). These categories included services provided by the LHD directly or contracted out and services provided by others; we show only the proportion in the first category in the table.

The profile data included a list of 13 select EH services provided by LHDs, plus 21 regulation, inspection, or licensing services, such as those covering food service establishments and public swimming pools, which are commonly provided as EH services. These data gave us a total of 34 EH services for this study.

Variables for each of these services were combined to discern if a particular service was provided by the LHD directly, by others in the community independent of LHD funding, or contracted out by the LHD (Table 2). Some services were not available in all communities, or a provider was not specified ("not known").

To establish associations with organizational characteristics, we chose to consider services most commonly provided by LHDs

TABLE **2**

Environmental Health Services and Providers in U.S. Communities, 2013

Environmental Health Service	LHD[a] (%)	Others[b] (%)	LHD and Others[c] (%)	Contractor (%)	Not Available (%)	Don't Know (%)
Air pollution	15.7	54.7	7.7	1.6	12.3	15.7
Body art (tattoo)	55.2	21.3	1.7	2.1	14.0	7.4
Campgrounds and recreational vehicles	39.6	26.4	2.6	2.1	17.1	14.8
Children's camps	48.5	23.2	4.0	2.2	13.1	13.0
Collection of unused pharmaceuticals	16.5	65.8	9.4	1.2	6.3	10.2
Cosmetology businesses	12.2	55.4	1.4	1.6	14.9	15.9
Food processing	32.1	46.4	4.3	2.0	11.0	8.5
Food safety education	72.4	18.6	14.9	2.2	3.5	3.3
Food service establishments	77.9	16.5	3.8	2.8	1.6	1.2
Groundwater protection	40.5	45.9	16.8	1.7	4.0	7.9
Hazardous waste disposal	15.0	70.3	7.3	2.5	4.9	7.3
Hazardous materials response	17.3	73.1	10.4	1.5	3.4	4.7
Health-related facilities	31.4	50.9	3.8	1.7	6.7	9.3
Hotel/motel	49.6	28.0	3.8	2.3	11.3	8.8
Housing (inspection)	25.9	54.0	6.6	1.3	7.1	11.7
Indoor air quality	30.7	36.3	8.8	2.4	18.1	12.5
Land use planning	14.1	68.4	6.7	0.8	5.3	11.4
Lead inspection	48.6	28.1	6.6	5.7	9.7	7.9
Milk processing	12.3	56.8	1.2	1.4	17.3	12.2
Mobile homes	27.7	32.5	2.2	1.6	19.9	18.3
Noise pollution	12.3	50.3	4.0	0.8	15.9	20.7
Pollution prevention	21.5	51.3	11.7	1.1	10.5	15.6
Private drinking water	55.7	30.6	7.3	2.6	5.6	5.5
Public drinking water	33.0	57.7	9.0	2.3	3.0	4.0
Radiation control	12.9	47.8	3.6	1.7	18.8	18.8
School/day care	68.7	23.3	10.5	2.9	1.8	3.3
Septic systems	66.5	24.9	2.8	3.1	2.9	2.6
Smoke-free ordinances	58.8	25.3	10.5	2.1	7.6	6.2
Solid waste disposal sites	27.8	53.9	2.8	2.1	7.3	8.9
Solid waste haulers	27.7	51.7	1.5	2.1	6.1	12.4
Surface water protection	32.9	51.9	13.8	1.3	4.1	9.8
Swimming pools (public)	68.0	19.0	2.5	2.4	5.9	4.7
Tobacco retailers	25.0	44.1	3.4	2.7	10.6	17.6
Vector control	48.1	32.0	12.8	2.3	8.1	9.5

[a]LHD = local health department.
[b]Agencies other than LHD.
[c]In some communities, services are provided by LHD and others. Row total would exceed 100% if this value were added.

(i.e., 19 EH services provided by ≥30% of LHDs) (Table 1). Table 1 shows the percentages of LHDs providing these services directly or through contract for the categories of the organizational characteristics. Values are shown only for services with significant association ($p \leq .05$). The other category of "provided by others" is not shown in the table.

Data were analyzed using statistical software (SAS version 9.3). We estimated the mean number of EH services directly provided by LHDs for some of the organizational characteristics. The significant differences of these means within each of the characteristics were tested using PROC ANOVA (Table 3). Individual means were compared using *t*-tests. We assessed the association of each organizational characteristics of an LHD with activities and services provided in the community by using likelihood ratio χ^2 tests.

Results

Figure 1 shows eight important LHD organizational characteristics: population size, governance type, jurisdiction, region, per capita EH FTE, per capita expenditure, per capita total income, and per capita revenues from fees and fines (other revenue). Among these, other revenue was not specifically described in the NACCHO profile report.

Most of the LHDs were under local governance (72%) and run by county government (74%). The largest portion (41%) of LHDs served populations <25,000, and 77% catered to populations <100,000. We found that 37% of LHDs had <1 EH FTE per 100,000 population, and 65% had <5 EH FTEs per 100,000 population.

Moreover, total revenues and expenditures of LHDs were closely aligned. Nearly one quarter (30% and 28%, respectively) had per capita expenditure and total income <$25, and only about one tenth (12% and 13% respectively) had per capita expenditure and total income ≥$100. Median revenue and expenditure of LHDs were similar (about $1.5 million). Other revenue was comprised of grants, donations, fees, and fines potentially generated by EH services such as food service inspections and permits. Only 13% of LHDs, however, earned ≥$1 million from these other sources, and 44% earned <$50,000, with a median of $84,000.

The study included a total of 34 EH services that LHDs provided (Table 2). Nine (26%) of these services, however, were provided by <20% of LHDs. Organizations other than LHDs provided a large proportion of communities with services such as hazardous materials response (73%), hazardous materials disposal (70%), collection of unused pharmaceuticals (66%), and land use planning (68%). As many as 14 (41%) of the 34 EH services were not available in >10% of the communities served by LHDs. These included services related to indoor air quality (18%), radiation control (19%), noise pollution (16%), mobile homes (20%), and milk processing (17%), among others. Although the majority of EH services were most frequently provided by LHDs directly or by other organizations serving the community, some were contracted out by LHDs. They varied from <1% (noise pollution and land use planning) to 6% (lead inspection). On average, LHDs directly provided 12 different EH services.

Table 3 shows the mean number of EH services LHDs performed, by population size, per capita other revenue, and per capita expenditure. The mean number of EH services provided by LHDs significantly increased with gains in population size and per capita other revenue, although it decreased for the highest group (>$50) of per capita other revenue, this dip could be an artifact of the small number of observations in this group. Per capita expenditure, however, did not follow this increasing pattern of mean number of EH services performed by LHDs. The mean was the same (13) in the lowest and highest group, indicating that the number of EH services performed by LHDs might not necessarily depend on expenditure only.

In general, as the per capita LHD expenditure increased, the proportion of LHDs directly providing services in the community also increased (Table 1). We found, however, that this increasing association was statistically significant ($p \leq .05$) for only 5 of the 19 services: food safety education, body art (tattoo), lead inspection, food service establishments, and health-related facilities. For food processing, the proportion of LHDs providing service decreased as per capita expenditure increased. No association was observed between per capita expenditure and any of the other services.

TABLE **3**

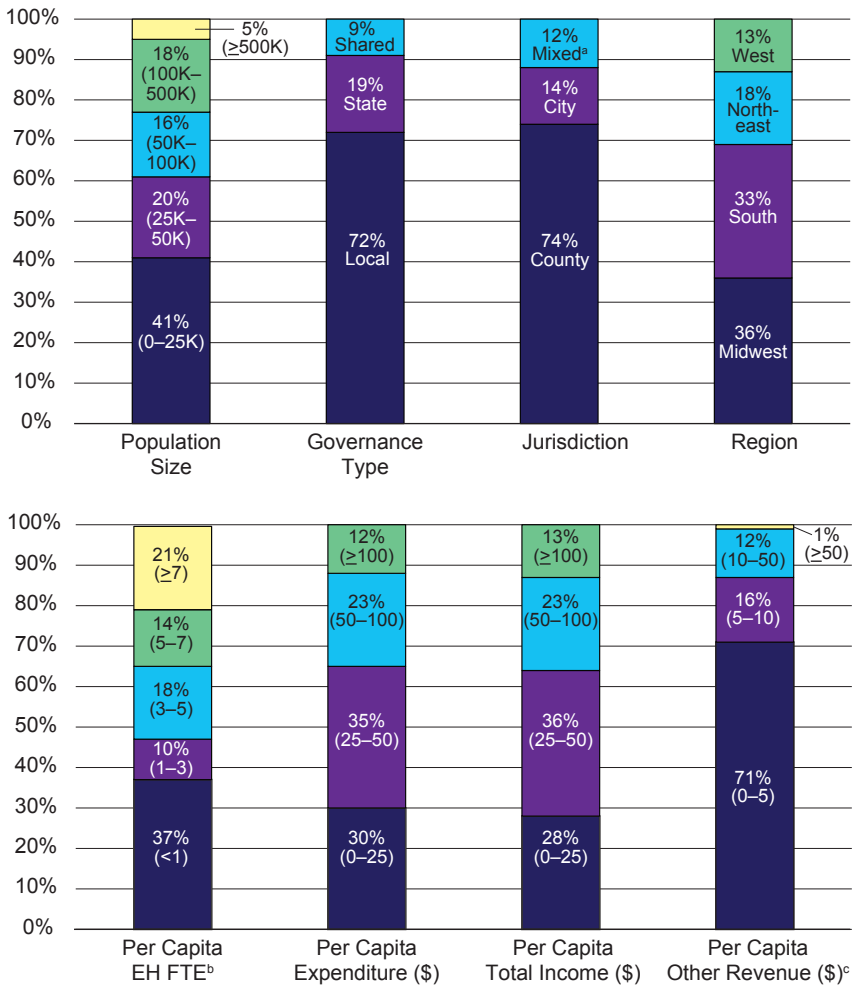
Mean Number of Environmental Health Services Provided by Local Health Departments, 2013

Organizational Characteristics	Mean Number of Services	*p*-Value*
Population size		
0–50,000	11	<.01
50,000–150,000	14	
≥150,000	14	
Per capita other revenue ($)		
0–5	12	<.01
5–10	14	
10–50	13	
≥50	10	
Per capita expenditure ($)		
0–25	13	<.01
25–50	11	
50–100	12	
≥100	13	

Note. Only lower limits were included in a grouped range.
**p*-value was obtained from the F-statistic using PROC ANOVA.

FIGURE **1**

Organizational Characteristics of Local Health Departments in the U.S., 2013



Note. Only lower limits were included in a grouped range.

[a]Mixed includes city–county, multicity, and multicounty.

[b]Per capita EH FTE = environmental health full-time equivalent per 100,000 population.

[c]Other revenue = revenue from grants, donations, fees, and fines.

A similar increasing association was observed with per capita total income and eight services: indoor air quality, septic systems, children's camps, body art (tattoo), lead inspection, public drinking water, private drinking water, and health-related facilities. This significant association was observed also for per capita other revenue with all the services except for vector control, hotel/motel, lead inspection, and food processing.

We found a significant positive association between EH FTEs per 100,000 population and LHDs directly providing each of the 19 services (Table 1). Regional differences in LHD participation for providing services was also significant for all the services, with Northeast and South regions, in general, having the two highest percentages of participation by LHDs directly. The same type of relationship was observed with the governance and jurisdiction characteristics for most of the services, with local government and city jurisdiction having the highest percentages of participation by LHDs directly for more than half of these services. The percentage of LHDs directly providing services significantly increased with population size for 12 of the 19 services.

Discussion

The NACCHO profile study identified 87 public health services provided by LHDs, of which 34 were EH related (NACCHO, 2014). On average, LHDs directly provided a total of 12 services, and as many as 14 of the 34 EH-related services were not available in >10% of the communities. Among the LHDs, 37% had <1 EH FTE per 100,000 population, and 65% had <5 EH FTE per 100,000 population. Many of the EH services were more commonly provided by agencies other than the LHDs (as much as ≥70%). This finding highlights the complex and varied EH service delivery system, which includes multiple EH partners and stakeholders.

All eight LHD organizational characteristics showed association with at least some of the 19 EH services reviewed. Of all the characteristics, per capita expenditure and total income were associated with the fewest number of services. Per capita other revenue, however, showed statistically significant relationships with most of the EH services (Table 1). Other revenue included funds potentially generated by licensing and permitting fees. Thus, the relationship of other revenue and EH services could affect the provision of EH services.

Food safety education was provided directly by 77.1% of LHDs with per capita expenditure <$25. That percentage increased to 87.6% for LHDs with per capita expenditure ≥$100, showing a significantly increasing association with per capita expenditure ($p < .01$) (Table 1). This associated increase would seem to reflect a natural assumption that with increases in per capita expenditure, the direct involvement of LHDs in providing health services will increase. We did not find this assumption to be true, however, for all of the EH services, except for body art (tattoo), lead inspection, food processing, food service establishments, and health-related facilities. We did find the association to be more pervasive for per capita total income, population size, per capita other

revenues, and per capita EH FTE. LHDs were certainly more likely to provide services with increases in income, expenditure, population, or EH FTE, but this pattern probably was also influenced by the importance or need for the service in the community.

Governance and jurisdiction showed association with most of the services. A higher percentage of LHDs at the city level were providing each of these services. The number of EH FTE per 100,000 population, and regional locations of LHDs showed the highest number of significant relationships, identified among all 19 EH services selected. One might expect that higher percentages of LHDs would be providing services as the number of EH FTE per 100,000 population increases. But, the relationship between regional locations and LHD provision of EH services might be an indication of services being based on needs of a particular geographic area.

The results of this study showed that the providers of EH services in communities can vary widely. Although LHDs are the common providers of the services, other organizations or agencies also contribute to service delivery. This supports claims about varied EH structure and consequent delivery systems. Organizational characteristics and their relationships with LHD EH services further demonstrate that variables such as finance, population, geographic location, and workforce are related to LHD provision of EH services. EH services provided in U.S. communities vary considerably, which might be the result of factors such as fee generation, specific community needs, type of governance, or simply population size.

Programs and activities specific to a health department or a community's needs were also one of the considerations of a Public Health Leadership Forum convened in 2013. The findings from our study might present implications for the description of environmental public health activities developed by this forum (Public Health Leadership Forum, 2014).

Further research into the structure and delivery of EH services could help build a better understanding of how and why certain services are provided in a community and others are not. This knowledge might be used to help ensure that communities receive necessary EH services.

Finally, our study contributes to public health services research by testing the association between organizational characteristics of LHDs and EH services rendered. Shah and coauthors (2014) showed differences in performed services for some of the characteristics. We showed this relationship to be true, however, for the available and derived organizational characteristics based on standard statistical procedure.

This study is subject to several limitations. The study imparts general information about whether or not an LHD provides a specific service, without going into much detail about its scope and level. The study is based also on self-reported information, without any verification for reliability, giving the possibility of biased results.

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Corresponding Author: Shailendra N. Banerjee, Division of Emergency and Environmental Health Services, National Center for Environmental Health, Centers for Disease Control and Prevention, Atlanta, GA 30341. E-mail: snb1@cdc.gov.

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Did You Know?

The Safe Water Program Improvement (SWPI) e-Learning Series, created in partnership with the Centers for Disease Control and Prevention, National Network of Public Health Institutes, Texas Health Institutes, Tulane University, and NEHA, was launched earlier this year. SWPI provides information and resources for improving health department programs on household wells, springs, cisterns, and other drinking water sources. The training is free and available online. NEHA continuing education credits are available upon completion of the courses and the final evaluation. Learn more at http://lms.southcentralpartnership.org/swpi.php.

2018 Walter F. Snyder Award

Call for Nominations

Nomination deadline is April 30, 2018.

Given in honor of NSF International's cofounder and first executive director, the *Walter F. Snyder Award* recognizes outstanding leadership in public health and environmental health protection. The annual award is presented jointly by NSF International and the National Environmental Health Association.

❖ ❖ ❖

Nominations for the 2018 *Walter F. Snyder Award* are being accepted for environmental health professionals achieving peer recognition for:

- outstanding accomplishments in environmental and public health protection,
- notable contributions to protection of environment and quality of life,
- demonstrated capacity to work with all interests in solving environmental health challenges,
- participation in development and use of voluntary consensus standards for public health and safety, and
- leadership in securing action on behalf of environmental and public health goals.

❖ ❖ ❖

Past recipients of the *Walter F. Snyder Award* include:

2017 - CAPT. Wendy Fanaselle	2008 - CAPT. Craig A. Shepherd	1998 - Chris J. Wiant	1989 - Boyd T. Marsh	1980 - Ray B. Watts
2016 - Steve Tackitt	2007 - Wilfried Kreisel	1997 - J. Roy Hickman	1988 - Mark D. Hollis	1979 - John G. Todd
2015 - Ron Grimes	2006 - Arthur L. Banks	1996 - Robert M. Brown	1987 - George A. Kupfer	1978 - Larry J. Gordon
2014 - Priscilla Oliver	2005 - John B. Conway	1995 - Leonard F. Rice	1986 - Albert H. Brunwasser	1977 - Charles C. Johnson, Jr.
2013 - Vincent J. Radke	2004 - Peter D. Thornton	1994 - Nelson E. Fabian	1985 - William G. Walter	1975 - Charles L. Senn
2012 - Harry E. Grenawitzke	2002 - Gayle J. Smith	1993 - Amer El-Ahraf	1984 - William Nix Anderson	1974 - James J. Jump
2011 - Gary P. Noonan	2001 - Robert W. Powitz	1992 - Robert Galvan	1983 - John R. Bagby, Jr.	1973 - William A. Broadway
2010 - James Balsamo, Jr.	2000 - Friedrich K. Kaeferstein	1991 - Trenton G. Davis	1982 - Emil T. Chanlett	1972 - Ralph C. Pickard
2009 - Terrance B. Gratton	1999 - Khalil H. Mancy	1990 - Harvey F. Collins	1981 - Charles H. Gillham	1971 - Callis A. Atkins

The 2018 Walter F. Snyder Award will be presented during NEHA's 82nd Annual Educational Conference (AEC) & Exhibition to be held in Anaheim, CA, June 25–28, 2018.

For more information or to download nomination forms, please visit www.nsf.org or www.neha.org, or contact Stan Hazan at NSF at 734-769-5105 or hazan@nsf.org.

BUILDING CAPACITY

Darryl Booth, MBA

Building Capacity by Hacking Your System Implementation

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*. *Building Capacity* is 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 bimonthly 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 senior vice president and 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.

I met this week with the director of a large health department and her information technology (IT) manager. The team described the following challenges in how the department currently functions.

- Multiple overlapping computer systems: Through circumstances too frustrating to unravel, her staff were compelled to use multiple systems, each with some margin of value.
- No system of record: Lacking a single trustworthy system, any query required cross-checking and reconciliation with the next best source.
- Abandoned environments: At least one of the systems described above could not be modified (the expertise was no longer available) and the data were not being backed up at all! Yet, the system remained online because none of the auxiliary systems could do what that system does.
- Manual report reconciliation: A single push button report should have summarized the department's progress (e.g., inspected facilities this quarter). In fact, there was massive underreporting. The results were so unbelievable that leadership asked the staff to return to their paper records and hand tally the true numbers.

Staff struggled to do their jobs. Managers scrambled to show progress. The health department leadership was sound, but enormously frustrated. They knew it was time to solve these problems.

Unfortunately, this story repeats itself in hundreds of health departments across the U.S. Taking control of one's system implementation can make all the difference. In addition to the normal project management techniques we see every day, the specific techniques below originate from 20 years of system implementation. What are your hacks?

Hacking Your Selection and Procurement

I have declared that the government procurement process is broken. In my view, the cycle of request for proposal (RFP)/proposal/fixed price bid/demonstration/selection/contracting does more to increase costs and complexity than it does to protect the agency or fee payers, especially for smaller health departments. Yet, there are some things we can do.

- Start by networking with similarly appointed health departments. Ask for recommendations and walk throughs. This process will help you better understand what is out there before you approach vendors or your internal IT department.
- Ask your internal IT department to bid, along with vendors, on the next system. Insist on an apples-for-apples bid, including implementation, ongoing mainte-

nance, support, required enhancements, and hosting fees.
- Use your RFP to ask more questions and make fewer instructive requirements. Ask questions like, "How does the proposed system do X, Y, and Z?" When you write prescriptive requirements, bidders might bend their solution to win the bid. Bending is bad.

Hacking Your Implementation Kickoff

Once the go forward plan is established, funded, staffed, and factored into the agency's work plans, it's time for a kickoff. The kickoff is a tangible moment where you, as leaders, set the path forward, make it clear that everyone is responsible for shared success, and that frankly, there's a lot of work coming but it's worth it!

- Use this platform to show your leadership and change management plan. Think about and carefully describe the future state. Use a lot of specifics. Express your confidence, commitment, and high expectations. Repeat this communication over the life of the project until you're tired of hearing yourself.
- This platform is THE system of record. This moment is the first of many where you declare THE system of record. There will be no side systems (e.g., Excel, MS Access, etc.).

Hacking Your Data Conversion

During data conversion planning, it will be tempting to preserve that cache of historical inspections, violations, complaints, plan checks, financial transactions, etc. Don't do it! Like driving a new car off the dealer's lot, the value of marginal or historical records immediately plunges.

- Take a true and honest assessment of your data. Better yet, have your internal IT department or vender do it. Look for bad addresses, duplicates, invalid values, and fields used for different purposes over time. Be honest about your current state.
- Purposefully reduce the amount of data to be converted. Like moving your family to a new home, reducing clutter minimizes costs and time. Plus, your new home has all the essentials and none of the clutter. If a record has fewer than 500 rows, just rekey it and don't convert it.
- For legacy data not converted, create an archive in another easily assessable format. For example, have the legacy system generate a PDF or spreadsheet of historical financial account history. Store that file. If your agency's public records retention policy suggests that, for example, records over 5 years old are not retained, then destroy those records.
- Treat converted data like you treat money. Account for every byte in and every byte out. Record counts must reconcile (e.g., input = 10,000 licenses; output = 9,998 licenses + 2 duplicates not converted = 10,000 licenses).

Hacking Your System Configuration

System configuration is where your internal IT department and/or your vendor inject your business rules into the new system. This configuration often includes data entry forms, valid values, business rules, workflow, etc.

Since every health department has the same mission to protect public health, there are likely preset ways of doing things that you can leverage. Join the user community of the system you are embracing. Ask other users how they approached uncommon needs. Ask questions like, "How did you configure the system to handle payments that span multiple accounts? Are you satisfied with that approach?"

Hacking Your Reports

The way your reports convey your agency's outcomes is often the measure of the system's success. When report writing is in the project scope, it means there are critical reports (perhaps unique reports) that must be satisfied.

- Ask your system's user community to share reports. Even if your report need is truly unique, it almost always has essential elements from other existing reports.
- Inject discipline in your report catalog. Use the team to validate and authorize certain reports for productive day-to-day use. Those reports should have a similar look, feel, font, naming convention, etc. Build a brand around your enterprise reports.
- Formalize a process to graduate ad hoc reports to enterprise reports. Ad hoc reporting is critical to go forward success. In my experience, however, ad hoc reports can proliferate, be duplicative, or be misleading because the average user doesn't have the training nor the discipline to create an enterprise report. Formalize the process of taking great ad hoc reports and turning them into enterprise reports.

Hacking Field Computers for Inspectors

Whether inspectors embrace field computing is another measure of a project's success. Lead inspectors to appreciate the downstream value of recording inspection activity electronically. Don't discount the wealth of downstream activities that will occur automatically (e.g., delivering the official inspection report, scheduling the next inspection, notifying other stakeholders, accumulating compliance data, making public copies available, etc.).

Give inspectors options. Giving control over some work-a-day decisions can make all the difference. For example, allow inspectors to select a backpack or roller bag, keyboard or stylus, print on site or e-mail, extra battery or plug-in, etc.

Hacking Interfaces to Other Systems

An interface is a machine-to-machine process that automates recurring processes. A great example of a system interface is a process that summarizes daily financial transactions (i.e., fees, payments, and adjustments) and transfers those to a central accounting system.

- Be selective. Interfaces require a big long-term commitment from two systems. Any failure or future change requires those two systems to be in lockstep. Sometimes an interface just isn't worth it.
- Formalize the commitment. Take the extra time to establish (e.g., by a memorandum of understanding) that the two systems are equally committed to, compensated for, and staffed to debug problems or make changes in sync with the other.

Hacking Your Go Live

Going live is a process, not a milestone. It involves final data conversion, final validation, and cutover. Processes change to reflect the months of long planning.

- Develop a contingency plan. Having a plan for bad outcomes highlights important concerns and how they can be addressed,

and gives everyone confidence in the deep thinking and work done by the team.

- Fortify leadership's position that the new system is now THE system of record. Yes, processes and norms have changed. Some things take longer, some are much quicker. That process is normal. Finally, there will be no side systems. You are committed to the new system.

Conclusion

I encourage you to couple these ideas with your own best practices. What are your hacks and experiences? Continue the conversation on the Building Capacity in Environmental Health Group on LinkedIn (www.linkedin.com/groups/6945520).

Corresponding Author: Darryl Booth, Senior Vice President and General Manager of Environmental Health, Accela, 2633 Camino Ramon #500, San Ramon, CA 94583. E-mail: dbooth@accela.com.

Did You Know?

NEHA will host its Second Annual Lobby Day in Washington, DC, on May 1. The entire NEHA board of directors will be there to meet with Democrats and Republicans to discuss the importance of environmental health professionals, as well as why Congress should invest in building a credentialed environmental health workforce. Lobby days are critical to demonstrate to members of Congress that Americans from around the country care about environmental health. They are also a great way to make your voice heard loud and clear on Capitol Hill. Stay tuned to www.neha.org for more information about NEHA's Second Annual Lobby Day!

DAVIS CALVIN WAGNER SANITARIAN AWARD

The American Academy of Sanitarians (AAS) announces the annual Davis Calvin Wagner Sanitarian Award. The award will be presented by AAS during the National Environmental Health Association's (NEHA) 2018 Annual Educational Conference & Exhibition. The award consists of an individual plaque and a perpetual plaque that is displayed in NEHA's office lobby.

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

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

NOMINATIONS MUST BE RECEIVED BY APRIL 15, 2018.

Nomination packages should be e-mailed to Craig A. Shepherd at shep1578@gmail.com. Files should be in Word or PDF format.

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

DIRECT FROM ATSDR

Loud Noise: Too Loud, Too Long!

John Eichwald, MA

Yulia Carroll, MD, PhD

Pat Breysse, PhD, CIH

National Center for Environmental Health/Agency for Toxic Substances and Disease Registry

Editor's Note: As part of our continuing effort to highlight innovative approaches to improving the health and environment of communities, the *Journal* is pleased to publish a bimonthly column from the Agency for Toxic Substances and Disease Registry (ATSDR). ATSDR is a federal public health agency of the U.S. Department of Health and Human Services (HHS) and shares a common office of the Director with the National Center for Environmental Health (NCEH) 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 and their impact on human health and how to protect public health. We believe that the column will provide a valuable resource to our readership by helping to make known the considerable resources and expertise that ATSDR has available to assist communities, states, and others to assure good environmental health practice for all is served.

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

John Eichwald is an audiologist currently detailed to NCEH/ATSDR's Office of Science. Yulia Carroll serves as the acting associate director for science at NCEH/ATSDR. Pat Breysse is the director of NCEH/ATSDR.

Hearing trouble is the third most prevalent health condition reported by U.S. adults (Blackwell, Lucas, & Clark, 2014). Noise is the most common modifiable environmental cause of hearing loss (Zelaya, Lucas, & Hoffman, 2015). Chronic exposure to noise has been associated with increased stress, anxiety, depression, blood pressure, heart disease incidence, and many other health problems (Basner et al., 2014). Despite recent studies that have reported on increased exposure to loud noise during leisure activities, we do not know how much of hearing loss is related to noise outside of work, nor are there any federal regulations regarding safe noise exposures outside the workplace.

The National Academies of Sciences, Engineering, and Medicine published a report in 2016, Hearing Health Care for Adults: Priorities for Improving Access and Affordability, that calls several agencies to action, including the Centers for Disease Control and Prevention (CDC) (National Academies of Sciences, Engineering, and Medicine, 2016). In response to the report, as well as recent public health inquiries regarding noise-induced hearing loss (NIHL), CDC's National Center for Environmental Health formed in 2016 a small, unfunded intra-agency workgroup to address the issues of nonoccupational NIHL. The vision of this workgroup is to provide data and education, increase awareness, and prevent noise-related hearing loss at home and in the community.

In February 2017, CDC launched a hearing loss campaign to address the issue with a special edition of *Morbidity and Mortality Weekly Report* (Carroll et al., 2017). The issue is based on the most recent available data from the National Health and Nutrition Examination Survey (NHANES) that reports on audiometric notches suggestive of noise-induced hearing damage. The study revealed that NIHL is much more prevalent and underrecognized than previously thought.

The study found that about 40 million U.S. adults aged 20–69 years have NIHL. The presence of NIHL increased from one in five among young adults aged 20–29 years to one in four among adults aged 50–59 years. Nearly one

in five adults who reported no occupational exposure had an audiometric notch. This finding suggests that 21 million adults in the U.S. are likely to have hearing damage from loud sound sources at home or in their communities. About one in four U.S. adults who report excellent to good hearing already have hearing damage. This finding suggests that many people with these audiometric configurations are either unaware or in denial of the existing damage to their hearing from noise exposure (Carroll et al., 2017).

Almost all hearing loss from noise exposure is preventable. The NHANES survey found, however, that 70% of persons exposed to loud noise in the past 12 months had never or seldom worn hearing protection.

Although there are no federal regulations regarding exposure to nonoccupational noise, a 1974 U.S. Environmental Protection Agency report identified 70 dB over 24 hr (75 dB over 8 hr) as the average exposure limit for intermittent environmental noise. The World Health Organization's 1999 Guidelines for Community Noise recommend avoiding noise exposure levels that exceed 70 A-weighted decibels (dB[A]) over a 24-hr period or 85 dB(A) over a 1-hr period. The National Institute for Occupational Safety and Health (NIOSH) has established an 8-hr, time-weighted average 85 dB(A) recommended exposure limit to protect most workers from developing hearing loss from noise exposure over a 40-year career. At that sound pressure level, however, approximately 8% of workers could still develop hearing loss and thus, NIOSH recommends that hearing protection be worn whenever noise levels exceed 85 dB(A), regardless of the length of exposure.

NIHL can occur any time in life and accumulates over time, therefore there is a heightened need for prevention efforts, particularly among children, adolescents, and young adults. CDC is working with various organizations and continues to analyze national data in order to shed more light on this public health need. NIHL is a health condition that can be prevented or slowed in its progression, which is easily accomplished by individuals taking relatively simple precautions. Many people may not recognize that excessive sound levels from common activities, such as mowing the lawn or attending sporting events, can be as loud as the noise found in the workplace and is enough to damage hearing.

CDC and its partners want the public to know that the louder the noise and the longer the exposure, the more likely hearing damage will occur. Getting out preventive messages might be helpful. These messages include avoiding or minimizing exposure to noisy environments whenever possible, using hearing protective devices (e.g., earplugs), and keeping the volume down. CDC encourages healthcare providers to ask patients about their hearing activity and loud noise exposure as part of routine care, refer them to hearing health professionals whenever there is a concern, and provide information on how noise exposure can permanently damage hearing and how to protect hearing.

A large body of scientific literature supports the recognition that excessive exposure to loud sound from both recreational and occupational sources leads to NIHL. As this preventable hearing loss often progresses insidiously for years before being self-perceived or diagnosed, it underscores the need for improving the availability of public health information for individuals and their healthcare providers. Downloadable and shareable resources are available at no charge on CDC's website at www.cdc.gov/media/dpk/injury-violence-safety/noise-induced-hearing-loss/hearing-loss.html.

Corresponding Author: Yulia Carroll, Associate Director for Science (Acting), National Center for Environmental Health/Agency for Toxic Substances and Disease Registry, Centers for Disease Control and Prevention, Atlanta, GA. E-mail: eya3@cdc.gov.

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Did You Know?

You can still view over 20 presentations from the Integrating Data to Empower Advancement (IDEA EH) Virtual Conference, which took place February 14–15. IDEA EH was designed to enhance the knowledge of environmental health professionals in data use and provide an opportunity to learn about the latest tools and resources for data-driven decision making. Presentations and exhibitor content will remain available until April 30. Register and login to view conference content at https://neha.6connex.com/event/VirtualConference/IDEAEH/login.

DIRECT FROM CDC ENVIRONMENTAL HEALTH SERVICES BRANCH

A Web-Based Review of Environmental Health Vector Control Services in the United States

Andrew Ruiz, MSPH
Christine Vanover, MPH
Alexis Parale
Justin Gerding, DHA, REHS
Centers for Disease Control and 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, we feature a column from the Environmental Health Services Branch (EHSB) of the Centers for Disease Control and Prevention (CDC) in every issue of the *Journal*.

In these columns, EHSB and guest authors share insights and information about environmental health programs, trends, issues, and resources. The conclusions in this column are those of the author(s) and do not necessarily represent the official position of CDC.

Andrew Ruiz is a health scientist in the National Center for Environmental Health (NCEH) and works on vector control issues. Christine Vanover is a public health analyst in NCEH and also works on vector control issues. Alexis Parale is a student at East Carolina University and a former CDC Summer Program in Environmental Health intern. CDR Justin Gerding is an environmental health officer in NCEH and leads its practice support activities.

By October 25, 2017, the U.S. and its territories documented 42,629 cases of Zika virus disease (Centers for Disease Control and Prevention, 2018). Zika renewed the need and importance for mosquito control in local jurisdictions. The National Association of County and City Health Officials (NACCHO) estimates that approximately half of local health departments in the U.S. provide vector control services (NACCHO, 2017a). While vector (i.e., mosquito, tick, and rodent) control is widely viewed as an environmental health responsibility, little is known about the services performed by environmental health vector control (EHVC) programs.

To learn more, we began with a list of mosquito control programs across the U.S. and used a structured web-based review process to identify the types of services EHVC programs offer. We used our findings to provide recommendations about how environmental health programs and professionals can strengthen their role in vector control with environmental health practices.

We reviewed 1,210 mosquito control programs from a preliminary list of programs identified by the Centers for Disease Control and Prevention's (CDC) Division of Vector-Borne Disease in spring 2017. We examined each mosquito control program's website, social media pages, and related news articles for information about agency and program characteristics (Table 1). We also noted whether programs addressed vectors other than mosquitoes (i.e., rodents and ticks). Out of the 1,210 programs reviewed, only 964 had information about vector control services online. Local health departments operated the majority of the 964 programs (n = 408, 42%), followed by mosquito control districts (n = 266, 28%), public works departments (n = 189, 20%), and other local government agencies (n = 101, 10%). Of the 408 local health departments providing vector control services, 360 local health departments had environmental health programs providing those services (Figure 1). This result emphasizes the important role that environmental health professionals could have in influencing the direction and scope of vector control services in the country.

Environmental Health Vector Control Program Services and Activities

A large number of local health departments provide vector control services. Our study suggested that the majority of this activity was the responsibility of environmental health. This investigation gave better insight into the types of services EHVC programs offer. On average, EHVC programs performed 2.3 of the 9 services and activities (Table 1) considered in this study. While this number was lower than the 3.6 performed by all other program types, EHVC programs stood out in a few key ways.

- **More EHVC programs performed rodent and tick services than other program types**. EHVC represented 62% of the programs performing rodent services and 39% of the programs offering tick services.

TABLE **1**

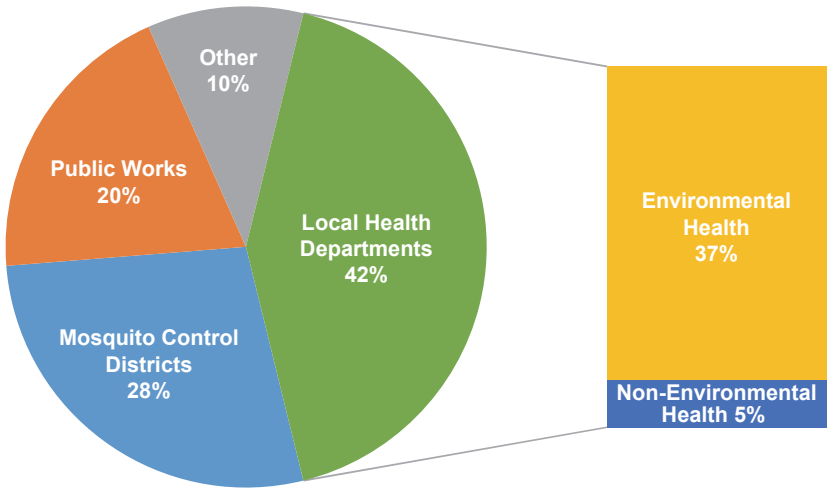
Number of Programs Performing Vector Control Services

Program	Mosquito Control Program Services									Other Vector Services	
	Public Outreach and Education	Service Calls and Site Inspection	Source Reduction	Mosquito Surveillance and Trapping	Larval Control	Adult Control	Pesticide Resistance Testing	Existing Outbreak Response Plan	Follows Integrated Pest Management	Rodent Program	Tick Program
Mosquito control district	153	155	124	204	194	208	46	33	128	36	30
Local health department (environmental health)*	108 (85)	162 (130)	52 (37)	318 (271)	167 (122)	125 (82)	7 (4)	39 (37)	32 (21)	103 (81)	48 (31)
Public works	76	56	36	57	73	180	9	5	31	1	2
Other	27	21	17	53	36	63	10	11	14	5	18

*Environmental health programs are included in the local health department totals.

FIGURE **1**

Vector Control Services by Program Type



- **EHVC programs prioritized mosquito monitoring.** Nearly 79% of EHVC programs mentioned performing mosquito surveillance.
- **EHVC programs performed more mosquito larval control than adult control when compared with other program types.** Thirty-four percent mentioned larval control while only 23% mentioned performing adult control.

In addition, a small fraction (8%) of mosquito control programs, regardless of type, mentioned conducting any form of pesticide resistance testing. This finding is consistent with NACCHO's 2017 assessment of mosquito control services and is an opportunity for improvement across all vector control agencies (NACCHO, 2017b).

Environmental health programs and professionals are responsible for delivering a wide range of services, and vector control might be one of the most important. Developing a strong understanding of EHVC program structure, capacity, and service delivery is essential to identify strengths and opportunities for improvement. This web-based review gave a snapshot of vector control programs and their activities by using a convenience sample of programs and relying upon the information available online, which varied significantly among the programs. A more in-depth study of U.S. EHVC services and program capacity is needed, but the results of this review shed light on the role of environmental health in vector control and the services they provide.

Environmental Health Vector Control Opportunities

EHVC programs might make up the largest proportion of all U.S. vector control program types, placing them in a position to influence and strengthen vector control capacity. Environmental health professionals should consider active participation in vector control associations and seek opportunities to build their technical skills, improve EHVC programs, and encourage integration of environmental health practices in vector control programs across the country. EHVC pro-

grams might also consider describing all of their services online to increase transparency and make web-based reviews more reliable. Increasing transparency could help EHVC programs link communities to available services and help provide a greater understanding of their activities.

CDC's Water, Food, and Environmental Health Services Branch continues to support environmental health programs and professionals by creating vector control tools and resources that can be accessed at www.cdc.gov/nceh/ehs/topics/vectorcontrol.htm.

Corresponding Author: Andrew Ruiz, National Center for Environmental Health, Centers for Disease Control and Prevention, 4770 Buford Highway, NE, Atlanta, GA 30341.
E-mail: nom0@cdc.gov.

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Environmental Health Makes a Strong Entry Into the Global One Health Framework in Jamaica

Jason W. Marion, PhD
Eastern Kentucky University

Henroy Scarlett, DrPH, REHS/RS
University of the West Indies

Priscilla Oliver, PhD

Norbert E. Campbell, MPH
University of the West Indies

Introduction

Globally, the environmental health discipline is rapidly being recognized as a critical science-based discipline needed for protecting human, animal, and ecological health. Such recognition and tremendous excitement were achieved as over 400 academicians and practitioners convened in October 2017 at the beautiful seaside Hilton Rose Hall Resort & Spa in Montego Bay, Jamaica, for the largest and first environmental health conference of its kind on One Health to occur worldwide.

Such recognition and enthusiasm by those outside environmental health add value to our profession, and our partners in One Health (e.g., veterinarians, medical doctors, nurses, academicians) can better advocate for our efforts when they know our stories. The same is true for how we can work and communicate to elevate our partners to support One Health disciplines. Collectively, we know that inherent in our DNA as environmental health professionals is the power to partner. Such is also true for natural partners from other professions embracing One Health (Gibbs, 2014). The One Health Initiative describes the One Health concept as "a worldwide strategy for expanding interdisciplinary collaborations and communications in all aspects of healthcare for humans, animals, and the environment" (One Health Initiative, n.d.). If we successfully work together, we will protect and save millions of lives across the generations.

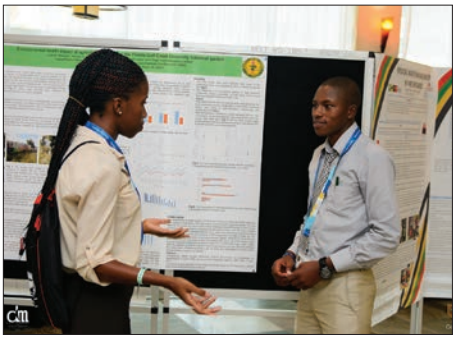
Bay-C, internationally acclaimed reggae artist, performs at the conference opening and gets a bit of audience participation on stage. Photo courtesy of Donovan Morrison, DA. Morrison Photography.

Conference Summary

The One Health: One Global Environment Conference represented the 2017 International Federation of Environmental Health's (IFEH) Academic World Conference and Global Environmental Health Faculty Forum. Directed by the Americas Region of IFEH and the Jamaica Association of Public Health Inspectors (JAPHI), the conference attracted over 90 submissions for presentations and resulted in 54 presentations. JAPHI netted a surplus from hosting the event and was able to match donations from IFEH leadership gifts to provide financial support to Caribbean hurricane recovery efforts. A community service donation project was also planned and approved to follow the conference. Attendees of the conference enjoyed the culture of Jamaica throughout in music, food, and the environment.

The opening ceremony included, Dr. Christopher Tufton, Jamaican Minister of Health, and other national leaders from food safety, environmental health, and veterinary communities. In addition, much excitement erupted as Bay-C, internationally acclaimed reggae artist and One Health ambassador, provided a musical performance regarding mosquito-borne diseases and "One Health, One Love" (see photo above).

Dr. Cheryl Stroud, executive director of the One Health Commission, welcomed the environmental health community to One Health while highlighting the role of animals as sentinels for emerging environmental health challenges related to chemical and biological hazards. Dr. Armando Hoet, director of the Veterinary Public Health Program at The Ohio State University, described relationships between environmental health and the spread of methicillin-resistant *Staphylococcus aureus* and other antibiotic resistant pathogens in a variety of settings such as hospitals and buses (Lutz et al., 2014). Dr. David Dyjack, executive director of the National Environmental Health Association (NEHA), spoke to the need for the enviro-



One of the many posters displayed at the conference that provided stimulating conversation between attendees and presenters alike. Photo courtesy of Donovan Morrison, DA. Morrison Photography.

mental health profession to develop friendships and partnerships outside the profession, and described how environmental health professionals are uniquely positioned to be One Health leaders in their local communities. Dr. R. Gregory from the Veterinary Services Division of the Jamaican Ministry of Industry, Commerce, Agriculture, and Fisheries provided an overview of the One Health movement in Jamaica, including efforts by the government to secure optimal health for humans and animals.

Exciting food safety trainings were also provided by Melissa Vaccaro of PTI Consulting. Dr. Matt Levine of the U.S. Army provided dynamic remarks regarding the importance of environmental health for promoting security and maintaining health among military personnel. Dr. Bryan Brooks of Baylor University organized sessions with world renown environmental chemists and toxicologists related to chemical risks and their relationships to human health and One Health. Drs. Timothy Murphy, Gary Brown, Carolyn Harvey, and Priscilla Oliver provided strategies for enhancing diversity in the profession integrating One Health concepts into existing science-based environmental health curricula.

Numerous presentations that provided case studies from Jamaica were well attended by the international audience that included attendees from all continents except Antarctica (see photo above). Photos and more information, including abstracts from the presentations and posters, can be found on the One Health: One Global Environment Conference website at www.onehealthconference.com.

Partnerships

The conference enjoyed support from the international planning committee and a local committee comprised of JAPHI member. Fourteen other organizations provided in-kind or monetary support. Notable financial contributions from corporate sponsors Hedgerow Software Ltd. and NSF International enabled several practitioners to attend the conference. Financial support for printing was provided by the Pan American Health Organization, Regional Office for the Americas of the World Health Organization. Conference organizers also benefited from NEHA and its *Journal of Environmental Health* for conference promotion.

Student Participation

Extra energy at the conference was provided by 35 student attendees, of which 31 participated in a study abroad course offered through Eastern Kentucky University. With support from JAPHI and the University of the West Indies, tours were arranged by public health inspectors that enabled students with faculty supervisors to observe operations at meat production facilities, food distribution centers, a drinking water treatment plant, and a wastewater plant. A trip highlight for students was the opportunity to assist JAPHI members in the construction of a vault pit latrine for a 83-year old Rastafarian gentlemen living in a nearby mountain forest area (Eastern Kentucky University, 2018). The tours were unforgettable learning experiences for these future environmental and public health professionals.

The Work Continues

The events that unfolded at Montego Bay mark the start of a new era for environmental health in the Americas and abroad. As many diseases here and globally move with little or no regard for species barriers and human-constructed boundaries, we as a profession need to be flexible in our thoughts and actions. In a world that is getting closer, warmer, and more easily connected by rapid transportation, we must strive to continue to work together with our allies in One Health including, but not limited to, human, veterinary, and wildlife medicine. These partnerships provide greater hope for our profession to achieve health goals in this rapidly changing world. Among all that was accomplished and discussed, the most important aspect of what occurred at this conference was that we celebrated environmental health as an active member and viable resource in the One Health community.

Moving forward there is tremendous enthusiasm stemming from those who attended the conference. As environmental health professionals, many of us have already embraced One Health whether or not we knew the term. To learn more about One Health, visit the One Health Commission (http://onehealthcommission.org) or One Health Initiative (http://onehealthinitiative.com) websites.

You are also invited to join us in Montego Bay in 2020 for our second and even larger One Health: One Global Environment Conference. The University of the West Indies' senior leadership and the Jamaican Ministry of Health have partnered with us to encourage and maintain steadfast momentum for this noteworthy cause of enhancing the protection of public health and the environment. For additional information and to join us, please contact Dr. Jason Marion at jason.marion@eku.edu.

Corresponding Author: Jason W. Marion, Associate Professor, Department of Environmental Health, College of Health Sciences, Eastern Kentucky University, 521 Lancaster Avenue, 220 Dizney Building, Richmond, KY 40475. E-mail: jason.marion@eku.edu.

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USING DATA TO IMPROVE ENVIRONMENTAL HEALTH

Part 2: Available Informatics Resources

Editor's Note: The National Environmental Health Association is publishing a three-part series that describes the development and application of tools, trainings, and resources available in informatics. This series will serve as a guide for identifying new and existing resources that can be adopted at the local environmental health level. This series is supported by the Centers for Disease Control and Prevention (CDC) Contract 200-2013-57475. The conclusions in this series are those of the author(s) and do not necessarily represent the official position of CDC.

Solly Poprish
Christl Tate
National Environmental Health Association

What Is Informatics and Why Is It Important to Environmental Health?

The Centers for Disease Control and Prevention (CDC) define public health informatics as the "systematic application of information, computer science, and technology to public health practice, research, and learning" (CDC, 2017). At the National Environmental Health Association (NEHA), we are focusing on environmental health data standardization, collection, sharing, and use. Local, state, and federal agencies collect environmental health data through many avenues: inspections, complaint investigations, community interactions, monitoring and surveillance, and illness outbreak investigations. When these data are collected, it creates a broad picture of an environmental health condition and can be used to inform environmental health initiatives and improve policies, interventions, and programs. By moving toward the wider adoption of informatics and data-driven decision making, we can expect positive impacts on population health.

What Is NEHA Doing?

Environmental health is profoundly local, however, collecting and using data at the local level can be a challenge. At NEHA, we've identified the limitation of resources as a key hinderance to meaningful data use and informatics systems adoption. As a response, this year we are working to identify and develop resources, tools, and success stories that you can reference and adopt to improve the policies, interventions, programs, and health of residents in your jurisdiction.

To kick-start our work, we developed the Informatics Committee that includes local, state, federal, and industry professionals who provide expertise and support by identifying data related needs and existing tools, and developing new resources. With the assistance of the committee and our partners, NEHA hosted the Integrating Data to Empower Advancement: Environmental Health (IDEA EH) Virtual Conference in February 2018. This conference brought together professionals from across the country in a virtual environment to exchange information and explore resources, innovative solutions, and programs in data-driven decision making.

Available Resources

IDEA EH included over 20 presentations from passionate professionals who recognize the value and importance of environmental health data. Each presenter has taken steps within their organization to develop innovative tools, partnerships, and programs to push environmental health data utilization with the mission of improving community health. Presentations covered topics from food safety and aquatic facility inspections to health equity, and included accomplishments from federal, state, local and industry levels. We'd like to share a few of these initiatives that highlight the collaboration, forward thinking, and creativity necessary for the development of data-driven projects and programs.

Project REVIVE

April Merrill, lead attorney and founder of Project Restoring Equality and Vitality in Vulnerable Environments (REVIVE) in Tulsa, Oklahoma, developed a model that can be used to identify and map hotspots in the community where environmental health and other social risk factors are correlated with heath diagnoses. For example, confirmed housing code violations are positively correlated with pediatric asthma diagnoses; however, they are negatively correlated with "good intention" calls to 911 (calls made when individuals observe something suspicious they think an authority needs to check out). The purpose of mapping these data are to visualize the physical spaces in the community where resources should be more intentionally targeted to address the convergence of known risk factors. REVIVE staff are using public data to inform practice on the ground. "The key to this initiative," says Merrill, "is that it's a community effort to address a community problem."

Healthy Wells

Samantha Dye of North Carolina's Gaston County Department of Health and Human Services Environmental Health (DHHS EH) presented on Healthy Wells, a project led

by DHHS EH in collaboration with the University of North Carolina at Charlotte. This project aims to upgrade the high performing DHHS EH's small drinking water program by digitizing and securing latitude/longitude coordinates for its paper archive of over 8,000 well records to enable the installation of these data on the county's GIS. The private well GIS data layer will describe wells that have been installed, repaired, and abandoned since 1989. DHHS EH will also plot state data on groundwater contamination to create a groundwater GIS layer. With these resources, DHHS EH will conduct analyses, provide data to the state and/or U.S. Environmental Protection Agency (U.S. EPA) for modeling contamination, and present these data to the public on the county website. Furthermore, DHHS EH will use its GIS analyses to develop information and education programs for the community and well drillers, promote periodic user initiated voluntary water testing, establish the Gaston Groundwater Council to advise on program activities, derive and describe insights for preservice and continuing education for environmental health specialists, and share program insights with the environmental health profession.

Local Environmental Public Health Reporting Tool

Eric Brown of the Colorado Department of Public Health and Environment discussed their recently launched Local Environmental Public Health Reporting Tool (LEHRT). LEHRT is an online data visualization tool that provides a look at environmental health conditions at a local or state level. The data behind the tool comes from several standardized sources including CDC's Environmental Public Health Tracking Network, U.S. EPA's Exchange Network, the Environmental Council of the States Results Project, and internal program data that follow accepted data standardization methodologies as set forth by national and state workgroups and statutes. The measures on the dashboard are queryable at the county level and might supplement statutory health reporting data at the local level in Colorado. While most data sets in the dashboard are standardized, additional measures such as private well water sample results or individual sewage disposal system permits lack known data standards. These measures will be developed by referencing other state and local program data standards.

If interested in learning more about these resources or viewing presentations from IDEA EH, you can access these presentations on NEHA's learning management system in the coming months. You can also anticipate monthly webinars, success stories, and additional resources available on NEHA's website at www.neha.org.

We'd also like to hear your data use stories. Do you have a success story you'd like to share? Are you familiar with tools similar to those shared during IDEA EH? What obstacles have you discovered in using data differently? Let us know! If you have questions, please contact Solly Poprish at spoprish@neha.org.

Corresponding Author: Solly Poprish, Program Coordinator, Program and Partnership Development, National Environmental Health Association, 720 South Colorado Boulevard, Suite 1000-N, Denver, CO 80246. E-mail: spoprish@neha.org.

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EH **CALENDAR**

UPCOMING NEHA CONFERENCES

June 25–28, 2018: NEHA 2018 Annual Educational Conference & Exhibition and HUD Healthy Homes Conference, presented by Green & Healthy Homes Initiative, Anaheim, CA. For more information, visit www.neha.org/aec.

July 8–11, 2019: NEHA 2019 Annual Educational Conference & Exhibition, Nashville, TN.

July 13–16, 2020: NEHA 2020 Annual Educational Conference & Exhibition, New York, NY.

NEHA AFFILIATE AND REGIONAL LISTINGS

Florida
July 24–27, 2018: Annual Education Meeting, hosted by the Florida Environmental Health Association, Cape Canaveral, FL. For more information, visit www.feha.org.

Kansas
April 19–20, 2018: Spring Conference, hosted by the Kansas Environmental Health Association, Manhattan, KS. For more information, visit www.keha.us.

Minnesota
May 10–11, 2018: Spring Conference, hosted by the Minnesota Environmental Health Association. For more information, visit www.mehaonline.org.

Missouri
April 3–6, 2018: Annual Education Conference, hosted by the Missouri Milk, Food, and Environmental Health Association, Springfield, MO. For more information, visit www.mmfeha.org.

Nevada
April 24–25, 2018: Annual Joint Education Conference, hosted by the Nevada Environmental Health Association and the Nevada Food Safety Task Force, Las Vegas, NV. For more information, visit www.nveha.org.

Ohio
April 17–18, 2018: 72nd Annual Education Conference, hosted by the Ohio Environmental Health Association, Worthington, OH. For more information, visit www.ohioeha.org.

Oregon
April 4–6, 2018: Annual Education Conference, hosted by the Oregon Environmental Health Association, Bend, OR. For more information, visit www.oregoneha.org.

Utah
May 2–4, 2018: Spring Conference, hosted by the Utah Environmental Health Association, Vernal, UT. For more information, visit www.ueha.org/events.html.

Washington
May 7–9, 2018 : 66th Annual Educational Conference—Environmental Public Health: Partnering, Protecting, & Planning, hosted by the Washington State Environmental Health Association, Olympia, WA. For more information, visit www.wseha.org.

TOPICAL LISTINGS

Public Health
April 10–11, 2018: Iowa Governor's Conference on Public Health, Des Moines, IA. For more information, visit www.ieha.net/IGCPH.

Water Quality
May 9–11, 2018: Managing *Legionella* and Other Pathogens in Building Water Systems 2018 Conference, hosted by NSF International, Baltimore, MD. For more information, visit www.legionella2018.org.

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NEHA BOOKSTORE
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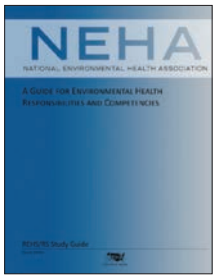
REHS/RS Study Guide, 4th Edition

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.

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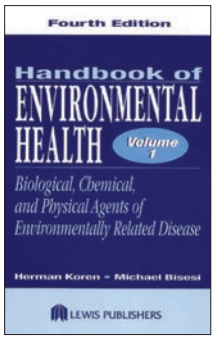

A must for the reference library of anyone in the environmental health profession, this book focuses on factors that are generally associated with the internal environment. It was written by experts in the field and copublished with the National Environmental Health Association. A variety of environmental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

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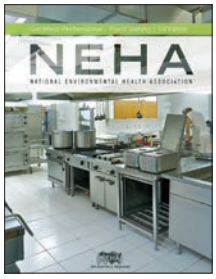

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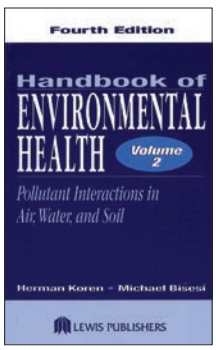

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john@jtakfoodsafety.com

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Georgia—Tamika Pridgon.
tamika.pridgon@dph.ga.gov

Idaho—Tyler Fortunati, Idaho Dept. of Environmental Quality, Meridian, ID.
tyler.fortunati@deq.idaho.gov

Illinois—David Banaszynski, Environmental Health Officer, Hoffman Estates, IL.
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Indiana—Patty Nocek, REHS/RS, CP-FS, La Porte County Health Dept., La Porte, IN.
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Iowa—Michelle Clausen Rosendahl, MPH, REHS, Director of Environmental Health, Siouxland District Health Dept., Sioux City, IA.
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Jamaica—Rowan Stephens, St. Catherine, Jamaica.
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Kansas—Guy Crabill, Lawrence, KS.
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bethleon@aol.com

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Mississippi—Susan Bates, Mississippi Dept. of Health/Webster County Health Dept., Pheba, MS.
susan.bates@msdh.state.ms.us

Missouri—Stacie A. Duitsman, Kansas City Health Dept., Kansas City, MO.
stacie.duitsman@kcmo.org

Missouri Milk, Food, and Environmental Health Association—Roxanne Sharp, Public Health Investigator II, Springfield/Greene County Health Dept., Springfield, MO.
rsharp@springfieldmo.gov

Montana—Alisha Johnson, Missoula City County Health Dept., Missoula, MT.
alishaerikajohnson@gmail.com

National Capital Area—Kristen Pybus, MPA, REHS/RS, CP-FS, Fairfax County Health Dept., VA.
kpybus@ncaeha.com

Nebraska—Harry Heafer, REHS, Environmental Health Specialist II, Lincoln-Lancaster County Health Dept., Lincoln, NE.
hheafer@lincoln.ne.gov

Nevada—Erin Cavin, REHS, Environmental Health Specialist II, Southern Nevada Health District, Las Vegas, NV.
nevadaeha@gmail.com

New Jersey—Paschal Nwako, MPH, PhD, REHS, CHES, DAAS, Health Officer, Camden County Health Dept., Blackwood, NJ.
pn2@njlincs.net

New Mexico—Cecelia Garcia, MS, CP-FS, Environmental Health Specialist, City of Albuquerque Environmental Health Dept., Albuquerque, NM.
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New York—Contact Region 9 Vice-President Larry Ramdin.
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North Carolina—Victoria Hudson, Rockingham, NC.
vhudson@orangecountync.gov

North Dakota—Grant Larson, Fargo Cass Public Health, Fargo, ND. glarson@cityoffargo.com

Northern New England Environmental Health Association—Brian Lockard, Health Officer, Town of Salem Health Dept., Salem, NH. blockard@ci.salem.nh.us

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Food (including Safety and Defense)—Eric Bradley, MPH, REHS, CP-FS, DAAS, Scott County Health Dept. eric.bradley@scottcountyiowa.com

Food (including Safety and Defense)—John Marcello, CP-FS, REHS, FDA. john.marcello@fda.hhs.gov

General Environmental Health—Tara Gurge, Needham Health Dept. tgurge@needhamma.gov

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NEHA Staff: (303) 756-9090

Seth Arends, Graphic Designer, NEHA Entrepreneurial Zone (EZ), ext. 318, sarends@neha.org

Jonna Ashley, Association Membership Manager, ext. 336, jashley@neha.org

Rance Baker, Program Administrator, NEHA EZ, ext. 306, rbaker@neha.org

Trisha Bramwell, Sales and Training Support, NEHA EZ, ext. 340, tbramwell@neha.org

Vanessa DeArman, Project Coordinator, Program and Partnership Development (PPD), ext. 311, vdearman@neha.org

Kristie Denbrock, Chief Learning Officer, ext. 313, kdenbrock@neha.org

David Dyjack, Executive Director, ext. 301, ddyjack@neha.org

Santiago Ezcurra, Media Production Specialist, NEHA EZ, ext. 342, sezcurra@neha.org

Soni Fink, Strategic Sales Coordinator, ext. 314, sfink@neha.org

Nancy Finney, Technical Editor, NEHA EZ, ext. 326, nfinney@neha.org

Michael Gallagher, Operations and Logistics Planner, NEHA EZ, ext. 343, mgallagher@neha.org

Arwa Hurley, Website and Digital Media Specialist, ext. 327, ahurley@neha.org

Faye Koeltzow, Business Analyst, ext. 302, fkoeltzow@neha.org

Elizabeth Landeen, Associate Director, PPD, (702) 802-3924, elandeen@neha.org

Angelica Ledezma, Member Services Assistant, ext. 300, aledezma@neha.org

Matt Lieber, Database Administrator, ext. 325, mlieber@neha.org

Bobby Medina, Credentialing Dept. Customer Service Coordinator, ext. 310, bmedina@neha.org

Marissa Mills, Human Resources Manager, ext. 304, mmills@neha.org

Eileen Neison, Credentialing Specialist, ext. 339, eneison@neha.org

Carol Newlin, Credentialing Specialist, ext. 337, cnewlin@neha.org

Christine Ortiz Gumina, Project Coordinator, PPD, cortizgumina@neha.org

Solly Poprish, Program Coordinator, PPD, ext. 335, spoprish@neha.org

Barry Porter, Financial Coordinator, ext. 308, bporter@neha.org

Kristen Ruby-Cisneros, Managing Editor, *Journal of Environmental Health*, ext. 341, kruby@neha.org

Allison Schneider, CDC Public Health Associate, PPD, ext. 307, aschneider@neha.org

Reem Tariq, Project Coordinator, PPD, ext. 319, rtariq@neha.org

Christl Tate, Program Manager, PPD, ext. 305, ctate@neha.org

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Learn how engineers, academia, and environmental health professionals are working together to construct disaster reduction structures by attending the panel presentation, "Integrating Environmental Health, Structural Engineering, and Risk Management for Disaster Risk Reduction and Resiliency." Hurricane Harvey, wildfire smoke health risks, and "Terrorists, Toxics, and Homeland Security" are just a few of the many preparedness sessions on the agenda.

Food Safety
Cannabis-infused food products pose many food safety concerns. Educational sessions will address issues such as cannabis policy, product labeling, product testing, and advertising restrictions. And you won't want to miss the "San Francisco Bay Area Cannabis Foodborne Illness Outbreak Collaborated Response" panel discussion. Additional emerging food safety topics covered will include the growth of the food truck industry, home restaurants, and fish fraud in retail food.

Healthy Homes
Choose from a large variety of healthy homes topics including air quality and asthma, land reuse and sustainability, and climate change and health. Sessions will also delve into the home health risks of lead from poisoning, prevention, and awareness angles.

Stay tuned for more details on the variety of educational sessions planned for the 2018 AEC. Register today at **neha.org/aec/register**.

Preconference

Check out the **credential review courses and training opportunities** scheduled for June 23–25 at **neha.org/aec/preconference**.

Workshops
Survival Skills for Environmental Health Leaders • Sunday, June 24 *(9:00 AM – 5:00 PM)* Target audience: Emerging leaders in environmental health
Health Impact Assessment 101 • Sunday, June 24 *(10:00 AM – 5:00 PM)*
Affiliate Leadership Workshop • Sunday, June 24 *(1:00 – 5:00 PM)* Target audience: Individuals serving in affiliate leadership positions post-conference

Schedule at a Glance

Available at **neha.org/aec/schedule**.

Exhibition

Exhibitors, be sure to reserve your booth now to take advantage of the best booth selection at **neha.org/aec/exhibition**.

Exhibiting at the 2018 AEC allows you to meet face-to-face with over 1,000 environmental health professionals from all over the nation.

REGISTER NOW!

NEHA **NEWS**

NEHA Supports National Healthy Schools Day

By Vanessa DeArman (vdearman@neha.org)

National Healthy Schools Day (NHSD) is April 3, 2018. NEHA is pleased to partner again with the Healthy Schools Network (www.healthyschools.org) to support and promote this event. NEHA has been a supporter since 2011.

NHSD is coordinated by the Healthy Schools Network in partnership with many agencies and organizations. Together they promote the use of the U.S. Environmental Protection Agency's (U.S. EPA) Indoor Air Quality (IAQ) Tools for Schools guidance (www.epa.gov/iaq/schools/index.html), as well as other U.S. EPA environmental health guidelines and programs for schools and children's health.

The Healthy Schools Network is the leading national voice for children's environmental health in schools and is an award winning 501c3 nonprofit environmental health organization. Founded in 1995, the network launched the national healthy schools movement with comprehensive state policy recommendations and a model coalition. It has since fostered reform coalitions in many states and localities.

Environmental health professionals recognize children's environmental health as a priority area. This recognition is reflected in NEHA's work in school integrated pest management, school IAQ, and food safety in schools. We are proud to again join our colleagues to offer strong support of this year's NHSD.

For more information about NHSD, please visit www.nationalhealthyschoolsday.org or follow the conversation on Twitter at #HealthySchoolsDay.

NEHA Staff Profiles

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

Jonna Ashley

I am originally from Charlottesville, Virginia, and studied art and art history at the University of Virginia. After college, I moved to Washington, DC, where I began my career in associations—and I never looked back! Before becoming NEHA's membership manager, I worked in associations in Washington, DC, and Chicago, doing everything from member services to affiliate relations and international programs. My true enthusiasm for association work lies in being able to help members make connections and develop professionally in their chosen career. My big challenging goal at NEHA is to establish a growing community of engaged members and affiliates who are supported and empowered through NEHA membership. I believe that this goal can be accomplished by providing every NEHA member with a valuable membership experience.

When I'm not at work I can usually be found enjoying time with my family, including my incredibly cute and rambunctious toddler. In my fleeting moments of free time I peruse other passions such as art and design projects, volunteer in support of causes that are meaningful to me, and get outside.

Please reach out to me with your thoughts, concerns, and expectations of NEHA membership at jashley@neha.org.

Kristie Denbrock

Even as a small girl I always wanted to be outside. I was the one using a fallen tree branch as a fishing pole in mud puddles and sailing peanut shells down rain-flooded street gutters. The majestic change of colors during a Michigan autumn, my home state, still amazes me. When the opportunity arose to work for a nonprofit association whose mission is to protect the public and the environments in which they live, those long ago memories came rushing back.

I am not new to Colorado. I began my career working in the media, including print, radio, and television, during and after graduating from Colorado State University–Pueblo. I returned to Michigan and received my master of public administration from Western Michigan University while working as deputy director of communications for the Michigan State Senate. Prior to returning to Colorado in 2017, I was the consortium coordinator and an adjunct faculty member at Michigan State University in the Online Master of Science in Food Safety program.

As chief learning officer at NEHA, I take pride in representing and working with our caring and dedicated environmental health professionals. I am excited to have an opportunity where my past career experiences can help build a strong NEHA. I will strive to develop the educational tools necessary for environmental health professionals to succeed and to continue to be our unsung heroes.

DirecTalk
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ages of 14–19, and about 80% were Black. Roughly 6% were illiterate and 52% of the teens had not finished high school.

Christopher Murray, director of the Institute for Health Metrics and Evaluation, may have summed it up best. "The gaps continue to widen between the communities with the highest life expectancy and the lowest," explained Murray. "Would that be different if the income inequality were reduced? If you took a 30-year view, then yes. There does seem to be that long run relationship between community income and these life expectancy outcomes."

Most, if not all, of us in the NEHA network are altruistic and desire every American to reach their full potential. It strikes me that environmental health professionals are the foundation of prevention in the U.S. and elsewhere. We know our communities because we spend considerable time in the field, unlike most of the other public health professions. We disproportionately ascend into leadership positions because our political skills are honed through routine interaction with elected officials and the regulated community. Our science-based education gives us special insight and abilities to communicate to clinical professionals.

One of the many faces of poverty. Photo courtesy of the Central Florida Commission on Homelessness.

I ask that as we engage in our demanding work obligations, let us be aware of opportunities to advocate with local employers to build employment bridges to impoverished communities. We should use our influence with local elected officials to create conditions that improve high school graduation rates. Let's be alert to teachable moments that might shine a light on the health implications of living in poverty.

Your association is doing its part. I nominated Dr. Sandra Whitehead, NEHA's director of Program and Partnership Development, to U.S.EPA's Federal Advisory Committee on Environmental Justice. U.S. EPA Administrator Scott Pruitt accepted our recommendation and recently named Dr. Whitehead to that committee. To the best of my knowledge, Dr. Whitehead is the first NEHA staff member to be named to a federal advisory committee.

I close on an optimistic note. I believe science as a worldview remains widely accepted. Society understands that addressing poverty and environmental issues are a strategic national, dare I say, global priority. To that end, and outside of the classroom, you represent science at the local level and command authority unlike many other professionals. Use your authority diplomatically. Use your authority humbly. Use your authority in service to others. Leadership matters. Your leadership matters. You matter.

Dave

ddyjack@neha.org
Twitter: @DTDyjack

Did You Know?

Four stories on emerging issues in food safety were posted on NEHA's A Day in the Life of an Environmental Health Professional blog in March. Read those stories and other fascinating posts from NEHA members at www.neha.org/membership-communities/get-involved/day-in-life.

DirecTalk MUSINGS FROM THE 10TH FLOOR

David Dyjack, DrPH, CIH

On Poverty

Food Safety Summit attendees rolled their eyes and noticeably suppressed an urge to smirk as I encouraged them to think about the root cause of most foodborne illness in the U.S.: sick retail food employees who show up to work. A few conference participants approached me privately to suggest that some chain restaurants provide liberal leave policies for sick employees, and that those policies are subject to abuse. As a frequent traveler, I shared my biased observation that I regularly encounter visibly ill employees in some of the largest and most ubiquitous companies in the global hospitality and food and beverage industry. I try to make it a point to ask these employees why they are at work since they appear unwell. The answers disproportionately fall into one of two buckets: 1) they need the money or 2) there is no one else to cover their shift. By far, the majority of answers is money.

The reality is that poverty is awful. As of 2016, more than 40 million U.S. citizens live below the poverty line—13.3 million are children. Poverty is also intrinsically linked with environmental health. Cities like Flint, Michigan, have the dubious distinction of poverty rates 3.5 times higher than the national average. Children are not the only ones who are affected, their mothers also suffer.

The U.S. ranks as the worst developed country for maternal health outcomes. Poor American women encounter difficulty accessing care, are over prescribed medical interventions when they have access to care, and often enter pregnancy with a chronic disease. Then toss race into the crucible. A baby born to a Black mother in the U.S. is twice as likely to die before reaching her/his first birthday compared with a baby born to a White mother. Sadly, poor infants of color are then subject to an environmental health race to the bottom. The risk of lead exposure falls disproportionately on minority children. Black children are 3 times more likely to have elevated blood lead levels than their White counterparts.

Leadership matters.
Your leadership matters.
You matter.

Childhood poverty is associated with lifelong struggles and difficulties. Evidence suggests poor children suffer from developmental and psychosocial struggles, which ultimately give rise to financial problems for them, their families, and society. Children who do not earn a high school diploma are more likely to become teenage parents, be unemployed, and be incarcerated. A study by the National Student Clearinghouse found that poverty remains a more important indicator of whether a student will go to college than high school demographics or location. Place does matter, however, in other contexts.

The U.S. Environmental Protection Agency (U.S. EPA) has reported that approximately 12 million people live within one mile of a Superfund site. These people are generally characterized as being more minority, low income, linguistically isolated, and less likely to have a high school education than the U.S. population taken in aggregate.

If a person is low income they are more likely to be obese. Poverty rates and obesity were reviewed in 2010 across 3,139 U.S. counties. Jurisdictions with poverty rates of more than 35% had obesity rates 145% greater than their wealthy counterparts.

The relationship between cancer and poverty is also sobering. There is an abundance of evidence that demonstrates cancer incidence and cancer survival are related to socioeconomic circumstances. If a person is poor, they are more likely to develop cancer and more likely to die from it. For breast cancer specifically, poverty is associated with lower survival rates. Dr. Danielle Henry, a Florida-based Board Certified General Surgeon and Breast Surgical Oncologist in Training, recently expressed her dismay. "I often see patients, those insured and uninsured, who have to make hard decisions about what parts of their cancer care they can afford. Even with all the advances we have made in cancer care, it often comes down to what they can afford and not always what they really need."

These relationships are not strictly U.S. phenomena. In a recent study conducted in Alagoas, Brazil, about half the mothers of Zika-affected babies were teens between the

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