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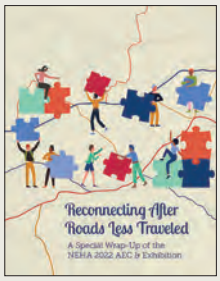

On June 28–July 1, 2022, the National Environmental Health Association held its 85th Annual Educational Conference (AEC) & Exhibition in Spokane, Washington, bringing together environmental health professionals from across the country and globe. The 2022 AEC marked the first time since 2019 that we were able to reconnect in person. The 2022 AEC was offered as a hybrid event, providing education and interaction for in-person and virtual attendees. We feature a special wrap-up of the 2022 AEC in this issue, highlighting our featured speakers, educational sessions, social events, exhibition, and award and scholarship winners.

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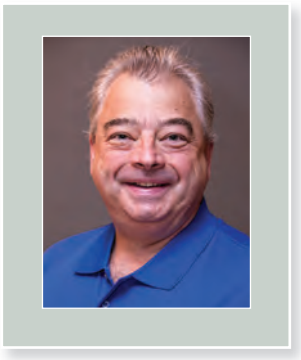

D. Gary Brown,
DrPH, CIH, RS, DAAS

Back in the Saddle

As I write this next column I have just returned from beautiful Spokane, Washington, after attending the successful National Environmental Health Association (NEHA) 2022 Annual Educational Conference (AEC) & Exhibition with approximately 1,000 in-person and 400 virtual attendees. Thank you for making the 2022 AEC a success.

Words cannot express how wonderful it was to see colleagues, friends, and members of my NEHA family. I have attended NEHA AECs since 2001 and have made numerous friends, many of whom have become part of my family. A shared passion to advance environmental health science—while helping people have clean air, food, and water, along with a safe place to live, work, and play—means we have an instant connection when meeting fellow professionals. Great minds think alike.

I have been lucky enough to live in various parts of our beautiful country. People from NEHA—as well as Eastern Kentucky University, the Kentucky Environmental Health Association, and Jamaican Association of Public Health Inspectors—have all become a part of my family. I grew up as a Buffalonian but am now an Alabamian, Kentuckian, Jamerican (i.e., Jamaican American), Manhattanite, and "NEHAian." The NEHA AEC allows me the opportunity to reconnect with many members of my different families.

Aristotle wrote, "Man is by nature a social animal." We are inherently social creatures, something the COVID-19 pandemic brought to the forefront for many people. As we learned during the pandemic, people around the world experienced increased loneliness that can have implications for long-term mental and physical health, longevity, and well-being (Ernst et al., 2022)

A shared passion to advance environmental health science means we have an instant connection when meeting fellow professionals.

The 2022 AEC was a celebration of the return of being in person. Everyone who I spoke with at the conference was ecstatic about reconnecting in person. The internet, social media, Zoom, Teams, etc. are useful tools, but they cannot replicate the in-person experience. I met numerous new people in Spokane, making personal connections that would have been much harder electronically. I learned something from everyone I met at the 2022 AEC, including students and professionals at all ends of the career spectrum.

Many attendees do not realize that there are a number of preconference offerings at the AECs, many of which are offered for free or at a minimal cost for NEHA members. Preconference offerings this year included:

- review courses for the NEHA Certified Professional–Food Safety (CP-FS) and Registered Environmental Health Specialist/Registered Sanitarian (REHS/RS) credential exams,
- inspector training for body art facilities,
- the Environmental Health and Land Reuse Certificate Program from NEHA and the Agency for Toxic Substances and Disease Registry,
- a National Retail Food Regulatory Program Standards Self-Assessment and Verification Audit Workshop from NEHA and the Food and Drug Administration,
- Climate for Health Ambassador Training,
- and many others.

The NEHA AEC is much more than a conference. It is the nexus for environmental health training, education, networking, and advancement. The NEHA AEC is the most comprehensive training and education investment you and your organization can make to achieve immediate and long-term benefits.

Attendees at the NEHA AEC acquired practical and real-world information and expertise from like-minded professionals who share your passion for environmental health. Attendees leave the conference trained, motivated, inspired, and empowered to further advance themselves and their organizations.

Attendees gain the skills, knowledge, and expertise needed to help solve daily and strategic challenges within their organizations, as

well as improve bottom-line results. An added bonus is that attendees can earned continuing education contact hours to maintain their professional credentials.

I thank the NEHA staff who ran our first hybrid AEC, which entailed running two conferences at the same time—in person and virtual. The NEHA staff worked 12 days straight before and during the conference from early in the morning to late in the evening. NEHA is lucky to have such dedicated, hardworking staff. The Washington State Environmental Health Association also deserves high praise for their role in helping to make this conference a success.

Many attendees do not realize how valuable the AEC sponsors are. The generous contributions from the sponsors help reduce the cost of attendance, as well as provide their expertise, products, and services throughout the year. NEHA is incredibly lucky to have sponsors who are true partners and who help spread the vision and mission of NEHA.

A special thank you goes out to Dr. Priscilla Oliver and Sandra Long, past presidents of NEHA, who kept the NEHA ship steered in the right direction and helped our organization gain steam during the pandemic. Their stellar leadership during their presidencies allowed NEHA to increase revenue along with reserves. They did not have the opportunity to attend and lead an in-person AEC. They have my gratitude as well as that from the environmental health profession and our members and staff .

We want our members to have the best possible experience when attending the AEC. When NEHA considers a location for the AEC, numerous factors are taken into consideration including cost, desirability of the location, and the facilities. Numerous hours go into the groundwork before a location is selected. Once NEHA determines the location of the AEC, the challenging work really begins.

For the 2023 AEC, New Orleans is much more than Bourbon Street and world-renowned food. New Orleans has something for everyone including one of the country's top-rated aquariums and zoos, historic homes, the National World War II Museum, the New Orleans Museum of Art, and architectural gems.

All environmental health professionals have unique knowledge and experiences. I hope you took advantage of the 2023 AEC Call for Abstracts that was open in September to share your story and knowledge. I look forward to seeing you at the 2023 AEC in New Orleans, Louisiana, on July 31–August 3.

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Reference

Ernst, M., Niederer, D., Werner, A.M., Czaja, S.J., Mikton, C., Ong, A.D., Rosen, T., Brähler, E., & Beutel, M.E. (2022). Loneliness before and during the COVID-19 pandemic: A systematic review with meta-analysis. *American Psychologist*, 77(5), 660–677. https://doi.org/10.1037/amp0001005

Estimation of High Blood Lead Levels Among Children in Georgia: An Application of Bayesian Analysis

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Abstract **In Georgia, children in high-risk counties are at increased risk for lead exposure. Those children and others in high-risk groups, such as families receiving Medicaid and Peach Care for Kids (i.e., health coverage for children in low-income families), are screened for blood lead levels (BLLs). Such screening, however, might not include all children at high risk for having BLLs above the reference levels (≥5 µg/dL) in the state. In our study, Bayesian methods were used to estimate the predictive density of the number of children <6 years with BLLs of 5–9 µg/dL in a targeted county from each of five selected regions of Georgia. Furthermore, the estimated mean number of children with BLLs of 5–9 µg/dL in each targeted county, along with its 95% credible interval, were calculated. The model revealed likely underreporting of some children <6 years with BLLs of 5–9 µg/dL in counties of Georgia. Further investigation might help reduce underreporting and better protect children who are at risk for lead poisoning.**

Introduction

Lead exposure can seriously affect the health of children (World Health Organization, 2022). High levels of lead exposure can harm the brain and central nervous system of children. High levels of lead exposure can also cause coma, convulsions, and death in children. Children who survive severe lead poisoning can suffer from mental deficiencies and behavioral disorders. Lead is known to affect children's brain development and can result in reduced IQ and behavioral changes such as short attention span and reduced educational attainment. Most importantly, these neurological and behavioral effects of lead are irreversible (Centers for Disease Control and Prevention [CDC], 2022; Egan et al., 2021).

Georgia Department of Public Health (n.d.) guidelines for blood lead screening recommend screening children who belong to high-risk groups such as families receiving Medicaid or Peach Care for Kids (i.e., health coverage for children in low-income families). The guidelines also recommend screening in 16 counties in which children are at greater risk for lead exposure. Following these guidelines, the resulting group of children to be tested for elevated blood lead levels (BLLs), however, is limited and some children with elevated BLLs might be missed.

In 2012, the Centers for Disease Control and Prevention (CDC, 2021) defined a BLL of 5 µg/dL as a reference value for children <6 years. Note, this reference value was changed to a more stringent level of 3.5 µg/dL but at the time of our study the limit was 5 µg/dL. Bayesian analysis with limited beliefs about a parameter can be helpful in modeling the exposure of lead in children by suitably matching these beliefs with some known distribution.

The primary objective of our study was to estimate and validate the observed number of children with BLLs of 5–9 µg/dL among children <6 years in different counties of Georgia, selected by region. This objective was important to investigate if screening of a limited group of children in Georgia resulted in underreporting of children with elevated BLLs. Although some studies have connected targeted screening and missed children with elevated BLLs (Roberts et al., 2017), no such research work has been found evaluating the impact of targeted screening on the rate of children <6 years with elevated BLLs in a region, especially in Georgia.

Methods

Data Collection

We used data collected by the Healthy Homes and Lead Poisoning Prevention Program of the Georgia Department of Public Health for 2015. Child blood lead surveillance data was used, including the number of children <6 years who were tested and the number of children with BLLs of 5–9 µg/dL, by race and county. Estimates of children <6 years were available from the Georgia Governor's Office of Planning and Budget (2016).

Bayesian Model

The variable z was used to represent the number of children <6 years with BLLs of 5–9 µg/dL in a county in Georgia. Because this event is rare, one can safely assume that z follows a statistical distribution known as Poisson distribution shown by:

$$p(z/\theta) = e^{-(m\,.\,\theta)}(m\,.\,\theta)^{z}/z! \qquad (1)$$

Where θ is the rate of children with BLLs of 5–9 µg/dL (i.e., θ = children with BLLs of

5–9 µg/dL/children tested for BLL); m is the number of children <6 years who were tested for BLL; m . θ is the number of children with BLLs of 5–9 µg/dL; and p(z/θ) is the probability that there are z number of children <6 years with BLLs of 5–9 µg/dL under the assumption that θ is the rate of children with BLLs of 5–9 µg/dL.

Clearly, θ is unknown or a parameter, and under the Bayesian principle, one tries to estimate it based on a reasonable assumption of its statistical distribution, called "prior distribution" or simply "prior." It is reasonable to assume that a parameter coming from a Poisson distribution should follow a statistical distribution called gamma distribution.

Thus, this model assumes that θ follows a gamma (α, β) prior:

$$p(\theta) = e^{-(\beta\,\theta)}\beta^{\alpha}\,\theta^{\alpha-1}/\Gamma(\alpha) \quad (2)$$

Where θ > 0, and α and β are its unknowns or parameters.

Then, according to Bayesian rule, actual or simply put, posterior distribution, p(θ/z) of θ, will be given by p(θ/z) = p(z/θ) × p(θ)/p(z), which is the distribution of the observed number multiplied by the prior of its parameter divided by the constant p(z). That is:

$$p(\theta/z) = e^{-(m\,.\,\theta)}(m\,.\,\theta)^{z} \times e^{-(\beta\,\theta)}\beta^{\alpha}\,\theta^{\alpha-1}/z!\;\Gamma(\alpha)\;p(z) \quad (2a)$$

$$\text{or, } p(\theta/z) = e^{-\theta(\beta+m)}\,(\theta)^{z+\alpha-1} \times \text{constant} \quad (3)$$

Here, the right-hand side of Equation 2 and that of the posterior distribution in Equation 3 are similar, which indicates that the posterior is also a gamma (α_1, β_1) distribution with parameters α_1 and β_1 where:

$$\alpha_1 = z + \alpha \text{ and } \beta_1 = \beta + m \quad (3a)$$

This equation means that if one assumes that the prior information about parameter θ (the rate of children with BLLs of 5-9 µg/dL) can be obtained from a small group of counties in Georgia, each of which is believed to have the same rate (θ) of 5–9 µg/dL BLLs among children <6 years, then applying Bayesian rule, the posterior for θ can be estimated from a gamma distribution as shown in Equation 3.

Moreover, if one supposes z_j is the number of children <6 years with BLLs of 5–9 µg/dL among x_j children from county j, then, assuming z_j follows a Poisson distribution, one would have, as in Equation 1:

$$p(z_j/\theta) = e^{-(xj\,\theta)}(x_j\theta)^{zj}/z_j! \quad (4)$$

Where θ is the same as defined earlier.

Thus, the likelihood function for n counties with the same parameter θ is given as follows:

$$L(\Sigma z_j/\theta) = e^{-(\Sigma xj\,\theta)}\Pi(x_j\theta)^{zj}/z_1!\;z_2!\;\ldots\;z_n! \quad (5)$$

This equation is obtained by multiplying density functions like Equation 4 for n counties. Omitting the constant terms, one has:

$$L(\Sigma z_j/\theta) \propto e^{-(\Sigma xj\,\theta)}(\theta)^{\Sigma zj} \quad (6)$$

Where ∝ indicates proportionality.

If for all these n counties, one assumes that θ follows a noninformative prior 1/θ (i.e., p(θ) = 1/θ), then as was done in Equation 2a and from Equation 6, the posterior distribution of θ is given by the following:

$$p(\theta/\Sigma z_j) \propto e^{-(\Sigma xj\theta)}(\theta)^{\Sigma zj}\,.\,1/\theta$$
$$\text{(i.e., } p(\theta/\Sigma z_j) \propto e^{-(\Sigma xj\theta)}(\theta)^{\Sigma zj-1}) \quad (7)$$

This is a gamma (α_2, β_2), where:

$$\alpha_2 = \Sigma z_j \text{ and } \beta_2 = \Sigma x_j \quad (8)$$

Here, Σz_j is the shape parameter and Σx_j is the rate parameter of this gamma distribution, where z_j is the number of children <6 years with BLLs of 5–9 µg/dL in county j and x_j is the number of children tested for BLL in county j. The assumption is that the rate of children with BLLs of 5–9 µg/dL among children <6 years in these counties is similar to that in a targeted county where one wants to estimate that rate. One can then use known α and β from Equation 8 in Equations 2 and 3 to evaluate the prior and posterior distributions of the parameter θ in the targeted county.

According to the multiplication rule of probability, the joint distribution of data z and the parameter θ are given by the following:

$$p(z,\theta) = p(\theta) \times p(z/\theta), \text{ and also}$$
$$p(z,\theta) = p(z) \times p(\theta/z)$$
$$\text{Thus, } p(z) \times p(\theta/z) = p(\theta) \times p(z/\theta),$$
$$\text{giving:}$$
$$p(z) = p(\theta) \times p(z/\theta)/p(\theta/z) \quad (9)$$

Here, p(θ) and p(θ/z) are the known prior and posterior distributions, respectively, of the parameter θ. Thus, p(θ) is a gamma density with the known shape and rate parameters from Equation 8. Similarly, p(θ/z) is a gamma density with known shape and rate parameters from Equations 8 and 3a. Assuming that p(z/θ) is the sampling distribution of data in the targeted county, one can estimate the predictive density p(z) of z in the targeted county from Equation 9 before any data are observed, where p(z/θ) is a Poisson density with known mean (mθ) as shown in Equation 1.

If our model assumptions for sampling distribution of data and prior density are valid, one can check the validity of the observed values of the number of children <6 years with BLLs of 5–9 µg/dL in the targeted county.

Detailed information about this Bayesian model can be found at www.neha.org/jeh/supplemental.

County and Region Selection

The model was applied by dividing Georgia into five different regions: North, South, East, West, and Central. Then 11 neighboring counties were arbitrarily selected in each region, assuming similarity of BLL rates of 5–9 µg/dL among children ages <6 years in these counties. For each region, the county with the lowest observed proportion of children with BLLs 5–9 µg/dL was selected as the targeted county. The remaining 10 counties from each region provided data for estimation of parameters α and β for the prior distribution. The parameter θ, the rate of children with BLLs of 5–9 µg/dL in the targeted county, was estimated from the mean value α/β of the gamma distribution, as the predictive density (Equation 9) is valid for all θ.

Data Analysis

Data were analyzed using statistical software SAS (version 9.4) and R package. For each region, predictive density was calculated for the targeted county from Equation 9 for all children, and separately for White and non-White children. We assumed that the observed value for the number of children with BLLs of 5–9 µg/dL among children <6 years within the three largest predictive probabilities was compatible.

Additionally, the mean number of children with BLLs of 5–9 µg/dL was estimated in the

TABLE **1**

Observed Blood Lead Levels (BLLs) for Children <6 Years From 11 Neighboring Counties in the North Region of Georgia, 2015

County [a]	# of Children <6 Years	# of Children <6 Years With BLLs of 5–9 µg/dL			Total # of Children <6 Years Tested		
		All	White	Non-White	All	White	Non-White
A	2,401	5	2	3	319	169	150
B	1,067	6	4	2	323	213	110
C	834	3	1	2	194	157	37
D	400	0	0	0	113	91	22
E	3,552	1	1	0	193	142	51
F	1,581	9	3	6	651	330	321
G	1,423	4	3	1	219	130	89
H	1,387	4	3	1	368	208	160
I	2,571	10	3	7	740	415	325
J	1,625	9	7	2	529	365	164
X [b]	743	0	0	0	246	148	98

[a] These 11 counties were chosen arbitrarily because they are contiguous. The assumption was that because they are contiguous, these counties will have similar BLL rates of 5–9 µg/dL among children <6 years.

[b] X indicates the targeted county. A targeted county is one with the lowest observed proportion of tested children with BLLs of 5–9 µg/dL among children <6 years.

TABLE **2**

Observed Blood Lead Levels (BLLs) for Children <6 Years From 11 Neighboring Counties in the East Region of Georgia, 2015

County [a]	# of Children <6 Years	# of Children <6 Years With BLLs of 5–9 µg/dL			Total # of Children <6 Years Tested		
		All	White	Non-White	All	White	Non-White
A	400	4	3	1	39	13	26
B	13,956	49	10	39	1,817	303	1,514
C	1,595	8	1	7	393	104	289
D	829	2	0	2	205	57	148
E	535	2	0	2	62	16	46
F	1,467	11	1	10	177	47	130
G	985	3	2	1	162	38	124
H	494	3	2	1	123	50	73
I	4,196	20	9	11	1,203	255	948
J	1,132	16	5	11	722	228	494
X [b]	9,328	2	1	1	458	233	225

[a] These 11 counties were chosen arbitrarily because they are contiguous. The assumption was that because they are contiguous, these counties will have similar BLL rates of 5–9 µg/dL among children <6 years.

[b] X indicates the targeted county. A targeted county is one with the lowest observed proportion of tested children with BLLs of 5–9 µg/dL among children <6 years.

TABLE **3**

Observed Blood Lead Levels (BLLs) for Children <6 Years From 11 Neighboring Counties in the South Region of Georgia, 2015

County [a]	# of Children <6 Years	# of Children <6 Years With BLLs of 5–9 µg/dL			Total # of Children <6 Years Tested		
		All	White	Non-White	All	White	Non-White
A	473	12	5	7	127	57	70
B	1,757	9	2	7	109	39	70
C	1,686	11	5	6	554	212	342
D	968	6	2	4	151	54	97
E	7,952	27	9	18	1,206	643	563
F	347	8	3	5	79	41	38
G	1,326	6	2	4	371	124	247
H	3,235	18	7	11	776	366	410
I	1,154	13	6	7	215	112	103
J	769	4	3	1	102	65	37
X [b]	2,910	15	4	11	990	519	471

[a] These 11 counties were chosen arbitrarily because they are contiguous. The assumption was that because they are contiguous, these counties will have similar BLL rates of 5–9 µg/dL among children <6 years.

[b] X indicates the targeted county. A targeted county is one with the lowest observed proportion of tested children with BLLs of 5–9 µg/dL among children <6 years.

targeted county from Equation 9 by simultaneously simulating 1,000 values from each of the probability densities $p(\theta)$, $p(\theta/z)$, and $p(z/\theta)$. A 95% credible interval for the mean number of children with BLLs of 5–9 µg/dL was estimated from the simulated values. An observed number of children with BLLs of 5–9 µg/dL in the targeted county was considered an acceptable number if within the boundaries of the credible interval for that county. The estimated mean number of children <6 years with BLLs of 5–9 µg/dL in the targeted county was recommended as the true value if the observed value was outside the boundaries of the credible interval.

Results

Tables 1, 2, and 3 show the observed numbers of White, non-White, and total children who had their BLLs tested and those children with BLLs of 5–9 µg/dL in the North, East, and South regions of Georgia. The 11 counties chosen in each of the regions, including West and Central regions (not shown in the tables), were next to each other. For our study, it was assumed that the BLL rates among children <6 years could be similar in each county because of their proximity to each other. County X in the last row of each table represents the targeted county where the proportion of children <6 years with BLLs of 5–9 µg/dL was found to be lowest among the 11 counties and the value of county X was estimated by the model.

Tables 1, 2, and 3 (representing North, East, and South regions of Georgia, respectively) have slightly different distributions of proportion of children with BLLs of 5–9 µg/dL between White and non-White children. In the North region (Table 1), a smaller proportion of non-White children were tested for BLL in almost all the counties—and yet a higher percentage of them were found to have BLLs of 5–9 µg/dL. Thus, in county I in the North region, only 3 (0.07%) out of 415 White children tested had BLLs of 5–9 µg/dL, compared with 7 (2.15%) out of 325 non-White children tested. This finding is similar to that of county C in the North region: 1 (0.06%) out of 157 White children tested had BLLs of 5–9 µg/dL, compared with 2 (5.4%) out of 37 non-White children tested.

In the East region (Table 2) and South region (Table 3), however, the situation was found to be completely the opposite. In both these regions, a smaller proportion of White children were tested, with a higher proportion of children with BLLs of 5–9 µg/dL in almost all the counties. Thus, in county A in the East region, 3 (23.08%) out of 13 White children had BLLs of 5–9 µg/dL, compared with 1 (3.84%) out of 26 non-White children. Similarly, in county A in the South region, 5 (8.77%) out of 57 White children tested had BLLs of 5–9 µg/dL, compared with 7 (1.00%) out of 70 non-White children tested.

Tables 4, 5, and 6 show the predictive densities or estimated probabilities for 0–15 children <6 years with BLLs of 5–9 µg/dL in the targeted county for all, White, and non-White children, respectively. Each of these tables show probabilities for the five regions calculated based on Equation 9. According to Table 4, the estimated probabilities were found to be highest (0.190, 0.212, 0.181) at moderately three smaller numbers (2, 3, and 4, respectively) of all children <6 years with BLLs of 5–9 µg/dL in the targeted county in the North region. This finding indicates that the number of all children <6 years with BLLs of 5–9 µg/dL in the targeted county in the North region should be small, which is corroborated by its 95% credible interval [0.0, 9.3] shown in Table 7. Moreover, this

finding proves that the "0" observed number of all children with BLLs of 5–9 µg/dL in the targeted county (Table 1) is acceptable according to our model.

The same findings holds true for the Central region, where the probabilities are highest (0.256, 0.270, 0.189) for a relatively smaller number (1, 2, and 3, respectively) of all children <6 years with BLLs of 5–9 µg/dL in the targeted county. The probabilities are, however, highest for a slightly larger number (9, 10, and 11) of all children <6 years with BLLs of 5–9 µg/dL in the targeted county in the East region. For the South and West regions, the highest probabilities are not reached within a number of 15 for all children <6 years with BLLs of 5–9 µg/dL in the targeted county, indicating the number of children should be higher (Table 4). Clearly, an observed number of 14 for all children <6 years with BLLs of 5–9 µg/dL in the targeted county in the West region (Table 7) is not acceptable because its 95% credible interval based on our model is [30.7, 65.3].

The same trend is observed for estimated probabilities for White and non-White children as shown in Tables 5 and 6. Table 7 shows the observed number of children <6 years with BLLs of 5–9 µg/dL in the targeted county, along with their estimated number and their 95% credible interval based on simulation. It is important to note from Table 7 that in only two regions—North and Central—the estimated numbers of children <6 years with BLLs of 5–9 µg/dL in the targeted county concurred with the observed values, which is true for all, White, and non-White children.

Figure 1 shows the estimated probability distribution for all children <6 years with BLLs of 5–9 µg/dL in the targeted county in the West and Central regions. The distribution in the West region, where the observed value of those children was not acceptable according to the model, is markedly different from the distribution in the Central region, where the model supported the observed value. The estimated probability is shown to be highest around 40 in the West region, indicating that the number of all children ages <6 years with BLLs of 5–9 µg/dL in the targeted county should be much higher than the observed value of 14, which is not acceptable. In the Central region, however, the estimated probability is shown to be

TABLE **4**

Predictive Density for All Children <6 Years With Blood Lead Levels of 5–9 µg/dL in the Targeted County by Region in Georgia, 2015

# of Children	Probability by Region				
	North	East	South	West	Central
0	0.036	0	0	0	0.121
1	0.116	0	0	0	0.256
2	0.190	0.001	0	0	0.270
3	0.212	0.005	0	0	0.189
4	0.181	0.012	0	0	0.100
5	0.125	0.025	0	0	0.042
6	0.074	0.044	0	0	0.015
7	0.038	0.066	0	0	0.005
8	0.017	0.088	0	0	0.001
9	0.007	0.106	0	0	0
10	0.003	0.115	0	0	0
11	0.001	0.114	0	0	0
12	0	0.105	0	0	0
13	0	0.090	0	0	0
14	0	0.072	0.001	0	0
15	0	0.054	0.002	0	0

TABLE **5**

Predictive Density for White Children <6 Years With Blood Lead Levels of 5–9 µg/dL in the Targeted County by Region in Georgia, 2015

# of Children	Probability by Region				
	North	East	South	West	Central
0	0.175	0.002	0	0	0.436
1	0.295	0.011	0	0.001	0.361
2	0.259	0.031	0	0.004	0.150
3	0.156	0.064	0.002	0.011	0.042
4	0.073	0.010	0.005	0.025	0.009
5	0.028	0.128	0.010	0.045	0.002
6	0.009	0.140	0.019	0.069	0
7	0.003	0.135	0.032	0.092	0
8	0.001	0.117	0.048	0.109	0
9	0	0.093	0.064	0.118	0
10	0	0.067	0.079	0.115	0
11	0	0.045	0.090	0.105	0
12	0	0.029	0.096	0.088	0
13	0	0.017	0.096	0.070	0
14	0	0.010	0.091	0.052	0
15	0	0.005	0.082	0.036	0

TABLE **6**

Predictive Density for Non-White Children <6 Years With Blood Lead Levels of 5–9 µg/dL in the Targeted County by Region in Georgia, 2015

# of Children	Probability by Region				
	North	East	South	West	Central
0	0.204	0.007	0	0	0.265
1	0.313	0.035	0	0	0.352
2	0.251	0.085	0	0	0.233
3	0.140	0.139	0	0	0.104
4	0.061	0.171	0	0	0.035
5	0.022	0.170	0.001	0	0.009
6	0.007	0.143	0.003	0	0.002
7	0.002	0.104	0.007	0	0
8	0	0.067	0.013	0	0
9	0	0.039	0.021	0	0
10	0	0.020	0.032	0	0
11	0	0.010	0.045	0	0
12	0	0.004	0.058	0	0
13	0	0.002	0.070	0	0
14	0	0.001	0.080	0.001	0
15	0	0	0.087	0.002	0

TABLE **7**

Observed and Estimated Mean Number of Children <6 Years With Blood Lead Levels (BLLs) of 5–9 µg/dL and 95% Credible Interval in the Targeted County by Region in Georgia, 2015

Region		Mean # of Children <6 Years With BLLs of 5–9 µg/dL		
		All	White	Non-White
North	Observed	0	0	0
	Estimated	3.8	2.0	1.9
	95% credible interval	[0, 9.3]	[0, 5.9]	[0, 5.6]
East	Observed	2	1	1
	Estimated	11.9	8.4	5.3
	95% credible interval	[5.1, 20.2]	[2.5, 17.1]	[1.1, 11.1]
South	Observed	15	4	11
	Estimated	34.6	16.2	17.9
	95% credible interval	[21.5, 50.8]	[7.8, 28.7]	[8.8, 30.0]
West	Observed	14	1	13
	Estimated	46.0	11.8	35.0
	95% credible interval	[30.7, 65.3]	[4.5, 22.4]	[21.9, 51.6]
Central	Observed	1	0	1
	Estimated	2.1	0.8	1.3
	95% credible interval	[0, 5.9]	[0, 3.3]	[0, 4.1]

highest around 2 or 3, indicating that the number of all children <6 years with BLLs of 5–9 µg/dL is closer to the observed value of 1, which is acceptable.

Discussion

The estimated probabilities for all children <6 years with BLLs of 5–9 µg/dL in the targeted county in the Central region was highest for 1, 2, and 3 children (Table 4). The observed number of all children <6 years with BLLs of 5–9 µg/dL in the targeted county was 1 (Table 7). These results support the observed value. As further corroboration, the estimated number of all children with BLLs of 5–9 µg/dL in the targeted county in the Central region was found to be 2.1 through simulation. Its 95% credible interval was [0.0, 5.9] (Table 7), which included 1.

Similar results were found for all, White, and non-White children for the North and Central regions. For the East region, however, the observed number of all children with BLLs of 5–9 µg/dL in the targeted county was 2 (Table 2) and the highest estimated probabilities were for 9, 10, and 11 children (Table 4). Similarly, the number of all children with BLLs of 5–9 µg/dL in the targeted county in the East region was estimated to be 11.9 by simulation and its 95% credible interval was [5.1, 20.2] (Table 7), which did not include 2. This finding shows discrepancies between the observed and estimated values of children with BLLs of 5–9 µg/dL in the targeted county. Similar results were found in the East region for White and non-White children. Discrepancies between observed and estimated numbers of children <6 years with BLLs of 5–9 µg/dL were also found for the targeted county in the South and West regions (Table 7).

Our model shows the possibility of checking the validity of observed numbers of children with BLLs of 5–9 µg/dL and, if necessary, replacing those numbers with estimates that better reflect the actual probable numbers in the targeted counties. The model could reveal incorrect reporting of elevated BLLs in children <6 years, which might be the case if many of the targeted counties in different regions of a state show discrepancies between the observed and estimated numbers of children with BLLs of 5–9 µg/dL. Therefore, this finding might also point to inadequacies in the screening process

used in the state, and thus lead to modifications to improve the process.

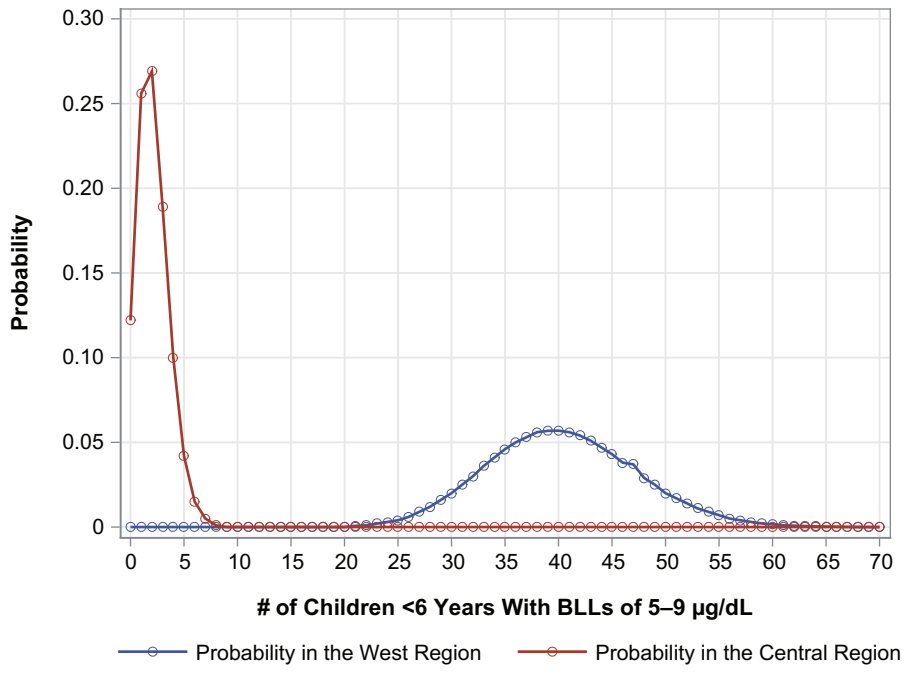
Some studies have observed this inadequacy in the screening process of BLL surveillance data. Based on estimates of elevated BLL (≥10 µg/dL) data for children 1–5 years from 1999–2010 for 39 states (including Washington, DC) that were reported to CDC, Roberts et al. (2017) found that approximately 1.2 million children had elevated BLLs. Among these, 337,405 (approximately 28%) were not reported because of incomplete case ascertainment and far fewer cases were ascertained in the South and West regions.

In Georgia, the case ascertainment ratio (i.e., the number reported/number of cases) was only 0.10. This finding points to undertesting of children with elevated BLL in many states, including Georgia. Similar results have been observed from other studies. According to data from the California Department of Health Care Services during 2009–2010 through 2017–2018, fewer than 27% of eligible children in California received all the required blood tests they should have, although many of these children lived in areas of the state with occurrences of elevated BLLs (Auditor of the State of California, 2020).

Although these studies point to the inadequacy of the screening process for children, no study showed how inadequacy can affect actual BLLs among children <6 years. Our study fills the gap in that research and detects the discrepancy between estimated and observed numbers of children with higher (i.e., 5–9 µg/dL) BLLs—a discrepancy that resulted, most likely, from an undertesting of children with elevated BLLs. Most importantly, we find the corrected number of children with higher (i.e., 5–9 µg/dL) BLLs.

FIGURE **1**

Plot for the Predictive Density of All Children <6 Years With Blood Lead Levels (BLLs) of 5–9 µg/dL in the Targeted Counties in the West and Central Regions of Georgia, 2015



Note. The observed value of children with BLLs of 5–9 µg/dL in the targeted county in the West region was 14 among 1,587 children tested. The observed value of children with BLLs of 5–9 µg/dL in the targeted county of the Central region was 1 among 170 children tested.

Limitations

Our study is subject to several limitations. For example, we assumed that the neighboring counties have similar BLL rates to what was found in the targeted county, which might not be true. If the neighboring counties do not have similar BLL rates, then the prior and posterior distributions of the parameter θ in the targeted county (Equation 9) will be distorted. The equation might still provide a reasonably reliable estimate, however, of the number of children with BLLs of 5–9 µg/dL in the targeted county, which is possible because prior $p(\theta)$ and posterior $p(\theta/z)$ occur in the numerator and denominator, respectively, of Equation 9 and might, to some extent, nullify each other's distorting effect. If the risk factors for elevated BLLs in the targeted county, however, vastly differ from those in the neighboring counties, then this approach might not give a good estimate. We also assumed that the number of children with BLLs of 5–9 µg/dL followed a Poisson distribution and the BLL rate was distributed as gamma. The results might change if these model assumptions were modified.

Conclusion

We observed underreporting of children <6 years with BLLs of 5–9 µg/dL in some counties of Georgia. This finding is based on the application of a Bayesian model on county data. More research is needed to investigate BLLs among children to ensure they are adequately protected from lead poisoning. Our study has the appeal of being applied in any situation where surveillance data are collected to obtain vital information in institutions or communities, such as hospital-acquired infection in a specific hospital. For example, assuming that the rate of infection is similar to other hospitals in the vicinity, one can check the validity of the rates in this specific hospital and possibly correct it, if necessary, as we did in our study. Similar situations can arise in estimating heart transplant mortality in a hospital, or, as another example, estimating crime rate in a community from self-reported statistics. Our study, then, highlights a general approach to verify useful information and details an opportunity to estimate an actual value or index from observed data.

Disclosure: The findings and conclusions in this article are those of the author and do not necessarily represent the official position of CDC.

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References

Auditor of the State of California. (2020). *Childhood lead levels: Millions of children in Medi-Cal have not received required testing for lead poisoning.* https://www.auditor.ca.gov/pdfs/reports/2019-105.pdf

Centers for Disease Control and Prevention. (2021). *Blood lead reference value.* https://www.cdc.gov/nceh/lead/data/blood-lead-reference-value.htm

Centers for Disease Control and Prevention. (2022). *Health effects of lead exposure.* https://www.cdc.gov/nceh/lead/prevention/health-effects.htm

Egan, K.B., Cornwell, C.R., Courtney, J.G., & Ettinger, A.S. (2021). Blood lead levels in U.S. children ages 1–11 years, 1976–2016. *Environmental Health Perspectives, 129*(3), Article 37003. https://doi.org/10.1289/EHP7932

Georgia Department of Public Health. (n.d.). *Healthy homes and lead poisoning prevention.* https://dph.georgia.gov/environmental-health/healthy-homes-and-lead-poisoning-prevention

Governor's Office of Planning and Budget. (2016). *Population estimates: County population by age, 2016.* https://opb.georgia.gov/census-data/population-estimates

Roberts, E.M., Madrigal, D., Valle, J., King, G., & Kite, L. (2017). Assessing child lead poisoning case ascertainment in the U.S., 1999–2010. *Pediatrics, 139*(5), Article e20164266. https://doi.org/10.1542/peds.2016-4266

World Health Organization. (2022). *Lead poisoning.* https://www.who.int/news-room/fact-sheets/detail/lead-poisoning-and-health

Exploring Foodborne Illness and Restaurant Cleanliness Reporting in Customer-Generated Online Reviews Using Business Analytics

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Abstract **Foodborne illness cases are chronically underreported, and it is crucial to investigate nontraditional strategies and approaches to identify food safety challenges that could lead to outbreaks. This point is especially important in the context of the food service industry because 61% of all foodborne illness outbreaks are attributed to restaurants. The overarching goal of our study was to data mine customer-generated restaurant reviews on an online review website and analyze the frequency at which restaurant patrons report specific terms related to foodborne illness and restaurant cleanliness. Our data analysis indicated statistically significant inverse correlations between the increased frequency of keywords in online reviews and customer satisfaction. The results from our study can be used to incentivize restaurateurs to implement enhanced food practices. Furthermore, the text mining methodology can be used in future studies to monitor food safety reporting in global markets.**

Introduction

The Centers for Disease Control and Prevention (CDC, 2020) estimates that 48 million people get sick from a foodborne illness (FBI) annually. Between 2009 and 2015, the Foodborne Disease Outbreak Surveillance System received reports of 5,760 outbreaks that caused 100,939 illnesses, 5,699 hospitalizations, and 145 deaths. Dewey-Mattia et al. (2018) included the specific location for food preparation for 5,022 outbreaks and showed that restaurants were the most common location (61%), followed by catering/banquet facilities (14%). FBI outbreaks are chronically underreported, however, because individuals and health professionals do not report a sizable number of cases to public health channels (CDC, 2018a). Therefore, there is a need for investigators to use novel and innovative methods to identify food safety issues and potential areas for improvement.

While individuals who have a case of FBI might not report their cases to public health officials, prior studies suggest that reviews—posted by restaurants patrons on online restaurant review forums such as Yelp.com—contain information related to FBI events (Nsoesie et al., 2014). Previous studies have used Yelp reviews as a tool to identify FBI outbreaks and have compared these reviews with health inspection scores (Harris et al., 2017; Park et al., 2016). No studies yet, however, have explored food safety or restaurant cleanliness issues in customer-generated reviews and examined how these issues affect customer satisfaction.

Consequently, our primary research objectives were to 1) explore customer-generated reviews on an online review platform (i.e., Yelp) to identify FBI and restaurant cleanliness issues and 2) examine the relationship of FBI and restaurant cleanliness issues with customer satisfaction. For our study, we collected and analyzed a database containing 231,381 Yelp reviews of 954 restaurants in the Greater Houston area from 2005–2017. We selected Houston as the city for our research because it is one of the best U.S. food cities and has been recognized as a dynamic dining destination (Nelson, 2016).

Research Background

Food Safety Regulations

The Food and Drug Administration (FDA, 2022) created the *Food Code* to serve as a model set of food safety regulations for U.S. states and municipalities to adopt for good food safety practices in food service establishments. The *Food Code* lists the following as the five major risk factors that cause the majority of FBI outbreaks:

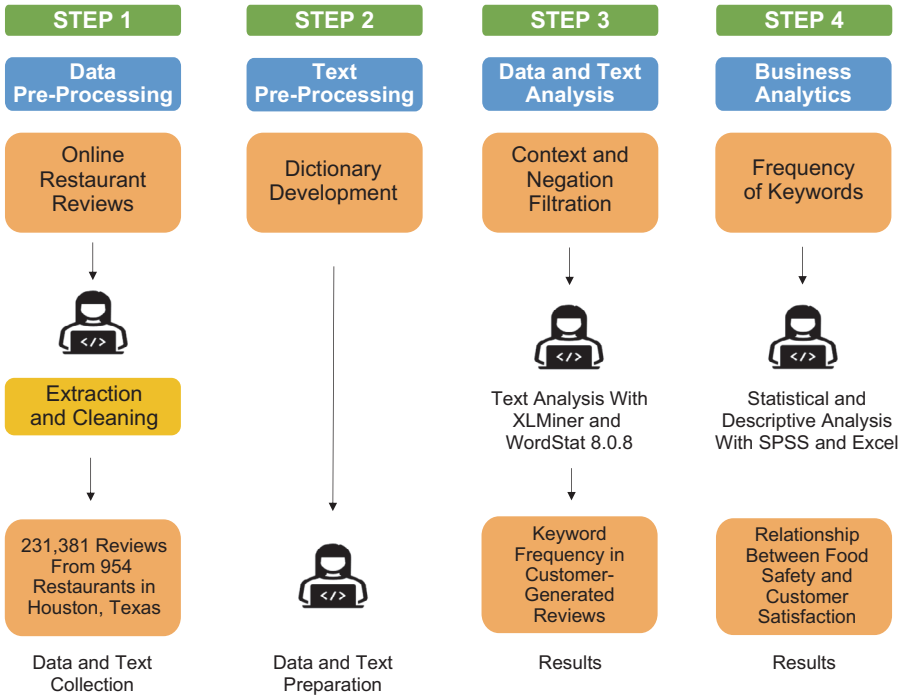
1. improper holding temperatures,
2. inadequate cooking (e.g., undercooking raw shell eggs or chicken),
3. contaminated equipment,
4. food from unsafe sources, and
5. poor personal hygiene.

The *Food Code* (U.S. Department of Health and Human Services, 2017) serves as a baseline set of regulations and individual jurisdictions can modify these regulations to fit the needs of their states. For example, in 2015 Texas legislators modified the Texas Food Establishment Rules (2021) and stipulated that all food service workers, regardless of their job descriptions, have to be food handler certified by September 2016. Companies such as ServSafe (National Restaurant Association Educational Foundation, 2019) that create food safety training programs design their curriculum to ensure all food handlers have a basic understanding of food safety as per the *Food Code*. Topics that are covered in these training programs include the following components:

1. basic food safety,
2. personal hygiene,

FIGURE **1**

Business Analytics Methodology



3. cross-contamination and allergens,
4. time and temperature control, and
5. cleaning and sanitation (National Restaurant Association Educational Foundation, 2022).

Food handlers receive this training to enhance their food safety knowledge and apply these principles toward reducing the risks of physical, chemical, and biological contaminants in food. To ensure that food service establishments adhere to food safety principles, public health officials at city and county levels inspect food service establishments and issue violations for poor practices.

An example of a violation would be indicators of pest presence in establishments. Pests can be vectors of pathogenic bacteria; flies and cockroaches are two of the most prevalent pests in restaurant settings (Morrison, 2007). A 2006 study in restaurants discovered cockroaches that carried *Salmonella* spp., *E. coli* O157:H7, *Shigella* spp., *Staphylococcus aureus,* and *Bacillus cereus*—all critical foodborne pathogens (Tachbele et al., 2006). Similarly, several studies have found that common houseflies can be vectors of *Shigella* spp. and *Salmonella* spp. (Poravi et al., 2014).

Additionally, health inspectors look for conditions in food service establishments that can denote bacterial activity. For example, biofilms are matrices of bacterial cells and sugars that form sticky substances on drains and in machinery and thus can clog systems and harbor infectious bacteria (Mair-Jenkins et al., 2017). Inspectors check for food preparation and service surfaces that have not been properly cleaned or sanitized. While restaurant inspections and staff trainings are crucial in preventing FBIs, restaurants still account for 61% of FBI outbreaks in the U.S. (Dewey-Mattia et al., 2018). Therefore, innovative methods of monitoring and preventing FBI are necessary to decrease the annual number of outbreaks nationwide.

Yelp as an Online Customer Food Safety Platform

Yelp is an industry-leading crowdsourced review forum where restaurant customers (i.e., Yelpers) post reviews of businesses and rate their satisfaction as a customer on a scale of 1 to 5 stars. Yelpers primarily report on the meal quality, service level, and restaurant ambience. Customers are free, however, to write whatever they want in their online reports. Yelp aggregates the rating from each individual review for a specific restaurant into an average review rating for the restaurant.

In recent years, Yelp has evolved into a tool that researchers can use to identify isolated FBI events. A 2015 study determined FBI-related reviews on Yelp were often "extremely detailed," even mentioning specific foods that had been implicated in foodborne outbreak reports by CDC (Nsoesie, et al., 2014). Another study identified multiple unreported FBI outbreaks in New York City via Yelp reviews (Harrison et al., 2014). As another example, the St. Louis Department of Health implemented a web-based dashboard and captured relevant tweets that reported an FBI outbreak that resulted in more filed reports than previously reported in St. Louis, Missouri (Harris et al., 2017).

The aforementioned studies demonstrate a discrepancy between what individuals report to their local public health department and what restaurant customers post on online review platforms. A 2016 study that focused on discrepancies between Yelp ratings and health inspection scores found that while a larger volume of Yelp reviews for one restaurant typically was correlated with higher Yelp ratings, there was no significant relationship between health inspection scores and Yelp ratings (Park et al., 2016).

Business Analytics in Food Service

Business analytics refers to the methods and techniques that are used to evaluate the performance of a company (Liebowitz, 2011). An example of a business analytics technique is text mining, which is the process of knowledge discovery from textual databases and extraction of significant patterns from unstructured text documents (Tan, 2000). The process of text mining begins with the creation of a dictionary of keywords that the software will then perform a search on. In the context of online reviews, text mining can be used to measure customers' emotional expressions (Lee et al., 2017). Thus, text mining customer-generated reviews can improve the understanding of customer behavior and trends, which can drive businesses to implement strategic change (Chau & Xu, 2012).

Prior studies have empirically and conceptually examined the factors affecting customer overall satisfaction ratings online.

TABLE **1**

Text Mining Dictionaries

Dictionary	Keywords
Foodborne illness	Vomit, vomiting, poisoning, food poisoning, ill, diarrhea, fever, puke, puking, nausea, cramps, throwing up, threw up, sick, nauseous
Restaurant cleanliness	Dirty, sticky, slime, slimy or slimey, roach, cockroach, rat, ammonia, hair in, fingernail or finger nail, crumbs, no gloves, smell, smelly

These factors commonly are segmented into the number of reviews a restaurant has, the restaurant's ranking, food quality, service quality, value, atmosphere, and prior customer rating (Kim et al., 2016). While several studies have examined these factors in-depth, food safety and restaurant cleanliness usually have not been considered. One study posited that food safety issues can present a major concern to a restaurant's continued success, as the study determined that food safety and restaurant cleanliness issues can decrease repeat patronage (Barber et al., 2011).

Our study aimed to utilize text mining to explore the content within customer-generated online reviews through the lens of food safety and restaurant cleanliness. To our knowledge, no prior studies have utilized text mining as part of the methodology to monitor FBI and restaurant cleanliness reporting and no studies have determined the relationship between customer satisfaction and food safety—thus presenting a gap in the scientific literature.

Methods

To address the two research objectives, we performed text mining and business analytics using XLMiner, Wordstat 8.0.8, and IBM SPSS Statistics (version 26.0; Figure 1). Our study utilized a data set of 231,381 reviews from Yelp from 2005–2017 for 954 restaurants in Houston. For each review in the data set, the following pieces of information were collected: review rating, review text, and customer satisfaction ratings. The initial steps of our study involved defining the research questions and cleaning the data to be used for business analytics.

To address research objective 1, we developed dictionaries for text mining containing keywords related to 1) FBI events and 2) restaurant cleanliness issues. The majority of typical foodborne pathogens cause acute gastroenteritis in humans; thus, terms relating to typical symptoms were included (Lucado et al., 2013). Additional terms were added from an exploratory sampling of 100 postings on IWasPoisoned.com (n.d.), a crowdsourced online forum for food service customers who have experienced food poisoning.

We selected words for the restaurant cleanliness dictionary for their relation to typical vectors of FBI (e.g., pests), facility conditions that could denote potential pathogenic activity (e.g., sticky, smelly), and violations of the Texas Food Establishment Rules (2021) recorded by health inspectors (e.g., hair in food, no gloves). Due to the nature of customer-generated reviews, common misspellings of keywords were added to the inclusion list. We excluded instances where keywords were preceded by negatives. The frequency of keywords within each individual review was recorded and totaled for each restaurant. The two dictionaries are shown in Table 1.

To address research objective 2 and to analyze the relationship between the frequency of keywords and customer satisfaction on a restaurant-by-restaurant basis, we performed a Pearson's correlation with the frequency of keywords as an independent variable and the restaurant's average rating as a dependent variable. Furthermore, to analyze this relationship for each individual review, we performed a similar Pearson's correlation, with the individual's rating as the dependent variable.

Results and Discussion

The overarching goals of our study were to explore the usage of keywords related to FBI and restaurant cleanliness in online customer reviews and to examine the relationship this usage had with customer satisfaction. Text mining the reviews for the Houston mar-

TABLE **2**

Number of Instances of Foodborne Illness and Restaurant Cleanliness Keywords

Keyword	#
Foodborne illness	
Sick	418
Ill	285
Poisoning	218
Threw up	53
Diarrhea	50
Nauseous	49
Throw up	46
Vomit	46
Vomiting	43
Throwing up	26
Fever	23
Puke	22
Cramps	20
Nausea	18
Puked	8
Puking	7
Diarrhea	2
Restaurant cleanliness	
Dirty	532
Smell	530
Sticky	298
Crumbs	182
Hair in	159
Slimy	133
Roach	119
Smelly	62
Cockroach	59
Rat	47
Slime	33
Finger nail	13
No gloves	12
Ammonia	8

Note. From a data set containing 231,381 online customer reviews from 954 restaurants in Houston, Texas.

FIGURE **2**

Foodborne Illness and Restaurant Cleanliness Keyword Instances by Restaurant Price

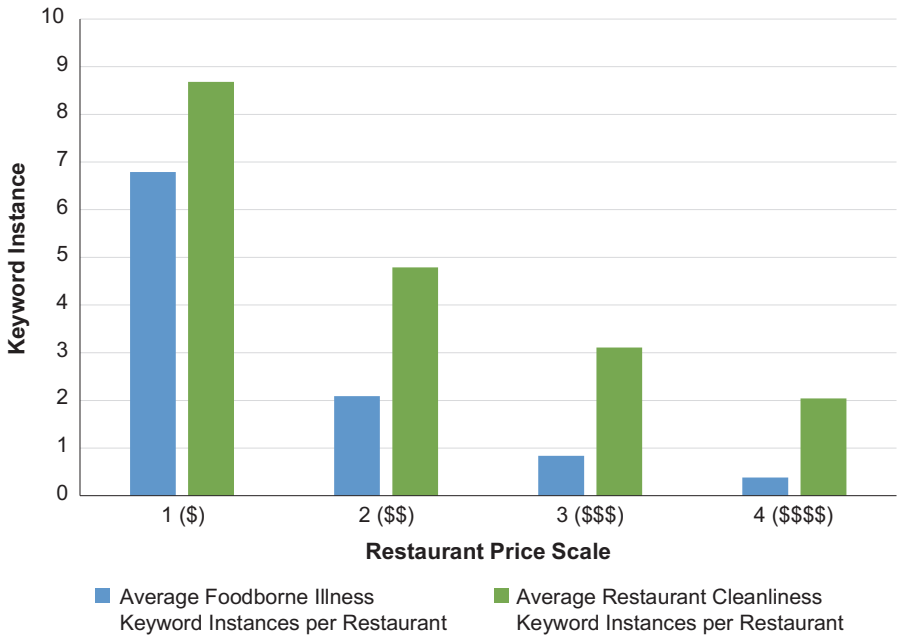


TABLE **3**

Statistical Analysis Report With Average and Individual Review Rating as the Dependent Variable

Review Rating Type	Statistical Analysis	Frequency of Foodborne Illness Keywords (1/10,000)	Frequency of Cleanliness Keywords (1/10,000)
Average review rating for entire restaurant ($N = 954$)	Pearson's correlation	-.109 *	-.024
	Significance (2-tailed)	.001	.450
Individual review rating ($N = 231,381$)	Pearson's correlation	-.078 *	-.071 *

* Indicates statistical significance.

ket across a period of 12 years revealed significant usage of these keywords; statistical analysis also indicated that the impact on customer satisfaction was significant. For practical and theoretical relevance, we also explored the most common keywords used, how these keywords were used across restaurants of different average meal prices, and the categories of restaurants that were most heavily implicated in these reviews.

Exploration of Keyword Frequency and Usage in Yelp Reviews

Research objective 1 involved exploring the use of terms in the text mining dictionaries within customer-generated reviews. The results showed that the presence of keywords from both dictionaries in individual customer reviews led to decreased customer satisfaction expressed on a 5-star scale, with 82.6% of restaurants receiving at least one review containing one or more keywords in either dictionary. Specifically, 77.4% of restaurants received at least one review containing one restaurant cleanliness keyword and 60.0% of restaurants received at least one review containing one FBI keyword. The breakdown of keyword frequencies for each dictionary is shown in Table 2.

Previous studies have focused on the relationship between health inspection scores and Yelp reviews (Park et al., 2016). Our study investigated customer online reviews related to food safety and restaurant cleanliness in the Houston area. Public health officials could use the correlations between the frequency of keywords and customer satisfaction to incentivize restaurateurs to implement safer food practices, as prior literature confirms the link between customer satisfaction and restaurant success (Jeong & Jang, 2011).

Yelp assigns each restaurant on its platform a standardized price score, indicated by a number of dollar signs ($) next to the restaurant's name. Our data from this study showed that the frequency of FBI keywords decreases as the price of the restaurant increases (Figure 2). Furthermore, our data indicated that customers reported restaurant cleanliness issues with the highest frequency at inexpensive restaurants. As the average meal price of the restaurant increased, guests reported fewer restaurant cleanliness issues until the average meal price reached its maximum category of four dollar signs ($$$$). Future studies could investigate customer perceptions of restaurant cleanliness issues across different restaurant scales, such as price.

Relationship of Foodborne Illness and Restaurant Cleanliness Issues With Customer Satisfaction

Regarding research objective 2, statistical analysis indicated there were statistically significant inverse correlations between the frequency of FBI keywords and customer satisfaction both on the average restaurant and individual review rating levels. Results also demonstrated a statistically significant inverse correlation between the frequency of restaurant cleanliness keywords and the individual review rating. The correlation

between the frequency of restaurant cleanliness keywords and the average review rating of a restaurant, however, was not found to be significant. Table 3 contains the correlation coefficients for these relationships. In addition, the relationship between a restaurant's average rating and the frequency of keywords can be found in Figure 3, while the relationship between a reviewer's individual rating and the frequency of keywords is depicted in Figure 4.

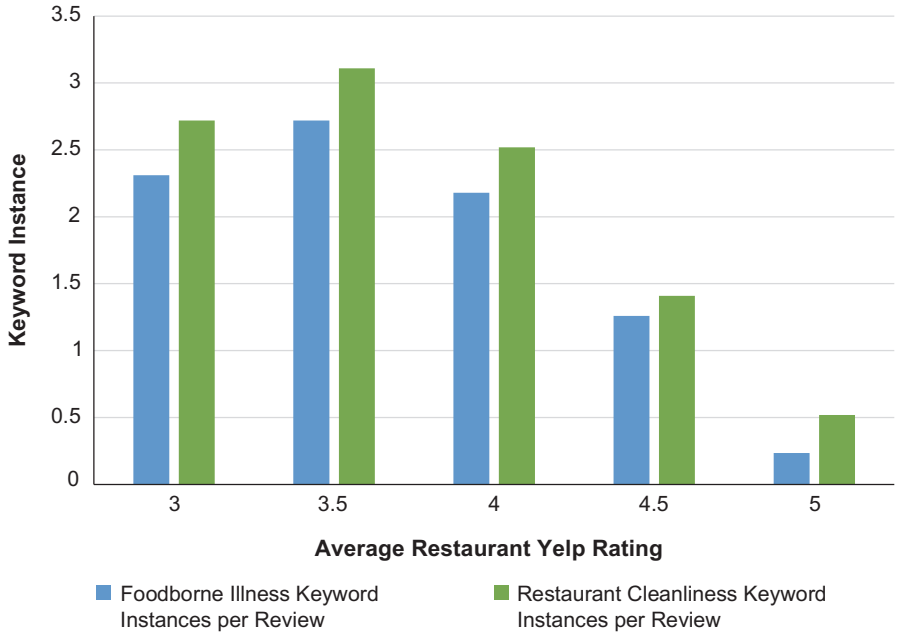
These results show that restaurant customers are cognizant of FBI and restaurant cleanliness and that they take these factors into consideration when writing a restaurant review. Inclusion of these terms in online reviews were associated with lower customer satisfaction ratings. Moreover, at the restaurant and individual levels, inclusion of words relating to FBI caused a greater negative impact on customer satisfaction. These findings affirm that online reviews about foodborne illness are "extremely detailed" (Nsoesie et al., 2014). While prior studies have not included FBI and restaurant cleanliness issues as significant contributors to online review ratings, the data from our study showed these issues contribute significantly.

Relationships Between Restaurant Cleanliness, Foodborne Illness, and Restaurant Category

Yelp also adds specific classifications to restaurants, such as Chinese food, pizza place, or trendy. A more widespread practice in the industry is to classify restaurants using the National Restaurant Association's system, which includes categories for limited and full-service restaurants including fast food (also known as quick-service restaurants), fast casual, moderate, midscale, upscale, and fine dining (Canziani et al., 2016). Thus, we subdivided the restaurants in our data set using these categories; we added a seventh category of food truck due to the concept's large presence in the data set and its unique characteristics when compared with traditional restaurants (Canziani et al., 2016). The frequency of keywords when the restaurants were divided into these seven categories is shown in Figures 5 and 6. The data showed that food truck reviews had the highest number of keywords per review in both categories. While limited-service restaurants

FIGURE **3**

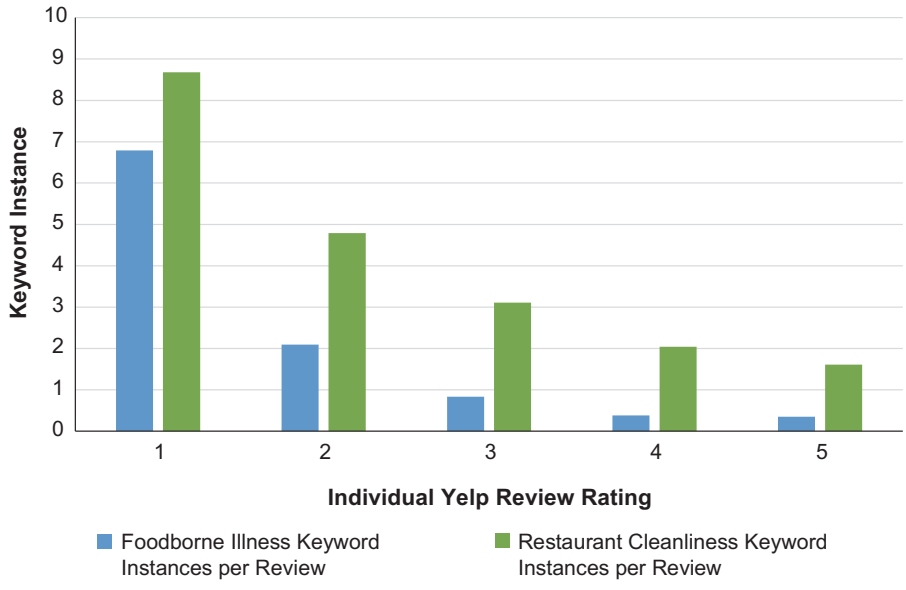
Foodborne Illness and Restaurant Cleanliness Keyword Instances by Average Restaurant Online Review Rating



Note. $N = 954$.

FIGURE **4**

Foodborne Illness and Restaurant Cleanliness Keyword Instances per Individual Online Review Rating



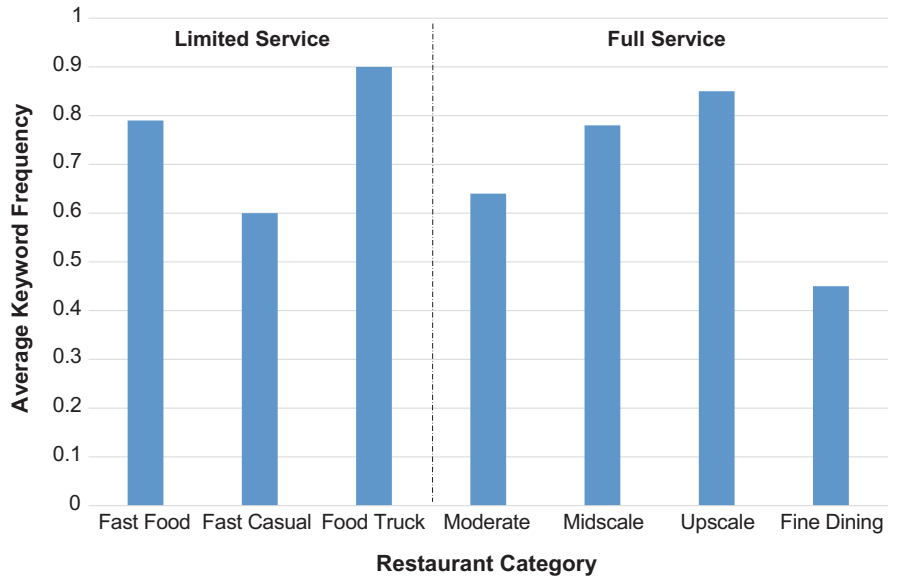
Note. $N = 231,381$

FIGURE **5**

Average Restaurant Cleanliness Keyword Frequency by Restaurant Category

FIGURE **6**

Average Foodborne Illness Keyword Frequency by Restaurant Category



seemed to receive reviews that included more restaurant cleanliness keywords, both limited and full-service restaurants received similar frequencies of FBI keywords.

Our study considered reviews only from the Houston area, and thus the results are not necessarily generalizable to other cities and markets. While we made a significant effort to ensure that the business analytics software analyzed keywords only within their proper context, it is possible that terms in atypical contexts might have deflated or inflated the recorded total frequency of keywords. For example, one particular restaurant with a restaurant cleanliness keyword as part of its name had to be excluded from text mining.

Additionally, FBIs have incubation periods ranging from a few hours to 50 days, which can lead to the likelihood that some of the online reviewers might be misattributing their FBI experience to the restaurant they ate at most recently. The main intent of our study, however, was not to develop an exhaustive list of cleanliness and food safety issues within restaurants or to identify which specific restaurants contained the highest frequencies. Rather, our study sought to analyze trends within the food service market as a whole.

Conclusion

FBI cases are underreported due to several complexities such as long incubation periods of pathogens; lack of reporting to public health officials; and, in some instances, illness severity not warranting a healthcare visit. In the food service context, however, it is crucial to have a multipronged approach to investigate plausible causes of FBIs and design a proactive strategy to address these issues, especially because 61% of all FBI outbreaks are attributed to restaurants (CDC, 2018b). Hence, the goal of our study was to use text mining on a data set containing 231,381 online customer reviews from 954 restaurants in Houston, Texas.

Our findings demonstrate statistically significant inverse correlations between the increased frequency of keywords in online reviews and customer satisfaction. Future research could investigate correlations between text mining using large data sets and the occurrence of FBI outbreaks in a hyperlocal setting to validate the efficacy of these methodologies in real time. The results of our study can be used by public health practitioners to obtain customer perspectives on restaurant cleanliness and sanitation. Similarly, restaurateurs can determine what areas of cleanliness and sanitation are most important to customers to ensure repeat business and inform restaurant marketing strategies.

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References *continued from page 21*

Barber, N., Goodman, R.J., & Goh, B.K. (2011). Restaurant consumers repeat patronage: A service quality concern. *International Journal of Hospitality Management*, *30*(2), 329–336. https://doi.org/10.1016/j.ijhm.2010.08.008

Canziani, B.F., Almanza, B., Frash, R.E., Jr., McKeig, M.J., & Sullivan-Reid, C. (2016). Classifying restaurants to improve usability of restaurant research. *International Journal of Contemporary Hospitality Management, 28*(7), 1467–1483. https://doi.org/10.1108/IJCHM-12-2014-0618

Centers for Disease Control and Prevention. (2018a). *Foodborne Disease Outbreak Surveillance System*. http://www.cdc.gov/foodsafety/fdoss/

Centers for Disease Control and Prevention. (2018b). *Highlights from the 2016 surveillance report*. https://www.cdc.gov/fdoss/annual-reports/2016-report-highlights.html

Centers for Disease Control and Prevention. (2020). *Foodborne germs and illnesses*. https://www.cdc.gov/foodsafety/foodborne-germs.html

Chau, M., & Xu, J. (2012). Business intelligence in blogs: Understanding consumer interactions and communities. *MIS Quarterly*, *36*(4), 1189–1216. https://doi.org/10.2307/41703504

Dewey-Mattia, D., Manikonda, K., Hall, A.J., Wise, M.E., & Crowe, S.J. (2018). Surveillance for foodborne disease outbreaks—United States, 2009–2015. *Morbidity and Mortality Weekly Report, Surveillance Summaries*, *67*(SS-10), 1–11. https://doi.org/10.15585/mmwr.ss6710a1

Food and Drug Administration. (2022). *FDA Food Code*. https://www.fda.gov/food/retail-food-protection/fda-food-code

Harris, J.K., Hawkins, J.B., Nguyen, L., Nsoesie, E.O., Tuli, G., Mansour, R., & Brownstein, J.S. (2017). Using Twitter to identify and respond to food poisoning: The Food Safety STL Project. *Journal of Public Health Management & Practice*, *23*(6), 577–580. https://doi.org/10.1097/PHH.0000000000000516

Harrison, C., Jorder, M., Stern, H., Stavinsky, F., Reddy, V., Hanson, H., Waechter, H., Lowe, L., Gravano, L., Balter, S., & The Centers for Disease Control and Prevention. (2014). Using online reviews by restaurant patrons to identify unreported cases of foodborne illness—New York City, 2012–2013. *Morbidity and Mortality Weekly Report*, *63*(20), 441–445.

IWasPoisoned.com. (n.d.). *About*. https://iwaspoisoned.com/page/about

Jeong, E., & Jang, S. (2011). Restaurant experiences triggering positive electronic word-of-mouth (eWOM) motivations. *International Journal of Hospitality Management*, *30*(2), 356–366. https://doi.org/10.1016/j.ijhm.2010.08.005

Kim, W.G., Li, J., & Brymer, R.A. (2016). The impact of social media reviews on restaurant performance: The moderating role of excellence certificate. *International Journal of Hospitality Management*, *55*, 41–51. https://doi.org/10.1016/j.ijhm.2016.03.001

Lee, M., Jeong, M., & Lee, J. (2017). Roles of negative emotions in customers' perceived helpfulness of hotel reviews on a user-generated review website: A text mining approach. *International Journal of Contemporary Hospitality Management*, *29*(2), 762–783. https://doi.org/10.1108/IJCHM-10-2015-0626

Liebowitz, J. (Ed.). (2011). *Beyond knowledge management: What every leader should know*. Auerbach Publications.

Lucado, J., Mohamoud, S., Zhao, L., & Elixhauser, A. (2013). *Infectious enteritis and foodborne illness in the United States, 2010* (Healthcare Cost and Utilization Project Statistical Brief #150). Agency for Healthcare Research and Quality. https://www.hcup-us.ahrq.gov/reports/statbriefs/sb150.pdf

Mair-Jenkins, J., Borges-Stewart, R., Harbour, C., Cox-Rogers, J., Dallman, T., Ashton, P., Johnston, R., Modha, D., Monk, P., & Pulleston, R. (2017). Investigation using whole genome sequencing of a prolonged restaurant outbreak of *Salmonella* Typhimurium linked to the building drainage system, England, February 2015 to March 2016. *Eurosurveillance*, *22*(49), Article 17-00037. https://doi.org/10.2807/1560-7917.ES.2017.22.49.17-00037

Morrison, G. (2007, May 1). Food for thought: Preventing pest infestations. *Restaurant Hospitality*. https://www.restaurant-hospitality.com/observer/rh_imp_16992

National Restaurant Association Educational Foundation. (2022). *ServSafe food handler program*. https://www.servsafe.com/ss/FoodHandler/FHoverview.aspx

Nelson, V. (2016). Food and image on the official visitor site of Houston, Texas. *Journal of Destination Marketing & Management*, *5*(2), 133–140. https://doi.org/10.1016/j.jdmm.2015.12.001

Nsoesie, E.O., Kluberg, S.A., & Brownstein, J.S. (2014). Online reports of foodborne illness capture foods implicated in official foodborne outbreak reports. *Preventive Medicine*, *67*, 264–269. https://doi.org/10.1016/j.ypmed.2014.08.003

Park, H., Kim, J., & Almanza, B. (2016). Yelp versus inspection reports: Is quality correlated with sanitation in retail food facilities? *Journal of Environmental Health*, *78*(10), 8–13. https://www.jstor.org/stable/26330473

Poravi, R., Sadeli, R., Fitrasanti, B.I., & Sudigdoadi, S. (2014). *Salmonella* sp. and *Shigella* sp.in house flies in Jatinangor. *Althea Medical Journal*, *1*(1), 17–20. https://doi.org/10.15850/amj.v1n1.291

Tachbele, E., Erku, W., Gebre-Michael, T., & Ashenafi, M. (2006). Cockroach-associated food-borne bacterial pathogens from some hospitals and restaurants in Addis Ababa, Ethiopia: Distribution and antibiograms. *Journal of Rural and Tropical Public Health*, *5*, 34–41. https://www.cabi.org/isc/abstract/20083219137

Tan, A.-H. (2000). *Text Mining: The state of the art and the challenges*.

Texas Food Establishment Rules, Texas Administrative Code, Title 25, Chapter 228 (2021). https://www.dshs.texas.gov/foodestablishments/laws-rules.aspx

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

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Lead-Based Paint and Other In-Home Health Hazards in Las Vegas, Nevada: Findings of the Las Vegas Lead Hazard Control and Healthy Homes Program

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Abstract **The outcomes of the Las Vegas Lead Hazard Control and Healthy Homes Program (Las Vegas LHCHHP) are characterized in this article by the prevalence, type, and location of lead-based paint and healthy homes hazards. A total of 62 participants were recruited for our program from residents of Las Vegas, Nevada, and were enrolled from 2018 until March 2020 according to U.S. Department of Housing and Urban Development requirements. Participants received a combined lead inspection and risk assessment, as well as a healthy homes visual assessment if lead-based paint hazards were identified. Occupant and housing characteristics were also recorded. The majority of Las Vegas LHCHHP housing units had ≥1 lead dust hazard, and most had ≥1 lead-based paint hazard on a variety of components. Domestic hygiene and structural issues were the most frequently identified healthy homes hazards. Lead-based paint and other health hazards were common in Las Vegas LHCHHP housing. Our findings could inform future occupant education and lead hazard control and healthy homes programs in other jurisdictions.**

Introduction

Health and safety hazards in housing remain significant public health concerns, particularly for vulnerable populations such as children, who spend 80–95% of their time inside their homes (Breysse & Gant, 2017; U.S. Department of Health and Human Services, 2019). A myriad of adverse health consequences have been linked to dilapidated housing conditions, including elevated blood lead levels, exacerbated asthma, and numerous types of injury (Sokolowsky et al., 2017; Srinivasan et al., 2003).

Exposure to lead-based paint in homes constructed prior to 1978 poses multiple hazards to children, usually via inhalation of lead dust, ingestion of lead paint chips, or both. Blood lead concentrations of <10 µg/dL have been associated with behavioral issues, cognitive impairment, and neurological damage (Council on Environmental Health, 2016; Mankikar et al., 2016). There is no safe level of exposure to lead. In 2021, the Centers for Disease Control and Prevention (CDC, 2022) updated its blood lead reference value to 3.5 µg/dL for children. This level of exposure can still have adverse effects on IQ, academic performance, and ability to pay attention (CDC, 2022). Related negative developmental and learning outcomes include attention deficit hyperactivity disorder (ADHD), attention deficit disorder (ADD), lower birth weight, and lower IQ in children. Blood lead concentrations of >100 µg/dL have severe health consequences, including encephalopathy and even death (Council on Environmental Health, 2016).

Housing deficiencies can also contribute to asthma development and exacerbation. In the U.S., asthma is recognized as the most common chronic illness among children, affecting 1 in 15 individuals (Mankikar et al., 2016). Asthma has multiple in-home triggers, including mold, excess moisture, dust, pests, and tobacco smoke that stays on carpets or clothing (Breysse & Gant, 2017; Mankikar et al., 2016). Low-income individuals, racial and ethnic minorities, and people who live in the central area of a city where older housing stock is more prevalent, seek hospital care more frequently than do other populations (Mankikar et al., 2016).

Injuries in the home can be caused by numerous health and safety hazards and include falls, burns, fires, and unintentional poisonings (Mankikar et al., 2016). Further, structural issues such as cracks in walls, holes in ceilings, peeling paint, or leaking pipes can also contribute to health issues for occupants and their children (Srinivasan et al., 2003).

Lead Hazard Control and Healthy Homes Grants

The Office of Lead Hazard Control and Healthy Homes within the U.S. Department of Housing and Urban Development (HUD) has long worked to prevent lead poisoning and address multiple health and safety hazards with its Lead Hazard Control and Healthy Homes Grants for state and local governments (Breysse & Gant, 2017; HUD, 2009). HUD (2009) estimates that due to this initiative, approximately 70% of learning dis-

abilities attributed to childhood lead poisoning cases have been reduced.

Lead and healthy homes hazards are systematically identified in program-qualified housing by grantee personnel before remediation plans are developed and implemented. Assessment approaches include environmental sampling, building performance testing, resident interviews, and visual assessment. In 2018, the City of Las Vegas Office of Community Services, with the University of Nevada, Las Vegas as a subgrantee, was awarded a HUD Lead Hazard Control and Healthy Homes Grant. Known as the Las Vegas Lead Hazard Control and Healthy Homes Program (Las Vegas LHCHHP), the initiative enrolled 62 homes through March 2020.

Demographics and Housing Characteristics of Las Vegas

According to the U.S. Census Bureau (2021) and the City of Las Vegas 2015–2020 Consolidated Plan, Las Vegas is home to >645,000 residents and is the most densely populated city in Nevada. In terms of race and origin, 58.5% of Las Vegas residents identify as White, 33.2% identify as Hispanic or Latino, 12.1% identify as Black or African American, 6.7% identify as Asian, 1.0% identify as American Indian and Alaska Native, <1.0% identify as Native Hawaiian and Other Pacific Islander, and 8.2% report being two or more races (U.S. Census Bureau, 2021). Of 211,690 households within the city limits, 81,930 (39%) reported having an income <80% of the area median income (City of Las Vegas, 2015).

According to City of Las Vegas 2015–2020 Consolidated Plan estimates, there are similar numbers of owner- and renter-occupied housing units built before 1980 (26,529 and 26,585, respectively). Over 50% of both owner- and renter-occupied housing had children present in the home. Approximately 30% of Las Vegas households faced housing issues including substandard housing conditions, overcrowding, and housing cost burden in 2015. Nearly 1,800 households reported issues with plumbing or kitchen facilities. Overcrowding, defined as having 1.01–1.50 persons per room, was identified in 4,180 renter-occupied households and 1,195 owner-occupied households; severe overcrowding, defined as ≥1.51 individuals per room, was identified in 240 owner-occupied households and 1,970 renter-occupied households. Housing cost burden of >50% of household income was reported by 18,760 renter-occupied households and 15,675 owner-occupied households, and there were 1,775 renter-occupied households and 910 owner-occupied households that were zero- or negative-income (City of Las Vegas, 2015).

Study Contributions

As the first HUD-funded Lead Hazard Control and Healthy Homes Grant within the city limits of Las Vegas, the Las Vegas LHCHHP was able to provide updated and more detailed information about the quality of qualified low-income housing stock in Las Vegas. The analysis of program findings here also offers additional insight into the types and locations of lead-based paint and other health and safety hazards throughout the participating homes.

Methods

Recruitment Methods

The Las Vegas LHCHHP was restricted to homes within Las Vegas city limits, with priority given to homes with children <5 years. We used a variety of recruitment methods to spread program awareness and enroll participants into the program, including door-to-door canvassing of target ZIP Codes (i.e., 89101, 89106, 89107, and 89108), posting on the City of Las Vegas website, news media outlets, community outreach events, and mailing letters to homeowners. The primary and most effective recruitment method was the mailing of letters to homeowners and property owners.

Participants interested in the program completed a prequalification intake form to determine initial eligibility based on their estimated household income, construction year of their home, location, and if they had a pregnant individual and/or any children <6 years living in or visiting the home frequently. If a participant prequalified for the program based on this information, an application would be mailed, emailed, or dropped off at their home, depending on the occupant's preference. Program staff were then readily available to address any questions, concerns, or scheduling requests for application processing appointments. All study activities, including the consent process, were approved by the University of Nevada, Las Vegas Institutional Review Board (Protocol #1128104).

Enrollment Requirements

To be enrolled in the program, the housing unit had to be a permanent structure within the City of Las Vegas and built prior to 1978, as verified by the Clark County Assessor's records. For an owner-occupied home, the household had to have a pregnant individual or a child <6 years who lived in or visited the home frequently. Verification of each child's age (e.g., birth certificate, immunization record, or visiting child form), applicant's identification (e.g., driver's license or passport), and income verification of all occupants ≥18 years (e.g., recent pay stubs, Social Security income statements, unemployment benefits) were required. Applicants also had to provide evidence of homeowners or renters insurance where applicable, and they had to acknowledge receipt and understanding of the U.S. Environmental Protection Agency's Renovate Right educational brochure regarding safe renovation procedures in pre-1978 housing.

Complete applications with agreement to the Las Vegas LHCHHP terms and conditions were required to qualify. Applicants living in rental properties also needed to provide a copy of their rental agreement as well as identification for all persons on that agreement. Rental properties were not required to have a child <6 years and/or a pregnant individual living there, but the property owner did have to agree to rent their home for 3 years to a low-income family. Once the application and all required documents were obtained, the final qualification for the program was based on calculation of the household's total income by household size using HUD income standards.

Lead Inspection and Risk Assessment

Once a participant qualified for the program, a lead inspection and risk assessment (LIRA) was scheduled. This surface-by-surface inspection of all interior and exterior painted surfaces involved testing with a Viken Pb200i portable X-ray fluorescence (XRF) analyzer. Inspection is conducted by lead risk assessor staff who are certified by the U.S. Environmental Protection Agency. Dust and soil sampling were also conducted in addition to an inspection of the building conditions. HUD standards were used to identify hazards from lead dust and soil sampling results once they were analyzed by a laboratory that was accredited by the National Lead Laboratory Accreditation Program. Once deteriorated

paint with a concentration of ≥1.0 mg of lead/cm^2 was identified by the XRF analyzer, the hazard was flagged, and a photograph was taken. The lead concentration, location, component, paint color, and paint condition were all noted in the XRF.

The visual assessment of healthy homes hazards was contingent on identification of ≥1 lead-based paint hazard during the lead inspection and risk assessment. The Las Vegas LHCHHP visual assessment tool was based on the 29 hazard categories of the Healthy Homes Rating System (HHRS), though the HHRS scoring system was not utilized per HUD guidance. Instead, each hazard example within the 29 hazard categories was ranked as good, concern, take action, or not applicable for all rooms and accessible exterior areas of the home. Items in good condition were not considered to be hazards. Hazards that were ranked as a concern or take action were documented with a photo for the edification of the resident and/or homeowner, and the take action hazards were prioritized for future program remediation.

All findings of the lead inspection and risk assessment and healthy homes visual assessment were compiled in informative reports provided to the resident and/or homeowner and the City of Las Vegas. All program files were maintained on a secure server.

Inclusion and Exclusion Criteria

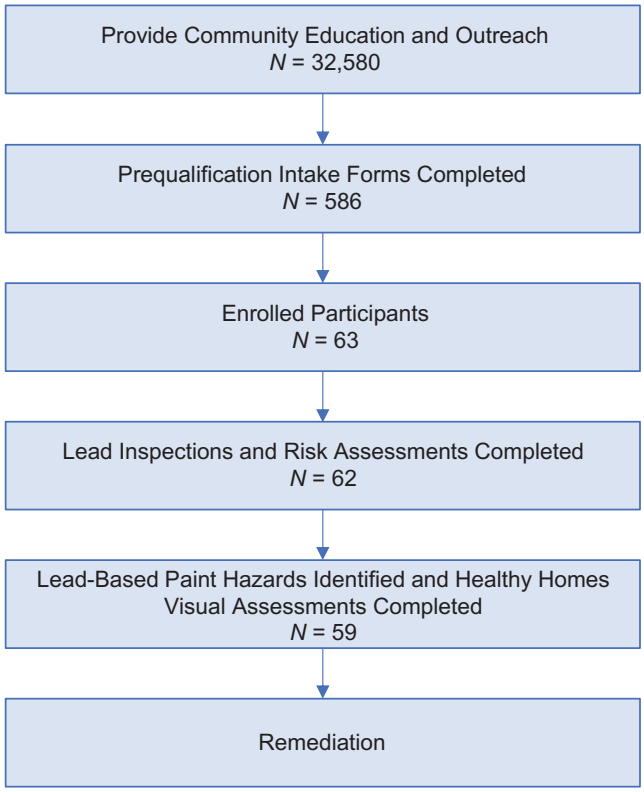
In order to be included in the subsequent analyses, Las Vegas LHCHHP participants had to have consented to participate in the research study. As informed consent could be provided only in-person by English-speaking participants, vacant units and Spanish-speaking primary participants (N = 19) were excluded from these data analyses. Thus, a total of 43 homes were included in our study. An additional four homes were excluded from the healthy homes visual assessment analysis due to fundamental changes in the visual assessment tool in the first quarter of the Las Vegas program.

Data Analysis

Descriptive statistics were obtained throughout the grant for the purpose of tracking project progress. Here, more complete descriptive assessments of participant demographics and income, housing characteristics, lead dust hazards, and types of components with lead-based paint hazards were obtained. Additional analysis considered the occurrence of each hazard category by location in the home (i.e., kitchen, bedroom, bathroom, other, and exterior). All analyses were performed using SPSS Statistics version 26.

FIGURE **1**

Participation From Outreach Through Remediation of Lead-Based Paint and Healthy Homes Hazards in Housing in the Las Vegas Lead Hazard Control and Healthy Homes Program



Results

Recruitment and Enrollment

The program distributed 32,580 educational and outreach materials in the Las Vegas community. During these outreach attempts, 586 interested participants completed the prequalification intake form. From those interested participants, 63 completed the application, provided the required documents, qualified for the program, and were enrolled. A total of 62 lead inspection and risk assessments and 59 subsequent healthy homes visual assessments were completed through March 2020 (Figure 1). This article includes data from 43 lead inspection and risk assessments and 39 healthy homes visual assessments.

Included participant demographics and housing characteristics are shown in Table 1. The majority (76.7%) of included Las Vegas LHCHHP primary participants (n = 43) self-identified as female, with a similar majority of female head-of-household (74.4%). Most primary participants identified as African American (39.5%) or White (34.9%) while 6.9% identified as another race. Additionally, 51.2% of primary participants identified as Hispanic or Latino. The median participant age was 46 years.

Per HUD requirements, all household incomes were within 80% of the federal poverty level by household size, and approximately 28% were considered extremely low-income,

TABLE **1**

Occupant and Housing Characteristics of Participants of the Las Vegas Lead Hazard Control and Healthy Homes Program (*N* = 43)

Occupant Characteristic	# (%)
Female head of household	
Yes	32 (74.4)
No	11 (25.6)
Race of primary participant	
White	15 (34.9)
African American	17 (39.5)
Other	3 (7.0)
Did not answer	8 (18.6)
Ethnicity of primary participant	
Hispanic or Latino	22 (51.2)
Not Hispanic or Latino	21 (48.8)
Household income *	
30% of the federal poverty level (extremely low)	12 (27.9)
50% of the federal poverty level (very low)	7 (16.3)
80% of the federal poverty level (low)	24 (55.8)
Housing Characteristic	**# (%)**
ZIP Code	
89101	6 (14.0)
89106	11 (25.6)
89107	16 (37.2)
89108	6 (14.0)
Other	4 (9.2)
Unit type	
Rental	7 (16.3)
Owner-occupied	36 (83.7)
Decade of construction	
1940–1949	2 (4.7)
1950–1959	10 (23.3)
1960–1969	27 (62.8)
1970–1979	4 (9.3)
Household size	
1–3	23 (53.5)
≥4	20 (46.5)

* Based on requirements of the U.S. Department of Housing and Urban Development.

which is defined as a household income at 30% of the federal poverty level. The median household income was $34,997.56, and most households had 1–3 residents; there were no pregnant individuals included in our study. Properties were primarily owner-occupied (83.7%) and built between 1950 and 1969 (87.1%), with the average year of construction being 1961. The median area of the included homes was 1,320 ft^2.

Lead Hazards

The frequency of houses with lead dust hazards on windowsills and on floors is shown in Table 2. In the 43 homes that were assessed, windowsill lead dust hazards were more common than floor lead dust hazards. Overall, 38 total windowsill lead dust hazards were identified compared with 14 total floor lead dust hazards. Notably, there were two homes that each had 4 windowsill lead dust hazards and there was another home that had 5 floor lead dust hazards. There were no soil hazards identified.

A variety of housing components in participant homes were found to have lead-based paint hazards (Table 3). In total, 859 lead-based paint hazards were identified; the majority of units had at least one identified lead-based paint hazard in each of the component categories. Nearly 63% of units had ≥1 lead-based paint hazard on a wall, ceiling, or floor component, and 40 of 43 units (93%) had a miscellaneous component with a lead-based paint hazard. Overall, we identified 198 wall, ceiling, or floor component lead-based paint hazards, ranging from 0 to 55 hazards in each unit. The number of homes with no hazard in a given component category skewed the results so much that average results were not meaningful.

Healthy Homes Hazards

Over 6,500 instances of healthy homes hazards (categorized as concern or take action) by location in the unit were identified in the 39 units with healthy homes visual assessments (Table 4). Domestic hygiene issues (n = 1,030) and structural problems (n = 1,412) were the most commonly identified healthy homes hazards across all locations of the units. Falls on level surfaces were also prevalent in these units, with 655 identified trip-and-fall hazards. By location, bedrooms (n = 1,984) and other rooms (n = 1,805) had the highest hazard counts. The highest single hazard count was for structural issues in bedrooms (n = 386).

Discussion

As the first Lead Hazard Control and Healthy Homes Grant-funded program in the City of Las Vegas, study findings from the program offer valuable and novel information about in-home health hazards in Southern Nevada. Hazards including lead-

based paint, asthma triggers, and/or injury risks were identified in most homes, and our findings provide additional insight about the types and locations of these hazards. Our results can inform the activities of future Lead Hazard Control and Healthy Homes Grants as well as other programs intended to identify and address hazards and deficiencies in older and low-income housing. Wider dissemination of these findings can also facilitate regional comparisons of pre-1978 housing conditions.

The occupant and housing characteristics presented here were largely representative of all Las Vegas LHCHHP enrollees and reflect target enrollment groups for HUD-funded Lead Hazard Control and Healthy Homes Grants. A higher proportion of primary participants were African American, Hispanic, or Latino compared with the City of Las Vegas as a whole. Most included properties were located in the 89106 and 89107 ZIP Codes, reflecting where the most Las Vegas LHCHHP recruitment letters were mailed. Homes in the City of Las Vegas that were included were typically larger by square footage and number of rooms compared with homes previously enrolled in the neighboring City of Henderson during the 2013–2016 Henderson Lead Hazard Control and Healthy Homes Program (Henderson LHCHHP).

Comparison of Henderson LHCHHP and Las Vegas LHCHHP findings offers one example of how even seemingly similar neighboring communities have different housing and occupant characteristics. By the conclusion of the Henderson LHCHHP in 2016, 79% of enrolled units had lead-based paint hazards (Sokolowsky, 2017), whereas 98% of all Las Vegas LHCHHP units had lead-based paint hazards through March 2020. While household sizes were similar, participants in the two programs differed in terms of income distribution, race, and ethnicity; Henderson LHCHHP participants predominantly were White, non-Hispanic or Latino, thus largely reflecting the demographics of the City of Henderson. Another contrast was that the Las Vegas LHCHHP had more owner-occupied units (83.7%) than did the Henderson LHCHHP (28.3%).

Understanding the types and locations of lead-based paint, dust, and soil hazards in qualified housing informs community-level educational efforts and supports the utility of current HUD guidelines for conducting combined lead inspection and risk assessments. The importance of lead dust sampling persists, as the majority of included Las Vegas LHCHHP homes had at least one lead dust hazard. Study findings from Las Vegas LHCHHP are consistent with a study by Jacobs et al. (2002) that found 16% of housing units in the U.S. had ≥1 lead dust windowsill or lead dust floor hazard and much fewer (5%) had lead soil hazards. Jacobs et al. (2002) further estimated that 25% of all U.S. dwellings have either deteriorated lead-based paint hazards, lead dust, or lead in the soil.

These study findings also demonstrate the necessity of testing all painted surfaces in homes, as a variety of individual components were identified as lead-based paint hazards. The high prevalence of lead-based paint hazards on doors, windows, and other components for the Las Vegas LHCHHP housing was consistent with findings by Rufin (2015) for the Henderson LHCHHP. Testing all com-

TABLE **2**

Lead Dust Hazards Identified During Lead Inspection and Risk Assessment Visits for the Las Vegas Lead Hazard Control and Healthy Homes Program (*N* = 43)

Lead Dust Hazard Location *	Frequency	Homes # (%)
Windowsill (≥100 µg/ft² of lead)	0	20 (46.5)
	1–2	19 (44.2)
	≥3	4 (9.3)
Floor (≥10 µg/ft² of lead)	0	37 (86.0)
	≥1	6 (14.0)

* According to 2019 lead dust standards from the U.S. Department of Housing and Urban Development.

TABLE **3**

Housing Components Identified to Have Lead-Based Paint Hazards in the Las Vegas Lead Hazard Control and Healthy Homes Program (*N* = 43)

Component	Homes With Hazards # (%)	Total Hazards # (Range)
Door (doors, stops, jambs, casings, steps, security doors, door knockers, doorbells)	25 (58.1)	109 (0–23)
Window (casings, sills, frames, aprons, shutters, security bars)	26 (60.5)	188 (0–37)
Roof (fascia, flashing, soffit, soffit supports, beams, gutters)	20 (50.0)	180 (0–23)
Walls, ceilings, and floors (interior and exterior walls, ceilings, foundation, floors, trim, baseboards, vents)	27 (62.8)	198 (0–55)
Miscellaneous (shelves, shelf supports, cabinets, light fixtures, vents, electrical boxes, pipes, water spigots, support columns and attachments, fences, railings, house numbers)	40 (93.0)	184 (0–15)

Note. Lead-based paint hazards were measured by X-ray fluorescence analysis.

TABLE **4**

Healthy Homes Hazard Frequency by Room in Housing in the Las Vegas Lead Hazard Control and Healthy Homes Program (*N* = 39)

Category	Bathroom	Bedroom	Kitchen	Exterior	Other
Asbestos, silica, and MMF	2	83	11	9	66
Biocides	33	9	36	8	30
Carbon monoxide	0	5	16	22	37
Collision and entrapment	17	60	17	33	32
Crowding and spacing	3	30	1	4	25
Damp and mold growth	107	51	38	60	60
Domestic hygiene	157	356	116	140	261
Electrical hazards	55	157	52	63	93
Entry by intruders	24	71	36	17	53
Excess cold	35	92	32	4	104
Excess heat	44	105	36	4	105
Explosions	1	2	1	13	19
Falls in baths	104	0	0	0	0
Falls on level surfaces	73	195	60	113	214
Fire	23	153	78	1	122
Flames and hot surfaces	12	13	2	3	10
Food safety	0	0	5	0	1
Lighting	23	65	1	6	56
Noise	5	19	9	21	17
Operability of amenities	28	88	25	11	53
Personal hygiene	9	1	19	0	1
Structural	190	386	120	334	382
Uncombusted fuel gas	0	1	5	7	13
Volatile organic compounds	78	42	42	58	51
Water supply	27	0	6	2	0

Note. Excludes lead, radon, falling on stairs, and falling between levels. MMF = manufactured mineral fibers.

ponents can be particularly relevant in older housing, where repairs and renovations over time can replace select components while leaving other related surfaces behind.

For example, Las Vegas LHCHHP risk assessors routinely found a door had been replaced, but that original door jambs, stops, frames, or casings were left in place. This consideration is essential for surfaces that are frequently subject to deterioration from impact and/or friction. Another important consideration is the lead-based paint hazard burden of the oldest housing units: one Las Vegas LHCHHP home built in the 1940s had >100 lead-based paint hazards.

At the time of submission no other Lead Hazard Control and Healthy Homes Grant had published findings about the frequencies of healthy homes hazards by in-home location. Some of our findings are straightforward by design (e.g., hazards involving falls in bathtubs and showers were restricted to bathrooms). Other findings, however, highlighted the possibility of hazards across multiple locations in the home, such as hazards related to domestic hygiene, falls, electricity, fire, and structural issues that were found throughout the homes. Even volatile organic compounds were observed across all location categories. Observing these healthy homes hazards throughout homes underscores the importance of thorough visual assessments and occupant education about these types of hazards, particularly for the most at-risk residents.

Strengths

As previously mentioned, our study of the Las Vegas LHCHHP findings offer a better understanding of Las Vegas's diverse and low-income resident population and the condition of the housing units in which they live. The novel presentation of results here provides more detail about types and locations of hazards; this information can inform future program activities, community education efforts, and even program guidance for future grantees. After initial refinement of the Las Vegas LHCHHP healthy homes visual assessment, tools and measurement equipment were used consistently throughout the course of the program, facilitating these comparisons across housing units. Our findings also highlight the importance of following HUD guidelines for identification of lead-based paint, dust, and soil hazards to prevent children of current and future residents from being exposed to lead.

Another unique strength of the Las Vegas LHCHHP was its ability to not only identify these hazards but also coordinate remediation, thus improving the condition of vulnerable housing stock. The assessment and remediation of lead-based paint and other healthy homes hazards simultaneously amplifies the lasting impact of these improvements, as many hazards examined occur together and are related (e.g., a water leak contributing to lead-based paint deterioration, structural issues, and mold growth).

Outreach and recruitment efforts by Las Vegas LHCHHP also extended community education efforts regarding lead-based paint and other in-home health hazards, fostering community partnerships, and building rapport with interested potential participants. As the program required significant participant time and involvement, these relationships were essential. Our study is descriptive in nature to fill an existing gap in the available literature and data about in-home hazards in Southern Nevada.

Limitations

There were, however, limitations of our study and of the Las Vegas LHCHHP. First, for the

purposes of our study, Las Vegas LHCHHP staff were unable to obtain informed consent from Spanish-speaking residents. Enrollment was limited, by design, to follow HUD requirements and was not representative of all housing units in the City of Las Vegas, but our studying findings did provide valuable insight about the older and lower-income housing stock at highest risk of having lead-based paint and multiple other home health hazards. These factors, combined with the timeline of the Las Vegas LHCHHP, limited the overall sample size included in our study, which precluded more complex statistical analyses. Our study was cross-sectional due to program design, and there will be no long-term follow-up data about the health and housing outcomes for participants.

Conclusion

From 2018–2020, the HUD-funded partnership between the City of Las Vegas and the University of Nevada, Las Vegas—known as the Las Vegas Lead Hazard Control and Healthy Homes Program—enrolled qualifying homes and participants in the program to identify numerous in-home health hazards, including lead-based paint and dust hazards. Our analysis of the program findings provides additional information about the types and locations of prevalent hazards in program housing. Furthermore, our results can inform future housing programs and community education efforts.

Acknowledgements: This work was supported by the HUD Office of Lead Hazard Control and Healthy Homes (grant number NVLHB0652-17). The authors acknowledge the support and guidance of the HUD Office of Lead Hazard Control and Healthy Homes, as well as its commitment to lead-safe, healthy housing throughout the U.S. The authors also acknowledge the participation of program enrollees and the support of community partner organizations throughout the Las Vegas LHCHHP. Lastly, the authors thank Melissa Marshall for her time editing the final draft of this manuscript.

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References

Breysse, P.N., & Gant, J.L. (2017). The importance of housing for healthy populations and communities. *Journal of Public Health Management and Practice*, *23*(2), 204–206. https://doi.org/10.1097/PHH.0000000000000543

Centers for Disease Control and Prevention. (2022). *Blood lead levels in children.* https://www.cdc.gov/nceh/lead/prevention/blood-lead-levels.htm

City of Las Vegas, Office of Community Services. (2015). *City of Las Vegas 2015–2020 Consolidated Plan & Action Plan.* https://files.lasvegasnevada.gov/community-services/Las-Vegas-HUD-Cosolidated-Plan-2015-2020.pdf

Council on Environmental Health. (2016). Prevention of childhood lead toxicity. *Pediatrics*, *138*(1), e20161493. https://doi.org/10.1542/peds.2016-1493

Jacobs, D.E., Clickner, R.P., Zhou, J.Y., Viet, S.M., Marker, D.A., Rogers, J.W., Zeldin, D.C., Broene, P., & Friedman, W. (2002). The prevalence of lead-based paint hazards in U.S. housing. *Environmental Health Perspectives*, *110*(10), A599–A606. https://doi.org/10.1289/ehp.021100599

Mankikar, D., Campbell, C., & Greenberg, R. (2016). Evaluation of a home-based environmental and educational intervention to improve health in vulnerable households: Southeastern Pennsylvania Lead and Healthy Homes Program. *International Journal of Environmental Research and Public Health*, *13*(9), Article 900. https://doi.org/10.3390/ijerph13090900

Rufin, K.G.A. (2015). *Lead hazard control in Henderson, Nevada: Identifying critical areas and the associated costs* [Master's thesis, University of Nevada, Las Vegas]. UNLV Theses, Dissertations, Professional Papers, and Capstones. http://dx.doi.org/10.34917/7646039

Sokolowsky, A., Marquez, E., Sheehy, E., Barber, C., & Gerstenberger, S. (2017). Health hazards in the home: An assessment of a southern Nevada community. *Journal of Community Health*, *42*(4), 730–738. https://doi.org/10.1007/s10900-016-0311-6

Srinivasan, S., O'Fallon, L.R., & Dearry, A. (2003). Creating healthy communities, healthy homes, healthy people: Initiating a research agenda on the built environment and public health. *American Journal of Public Health*, *93*(9), 1446–1450. https://doi.org/10.2105/ajph.93.9.1446

U.S. Census Bureau. (2021). *QuickFacts: Las Vegas city, Nevada.* https://www.census.gov/quickfacts/lasvegascitynevada

U.S. Department of Health and Human Services, Office of the Surgeon General. (2019). *Healthy homes reports and publications.* https://www.hhs.gov/surgeongeneral/reports-and-publications/healthy-homes/index.html

U.S. Department of Housing and Urban Development, Office of Healthy Homes and Lead Hazard Control. (2009). *Leading our nation to healthier homes: The Healthy Homes Strategic Plan.* https://www.hud.gov/sites/documents/DOC_13701.PDF

Did You Know?

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BUILDING CAPACITY

Chirag Bhatt,
RS, CCFS

Capacity Building for Retail Food Regulatory Programs

Editor's Note: A need exists within environmental health agencies to increase their capacity to perform in an environment of diminishing resources. With limited resources and increasing demands, we need to seek new approaches to the practice of environmental health. Acutely aware of these challenges, the *Journal* publishes the Building Capacity column to educate, reinforce, and build upon successes within the profession using technology to improve efficiency and extend the impact of environmental health agencies.

The content and conclusions of this column are those of the author(s) and do not necessarily represent the views or official position of NEHA or its programs.

Chirag Bhatt is the director of regulatory affairs for environmental health at HS GovTech. He has over 40 years of experience in the food safety and environmental health field and specializes in technology and regulatory compliance. Prior to working at HS GovTech, Bhatt worked at the local level as a program manager for the Houston Health Department.

Capacity building is the improvement in an individual's or organization's facility (or capability) to produce, perform, or deploy. Community capacity building is a long-term continual process of development that involves all stakeholders as opposed to practices that limit oversight and involvement in interventions with governments. The list of parties defined as community includes local authorities, nongovernmental organizations, professionals, community members, academics, and more.

A widespread failure to invest in public health has left local and state health departments struggling to respond to outbreaks, which makes these departments ill-prepared to face the swelling crisis. Many health departments are suffering from budget and staffing cuts, yet still manage a vast, but often invisible, portfolio of duties. Nationwide, local and state health departments have lost nearly one quarter of their workforce since 2008 (Grenadier, 2020).

Several federal agencies and other organizations want to help health departments. One such funding program to assist health departments is the National Environmental Health Association (NEHA)-Food and Drug Administration (FDA) Retail Flexible Funding Model (RFFM) Grant Program (NEHA, 2022a). The grant provides funding to state, local, tribal, and territorial (SLTT) retail food regulatory agencies as they advance conformance with the FDA Voluntary National Retail Food Regulatory Program Standards (Retail Program Standards).

The FDA Retail Program Standards serve as a guide to regulatory retail food program managers in the design and management of a retail food regulatory program and provide a means of recognition for those programs that meet the standards (FDA, 2022). Program managers and administrators can establish additional requirements to meet individual program needs. The Retail Program Standards are designed to help food regulatory programs enhance the services they provide to the public. These programs represent an important component of a comprehensive strategic approach to help ensure the safety and security of the food supply at the retail level.

Introduced in 2021 for calendar year (CY) 2022 of the NEHA-FDA RFFM Grant Program, a Capacity Building Optional Add-On Grant of up to $100,000/year was offered to develop a 3-year project or initiative that advances SLTT retail food programs by collaborating with stakeholders involved in retail food safety (NEHA, 2022b). From the grant guidance, the "project or initiative would leverage the strengths, knowledge, tools, and other resources of collaborators to further city-wide, multi-county, regional, statewide, or national conformance with the Retail Program Standards" (NEHA, 2022b, p. 9). This grant could also be utilized to fund a Retail Program Standards coordinator position.

A total of 26 Capacity Building Grants were awarded for CY 2022 (NEHA, 2022c). While the Capacity Building Optional Add-On Grant is not being offered in the CY 2023 project year, there are project options from that grant category for health departments to consider if they

want to build their capacity. Health departments might be able to identify projects that they can fund through their own budgets or that they can collaborate on with other agencies and partners.

Possible Capacity Building Projects

We can glean some valuable project ideas from the CY 2022 Capacity Building Add-On Grant (NEHA, 2022b).

- Develop and implement a software system that supports elements of your retail food inspection program. The software should allow your agency to manage and monitor risk-based food inspection programs, as well as provide the ability to use the data to mitigate challenges and devise strategic interventions. The deployment of a fully web-based data management system for food safety inspections should enable agencies to efficiently comply with the Retail Program Standards. Furthermore, this deployment should allow multiple departments in the state or within a local area to standardize to the same platform and the Retail Program Standards.
- Purchase and use innovative technologies that can facilitate continuous improvement among jurisdictions toward conformance with the Retail Program Standards.
- Purchase software that can assist with the tracking of projects developed toward conformance with the Retail Program Standards that can be shared with or interfaced by other jurisdictions.
- Implement comprehensive intervention strategies for reducing foodborne illness risk factors.
- Implement activities that encourage collaboration among food safety stakeholders, such as food safety advisory boards, councils, or task forces.
- Hire or reassign existing staff to specifically manage and coordinate advancement in the Retail Program Standards, including oversight of standards-focused projects to encourage collaboration with other SLTT jurisdictions that are enrolled in the Retail Program Standards.
- Develop approaches that facilitate the delivery of FDA *Food Code* standardizations that meet the intent of criteria for Retail Program Standard 2 within multiple jurisdictions.

Software Solutions

Managing, monitoring, and maintaining databases and all the information your agency collects using typical computer software programs (e.g., Microsoft Excel) might not be feasible these days. Agencies might need to turn to a software system that can provide robust tools for data management to be effective and efficient.

While each department will have different needs and demands for a system to manage its databases and programs, there are a few capabilities to keep in mind. For example, software solutions should:

- Provide total alignment with FDA *Food Code* language including foodborne illness risk factors and good retail practices.
- Allow agencies to capture and track all training-related details as required in the Retail Program Standards and much more.
- Include risk factor-based categorization and allow agencies to design risk-based inspection scheduling.
- Include FDA standard compliance status (i.e., in compliance, out of compliance, NA [not applicable], NO [not observed]) and force the users to choose what is only approved for the type of violation.
- Allow policy-based actions that are specific to the agency, such as corrected onsite, follow-up inspections, corrective action plans, and other similar enforcement actions.
- Provide a foodborne illness tool that is fully aligned with FDA standards and that requires mandatory information gathering during complaint intake and investigations and reporting.
- Provide laboratory support, analytical reports, and ad-hoc reports. Traceback and recall procedures should be easily captured in the system and allow an on-demand checklist creation for disasters and unplanned events.
- Include a robust compliance and enforcement workflow tool to fully implement compliance protocols of the agency. For example, a follow-up inspection can be created automatically based on the risk factors identified during an inspection.
- Allow a robust interactive platform online for the regulated industry and local residents. Inspection results and license applications and renewals (including payments) should be included in the system.

It is time to consider the addition of technology solutions for your agency.

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References

Food and Drug Administration. (2022). *Voluntary National Retail Food Regulatory Program Standards*. https://www.fda.gov/food/retail-food-protection/voluntary-national-retail-food-regulatory-program-standards

Grenadier, A. (2020, July 10). *NACCHO new analysis: Changes in local health department workforce and financial capacity since 2008*. National Association of County and City Health Officials. https://www.naccho.org/blog/articles/naccho-new-analysis-changes-in-local-health-department-workforce-and-finance-capacity-since-2008

National Environmental Health Association. (2022a). *NEHA-FDA Retail Flexible Funding Model Grant Program*. https://www.neha.org/retailgrants

National Environmental Health Association. (2022b). *NEHA-FDA Retail Flexible Funding Model Grant guidance*. https://www.neha.org/retailgrants/grantguidance

National Environmental Health Association. (2022c). *NEHA-FDA Retail Flexible Funding Model Grant Program: Grand awards*. https://www.neha.org/retailgrants/awards

CALL FOR SUBMISSIONS

The *Journal* seeks guest authors for the Building Capacity column. Our goal is to provide a platform to share capacity building successes occurring across the country and within different sectors of the environmental health profession, including academia, private industry, and state, local, tribal, and territorial health agencies. Submissions will be reviewed by the NEHA technical advisors for data and technology and *Journal* staff for appropriate content, relevance, and adherence to submission guidelines. To learn more about the submission process and guidelines, please visit www.neha.org/jeh/building-capacity-column.

DIRECT FROM CDC ENVIRONMENTAL HEALTH SERVICES

CDR Anna Khan, MA, REHS, RS

Jonathan Lynch, MBA-PM

The Environmental Health Nexus: A Communication Hub

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

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

CDR Anna Khan is the associate director for communication and Jonathan Lynch is the deputy associate director for communication in the Division of Environmental Health Science and Practice within CDC.

Introduction

Environmental health affects everyone. The air we breathe, the food we eat, the water we drink, and other aspects of the environment in which we live, work, and play all have a direct impact on our health. The Environmental Health Nexus (EH Nexus) from the Centers for Disease Control and Prevention (CDC) is a new communication network for sharing information about environmental public health topics. It is managed by the associate director for the communication team in the Division of Environmental Health Science and Practice (DEHSP). "CDC's EH Nexus communicates about environmental health projects across the agency such as environmental justice and climate and health, providing partners and the public with information, guidance, and recommendations. We look forward to collaborating with environmental health practitioners, academia, and our local, state, federal, territorial, and international partners about these important issues," stated CDR Anna Khan, associate director for communication for DEHSP within the National Center for Environmental Health at CDC.

The network was created to help CDC actively communicate about environmental public health with interested members of the public and public health colleagues whose work involves environmental health concerns. It promotes the communication work of the branches within DEHSP, as well as collaborates with internal and external partners. Our network can be divided into four pillars: webinars and conferences, newsletters, communication partners, and expanded outreach activities.

Background

Environmental health specialists work in many different public health fields such as food and water safety, air quality improvement, emergency management, climate change adaptation, and childhood lead poisoning prevention. They work in a wide range of organizations, including health departments at all levels, federal agencies, international public health agencies, private industry, and nongovernmental organizations. They have acquired skills and insight from academics and on-the-ground experience that cannot be simulated. The depth and breadth of their knowledge is an incredible resource for colleagues, decision makers, and the public.

The Environmental Health Nexus

The CDC EH Nexus is a hub for a variety of communication activities that connect resources, tools, and people involved in environmental public health work. Environmental health professors, subject matter experts, environmental health specialists, and interested members of the public are able to share their insight and guidance through the EH Nexus.

The COVID-19 pandemic and other recent events have created an unprecedented demand for these skills. We created the EH Nexus to bring together subject matter experts and practitioners to share skills, lessons learned, useful tools, and other critical knowledge. We are not just sharing with each other, we are also sharing with interested members of the public and key stakeholders.

EH Nexus webinars provide applicable content for professionals and the public about important environmental health topics, such as climate change and its impact on

public health. These webinars are designed to explain specific environmental health concerns, events, and resources, in collaboration with EH Nexus partners. Attendees are provided actionable information and additional resources to support them. Webinars are recorded and attendees are encouraged to share the recordings with their colleagues, partners, and communities.

The EH Nexus also hosts conferences. These events provide a more interactive knowledge-sharing environment through breakout sessions, open discussions, and presentations. We have covered topics on extreme heat and climate change and working with partners such as the National Oceanic and Atmospheric Administration and National Institute of Standards and Technology.

EH Nexus newsletters include a timely monthly topic, helpful tools, guidance, announcements of upcoming EH Nexus and partner webinars, and public health events across the globe such as World Food Safety Day. The newsletter also provides information that the audience can use to protect themselves, their families, and their communities.

The EH Nexus partnerships are a collection of partner organizations committed to sharing environmental health information with audiences who have an interest in environmental public health issues. EH Nexus partner organizations are diverse and come from all sectors and jurisdictions. The common thread among the partners is a commitment to environmental health communication.

As partners, we work together on communication activities, such as a webinar in March 2022 about climate change and how clinics can plan and prepare for its impact. We partnered with the Health Resources Services Administration on this event. We also collaborated with the U.S. Department of Housing and Urban Development and U.S. Environmental Protection Agency on webinars for National Lead Poisoning Prevention Week in October. We are planning many more upcoming collaborative activities with our partners.

Environmental Health Nexus Outreach

The EH Nexus is actively expanding its partnerships. All organizations that have an interest in promoting environmental health activities are welcome to join. Joint webinars and other communication activities help our partners reach new audiences and expand their outreach. The EH Nexus is also strengthening its connections with academic environmental health institutions. These institutions have strong connections with their local environmental health communities and can help share information widely. To learn more, visit www.cdc.gov/nceh/ehsp/ehnexus/index.htm.

Join the Environmental Health Nexus!

Be part of the Environmental Health Nexus (EH Nexus) as we work together to share knowledge, save lives, and protect public health. Healthy environment, healthy you.

- Reach out to us at ehnexus@cdc.gov to sign up as a partner.
- View the EH Nexus at www.cdc.gov/nceh/ehsp/ehnexus/index.htm.
- Subscribe to the monthly newsletter at https://tools.cdc.gov/campaignproxyservice/subscriptions.aspx?topic_id=USCDC_2150.

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DIRECT FROM ecoAmerica

Nicole Hill, MPH

Robert Perkowitz

The United Nations, Climate Change, Environmental Health, and You

Editor's Note: The National Environmental Health Association (NEHA) strives to provide up-to-date and relevant information on environmental health and to build partnerships in the profession. In pursuit of these goals, we feature this column from ecoAmerica whose mission is to build public support and political resolve for climate solutions. NEHA is an official partner of ecoAmerica and works closely with their Climate for Health Program, a coalition of health leaders committed to caring for our climate to care for our health. The conclusions in this column are those of the author(s) and do not necessarily represent the official position of NEHA.

Nicole Hill is the research and marketing manager for ecoAmerica. Robert Perkowitz is the founder and president of ecoAmerica.

The leading authority globally on climate change is the Intergovernmental Panel on Climate Change (IPCC) within the United Nations. Every 5 years, the panel releases an extensive 3-part assessment on climate change that explores the science, the impacts, and the solutions. In February 2022, IPCC released findings from Working Group II as part of its Sixth Assessment Report. The Working Group II report—3,675 pages long itself—focused on climate change impacts on ecosystems, biodiversity, and human communities. So, what do these findings mean for environmental health and you?

The Working Group II contribution to the IPCC Sixth Assessment Report chronicles how climate change impacts human systems, including water scarcity and food production; health and well-being; and cities, settlements, and infrastructure. These systems span both the natural and built environment and are closely or directly related to the environmental health field. The diversity of environmental health professionals ranges from inspectors who monitor our air, water, and food, to city planners who implement design strategies that keep us safe and mitigate the risk of harm around us. Environmental health professionals are at the core of public health, and therefore, also at the core of climate change solutions.

The IPCC (2022) report states with "very high" confidence that "climate change has negatively affected human health and well-being in North America." We all see and feel the impacts of our changing climate but like many other environmental health challenges, risks and consequences vary by population. Factors including age, gender, location, and socioeconomic status influence how heavily the burden of climate change impacts various groups of people (IPCC, 2022). Within the U.S., communities of color are disproportionately impacted by climate change. For example, Black and African American individuals are more likely to live in areas with the highest projected increase in deaths from extreme temperatures due to climate change (U.S. Environmental Protection Agency, 2021). Additional IPCC health projections include "very high" confidence that morbidity will be impacted by mean temperatures and air pollution. Mortality will be impacted by severe windstorms. Morbidity and mortality will be impacted by extreme heat (IPCC, 2022).

We see these impacts played out in our own communities. Many people in the U.S. report that they have already experienced the impacts of climate change. For example, 79% of survey respondents report having noticed more extreme heat in the past few years (Hill, 2021). And a majority of people in the U.S.—especially in the West—report noticing more severe wildfires in the past few years (Hill, 2021). From a national poll, 78% of respondents indicated that they have been personally impacted by extreme weather in the last 5 years (NPR et al., 2022). At the same time from a different survey, 96% of U.S. adult respondents agree that we have a right to live in a healthy environment with clean air and water (Hill, 2021b). What actions can we take to get there? What can environmental health professionals do?

The most important thing you can do to help slow, stop, and reverse climate change is to communicate, especially about the health risks. From a 2022 survey, 60% of respondents say they are curious about climate change (Hill, 2022a). We need to turn that curiosity into action. Furthermore, 61% of people in the U.S. surveyed associate heat

waves with climate change and 50–60% associate severe storms, drought, wildfires, and floods with climate change (Hill, 2022b). Less understood impacts of climate change include air pollution, seasonal allergies, and disease-carrying insects. Of those surveyed, only 21% noted the association of climate change with disease-carrying insects (Hill, 2022b). As trusted professionals, talking about climate change in terms of real, tangible, and local impacts helps build support for climate action.

So, when you talk about climate change, keep these factors in mind:

- **Start with people**. Consider the concerns and values—such as family, community, health, and fairness—of those you are speaking to and honor them. Then, move from people to climate.
- **Make it real**. Focus on local realities everyone can see with their own eyes and bring forward your own climate journey to personalize the issue.
- **Focus on solutions and personal benefit**. Avoid speaking about climate solutions as a matter of sacrifice. Solutions invest today in the future we want tomorrow. Emphasize local, tangible, and effective solutions.
- **Inspire and empower**. People are often told that we cannot make a difference on climate change but that is not true. Provide hope and optimism by sharing solutions and letting your audience know that we can make a difference.
- **Be thoughtful**. Be considerate to your audience and ask them to get involved in action today.

Additionally, you can bring climate change forward in all aspects of your life. A total of 88% of surveyed people in the U.S. are either very, somewhat, or a little concerned about climate change, which means there is an opportunity to help initiate climate conversations in your neighborhood, workplace, and community (Hill, 2022c). For environmental health professionals in community health departments, state agencies, or the federal government, consider the following about people in the U.S. who we surveyed in 2021:

- 70% say it is the responsibility of local communities to address climate change,
- 69% say it is the responsibility of the U.S. Environmental Protection Agency to address climate change, and
- 64% say it is the responsibility of states to address climate change (Hill, 2021b).

> *"Climate change is here today. It's impacting our health today. And there's something we can do about it. It's all in our hands."*
>
> Georges C. Benjamin, MD, Executive Director, American Public Health Association (ecoAmerica, 2022, 6:13)

Notably, more than any other group, people in the U.S. said that it was their personal responsibility to address climate change (Hill, 2021b). Your colleagues, friends, and family want to be part of the solution. Reach out to everyone, every day. Follow these steps and contact your local elected and appointed officials to get started on advocacy:

1. **Know who represents you**. It takes only a moment to find out who your local representatives are. Learn about their priorities to see how and why climate change ties into their interests.
2. **Look for local connections and leverage points**. Focus on solutions that can take place in your local community first, then engage with them and help local government make the connections.
3. **Do not limit yourself**. There is no one-size-fits-all approach to climate change at the local level. See where you can make the greatest impact and engage with elected officials on those issues.
4. **Be persistent and clear. Use several means of communication**. Especially when voting is around the corner, use all forms of communication to let elected officials know you expect ambitious climate action. Phone calls, email messages, and all forms of social media can help get your priorities across.
5. **When you send an email, put your "ask" in the subject line**. Make your request clear so elected officials can count you as a constituent that cares about climate solutions.
6. **Tell a personal story that brings the issue home**. Focus on issues that are important to you to help make your message stick.
7. **Say thank you**. When elected officials follow through with climate action, show gratitude.
8. **Join a local organization that focuses on climate issues**. If there is not one in your local community, work with your family and neighbors on climate advocacy.

The latest IPCC report shows that climate change already has—and continues to have—adverse impacts on our health, ecosystems, and communities. The findings, however, remind us how critical it is to take action. Join us in these steps toward solutions and invite people in your local environmental health community to join you.

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References

ecoAmerica. (2022, April 4). *Day 2: Local action, national purpose spotlight; Personal family + friends 2.4*. [Video]. YouTube. https://youtu.be/2r7ZggArPkM

Hill, N. (2021a, August 4). *American Climate Perspectives Survey 2021, vol. IV: Severe weather drives climate concerns*. ecoAmerica. https://ecoamerica.org/american-climate-perspectives-survey-2021-vol-iv/

Hill, N. (2021b, May 26). *American Climate Perspectives Survey 2021, vol. III: The rural–urban divide on climate change. Where's the polarization?* ecoAmerica. https://ecoamerica.org/american-climate-perspectives-survey-2021-vol-iii/

Hill, N. (2022a, May 30). *American Climate Perspectives Survey 2022, vol. II: Climate change sparks emotional responses*. ecoAmerica. https://ecoamerica.org/american-climate-perspectives-survey-2022-vol-ii-part-ii-blog/

Hill, N. (2022b, May 23). *American Climate Perspectives Survey 2022, vol. II: Are Americans making the health and climate connection?* ecoAmerica. https://ecoamerica.org/amer

ican-climate-perspectives-survey-2022-vol-ii-part-i-blog/

Hill, N. (2022c, January 26). *American Climate Perspectives Survey 2022, vol. I: More Americans are concerned about climate change than you think*. ecoAmerica. https://ecoamerica.org/american-climate-perspectives-survey-2022-vol-i-blog/

Intergovernmental Panel on Climate Change. (2022). *Sixth Assessment Report, Working Group II—Impacts, adaptation, and vulnerability. Fact sheet—North America.* https://www.ipcc.ch/report/ar6/wg2/downloads/outreach/IPCC_AR6_WGII_FactSheet_NorthAmerica.pdf

NPR, Robert Wood Johnson Foundation, & Harvard T.H. Chan School of Public Health. (2022). *The impact of extreme weather on views about climate policy in the United States*. https://www.documentcloud.org/documents/22064906-weather_climatechangereport_final

U.S. Environmental Protection Agency. (2021). *Climate change and social vulnerability in the United States: A focus on six impacts* (EPA 430-R-21-003). https://www.epa.gov/system/files/documents/2021-09/climate-vulnerability_september-2021_508.pdf

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

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

Thank you.

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THE PRACTITIONER'S TOOL KIT

An Introduction and Checking Field Thermometer Accuracy

James J. Balsamo, Jr., MS, MPH, MHA, RS, CP-FS, CSP, CHMM, DEAAS
Nancy Pees Coleman, MPH, PhD, RPS, RPES, DAAS
Gary P. Noonan, CAPT (Retired), MPA, RS/REHS, DEAAS
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Vincent J. Radke, MPH, RS, CP-FS, CPH, DLAAS
Charles D. Treser, MPH, DEAAS

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

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

Introduction

Welcome to tricks of the trade. This column will look at the "what, why, and how" behind exercising our professional knowledge, skills, and attributes in the field. The information we will present is based on good science and uses a practical, commonsense approach.

We are all quite adept at interpreting codes, rules, regulations, and policies but unfortunately, applying this skill did not come with an owner's manual. Like most, we initially learned from a mentor, who learned from a mentor, and so on. It only becomes apparent that there might be a better way of doing things after we have been in practice for several years, or when we observe a colleague and wonder if there is something that can improve what we are doing. At best, we hone our skills. At worst, we become static and subsequently can be challenged when our work does not hold up to scientific or legal scrutiny.

This column is an extension of something we started approximately 30 years ago in the *Journal of Environmental Health*, albeit with a new perspective. We initially penned a column on field instrumentation and tools. Our approach was similar to that of *Consumer Reports* in reviewing household appliances, tires, and auto insurance. We put the tools into actual practice and gave an honest and critical accounting of our findings.

We learned much writing that column. We also learned new insights into our applied environmental health science. In particular, we learned how to sample, measure, and interpret findings to eliminate bias, ensure repeatability, and be responsive to developing scientific and technological trends, current public health needs, and the needs of our clients. We learned to use our field instruments and inspection, audit, or evaluation techniques to assess risk and help tailor corrective measures in a cost-effective and cost-efficient manner. We found that this approach encourages our clients to think of new ways to protect the public.

We learned to interpret data that conform with the sampling method and inherent error and limitations of the field instruments, as well as to structure our reports so that they cannot be easily assailed. And finally, we learned teaching and sales techniques along with professional deportment that results in improved communication and cooperation for the good of public health.

The idea for this column came from an experience working as a defendant's expert in a correctional conditions case. During field work, it became obvious—much to our own embarrassment because we were guilty of doing much of the same thing—that the sampling and measuring techniques of the plaintiff's expert were not defensible. Routine monitoring such as evaluating the temperature of food, as well as evaluating lighting, ventilation, and general sanitation practices, were without a good grounding in our applied science and industry accepted practices. Likewise, we are often called on to comment and defend (or critique) contentious sampling strategies, concise report preparation, and professional deportment in the performance of our duties. We are looking forward to sharing these experiences and the insights that go with them.

The authors of this column collectively have over 300 years of experience as environmental health professionals. We are all credentialed and worked as regulatory practitioners, academicians, industry consultants, and forensic technologists. Our careers were fraught with mistakes and successes, both large and small. We have embraced and learned from our mis-

takes and successes—and we are still learning. We do not know all the answers but realize it is now our turn to give to the best of our ability our version of an owner's manual for environmental health practitioners.

In so doing, we hope to introduce timely ideas and tips to make your field work easier and seamless. Most important, however, we welcome your questions and comments. We will try to respond in a way that is both useful and in keeping with our collective professional goals. We know there are emerging issues that affect our professional acumen and therefore, we welcome all your comments, opinions, and questions. Most of all, we are open to sharing novel approaches and techniques that you are using that make your job easier, safer, and more concise and understandable.

By way of introduction, here are the coauthors of this column:

- James J. Balsamo, Jr., MS, MPH, MHA, RS, CP-FS, CSP, CHMM, DEAAS: Forensic sanitarian who specializes in institutional environmental health and safety.
- Nancy Pees Coleman, MPH, PhD, RPS, RPES, DAAS: Toxicologist who specializes in occupational and environmental toxicology, environmental data analysis, and risk assessment.
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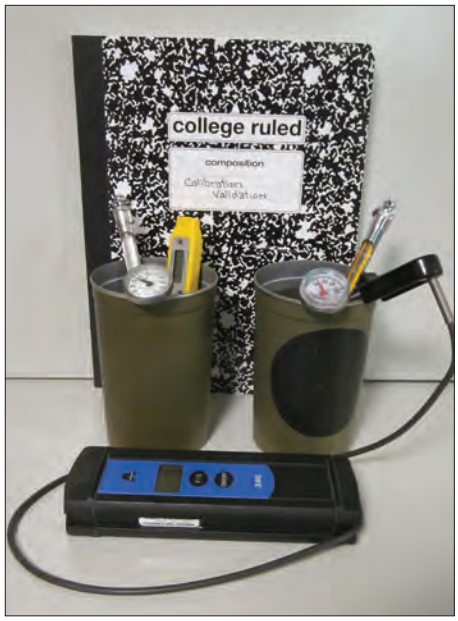
- Vincent J. Radke, MPH, RS, CP-FS, CPH, DLAAS: Sanitarian who specializes in food safety, policy development, and risk assessment.
- Charles D. Treser, MPH, DEAAS: Principle lecturer emeritus of environmental and occupational health sciences who specializes in environmental health regulation, workforce development, and communication.

To contact us, send your comments and questions to toolkit@sanitarian.com.

Checking Field Thermometer Accuracy

When conducting a retail food establishment inspection, one of the most critical and often observed violations is the failure to maintain safe temperatures, particularly hot and cold holding. Temperature readings above 41 °F (5 °C) and below 135 °F (57 °C), barring any time component, can result in immediate food destruction or a serious consequence in fines, sanctions, or even closure. On rare occasions, the restaurateur might challenge these findings that include questioning the thermometer accuracy and/or the conditions of sampling. When findings are questioned, it is our responsibility to justify inspection results in a way that cannot be challenged. In occasions when we have worked with a restaurateur to defend their claim, we found that failure to validate and record the thermometer(s) accuracy can and will invalidate inspection findings. We will deal with sampling strategies in another column.



Calibration and validation array that shows the "temperature standard" thermometer along with the thermometers to be validated (bimetallic dial, thermistor, and thermocouple thermometers), and record book. Note, the black dot on the container shown in the photo is used for validating our infrared thermometer, which will be discussed in a future column. Photo courtesy of Dr. Robert Powitz.

For this column, however, we will focus on ensuring accuracy of the temperature measuring devices that we regularly use in the field.

The need for validation—to confirm its accuracy or calibration, which is to precisely adjust the instrument in accordance with manufacturer recommendations—is inherent in the temperature measuring device itself. Most electronic thermometers are manufactured to an accuracy of ±0.2 °F (0.1 °C). Mechanical thermometers, such as bimetallic (dial) thermometers, have a tolerance of ±2 °F (1.1 °C). Thermometer accuracy can also be further compromised by external conditions encountered during transport, such as keeping them in a hot car, in freezing temperatures, or subjecting them to jarring before use.

Therefore, in the absence of a National Institute of Standards and Technology (NIST)-traceable dry-well thermometer calibrator, validating thermometer accuracy by some simple but traceable means is essential. Conventional wisdom recommends using an ice bath to validate electronic thermometers or calibrate mechanical ones. Presumably, the ice and water mixture will be 32 °F (0 °C) but that is not always the case. A water and ice mixture made from distilled, reverse osmosis, or deionized water will result in a 32 °F (0 °C) bath. A water and ice mixture made from surface, well, or bottled water can differ widely in total dissolved solids (TDS) content and affect the temperature of the mixture. The higher the concentration of dissolved salt, the lower its overall freezing point. The freezing temperature of "pure" versus highly mineralized water can vary as much as ±4.5 °F (2.5 °C). Along with the inherent accuracy of the thermometer, the variance of the ice and water mixture and thermometer together can result in an error as high as ±6.5 °F (3.6 °C). This high possibility for error does not instill a lot of confidence in verification of thermometer accuracy using an ice bath, particularly when a poorly functioning thermometer is used as an enforcement tool. There is a better way.

Here is the logic. If the thermometer is used to measure both hot and cold holding temperatures, would it not make more sense to do a two-point validation at some approximate temperature in the hot and cold range? Secondly, would it not make more sense to compare the temperatures of the thermometers to some temperature standard rather than worry about the TDS levels of the water and ice mixture and its freeze point conversion factor?

Let us begin by using a "temperature standard" thermometer, which is a liquid-in-glass general purpose laboratory thermometer, preferably built to NIST specifications but not necessarily essential. A convenient temperature range of the temperature standard

thermometer is 0–220 °F (-20–110 °C). You will also need two containers of the same material type, such as inexpensive insulated travel mugs.

Fill one container with cold tap water and the other with hot tap water; immerse the temperature standard liquid-in-glass thermometer in either container along with the probe of the electronic thermometer or the mechanical thermometer to be tested. Let both thermometers equilibrate (a few minutes will do) and compare the temperature reading of the temperature-standard thermometer against that of the thermometer being validated. Repeat the process in the other container.

Always record your results. We use a bound composition book that is admissible in court and enter the time, date, and results that include the temperature of the temperature standard thermometer versus the field thermometer, along with your initial or signature. We use a separate column, marked in red ink, to list the correction factor (± variance from the standard) that we will apply in the field when taking temperatures. The results recorded in a bound composition book are a legal document that verifies due diligence in the performance of our duties as environmental health professionals. The process is simple, fast, accurate, inexpensive, defensible, and best of all, it cannot be challenged.

Contact: toolkit@sanitarian.com.

EH CALENDAR

UPCOMING NATIONAL ENVIRONMENTAL HEALTH ASSOCIATION (NEHA) CONFERENCE

July 31–August 3, 2023: NEHA 2023 Annual Educational Conference & Exhibition, Hilton New Orleans Riverside, New Orleans, LA, https://www.neha.org/aec

NEHA AFFILIATE AND REGIONAL LISTINGS

Illinois
November 7–8, 2022: IEHA Annual Educational Conference, Illinois Environmental Health Association (IEHA), Oglesby, IL, https://www.iehaonline.org/conference-registration

Iowa
October 12–13, 2022: IEHA Fall Conference, Iowa Environmental Health Association (IEHA), West Des Moines, IA, https://www.ieha.net

Michigan
March 22–24, 2023: Annual Education Conference, Michigan Environmental Health Association, Port Huron, MI, https://www.meha.net/AEC

Nebraska
October 19, 2022: Annual Conference, Nebraska Environmental Health Association, Ashland, NE, https://nebraskaneha.com/annualConference.html

North Dakota
October 18–20, 2022: NDEHA Fall Education Conference, North Dakota Environmental Health Association (NDEHA), Minot, ND, http://www.ndeha.org/wp/conferences

Texas
October 19–21, 2022: 66th Annual Educational Conference, Texas Environmental Health Association, Round Rock, TX, https://myteha.org/Annual-Education-Conference

Wisconsin
October 26–28, 2022: WEHA 2022 Educational Conference, Wisconsin Environmental Health Association (WEHA), Lake Geneva, WI, https://weha.net/events

TOPICAL LISTINGS

Preparedness
October 23–29, 2022: Environmental Health Training in Emergency Response (EHTER) Operations, Center for Domestic Preparedness, Federal Emergency Management Agency, Anniston, AL, https://cdp.dhs.gov/training/course/PER-309

Did You Know?

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

RESOURCE CORNER

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

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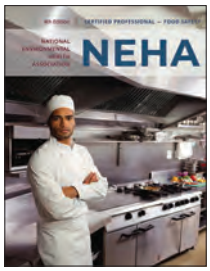
NEW! CP-FS Study Guide (4th Edition)

National Environmental Health Association (2022)



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

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

NEW! Control of Communicable Diseases Manual (21st Edition)

Edited by David L. Heymann, MD (2022)

The 21st edition of the *Control of Communicable Diseases Manual* (*CCDM*) was updated to include new chapters on SARS-CoV-2, Zika virus, and many other pathogens and infectious diseases. This landmark publication is essential to people working in and around public health. The manual is one of the most widely recognized sourcebooks on infectious diseases and provides detailed, accurate, and informative text for public health workers. Each listing is easy to read and includes identification, infectious agent, occurrence, mode of transmission, incubation period, susceptibility, and resistance. The *CCDM* is a study reference for NEHA's Registered Environmental Health Specialist/Registered Sanitarian and Certified Professional–Food Safety credential exams.

750 pages / Paperback
Member: $75 / Nonmember: $85

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

Herman Koren and Alma Mary Anderson (2021)

The 4th edition of this bestseller provides up-to-date information for newly promoted or management-aspiring professionals and engineers in the fields of environmental health, occupational health and safety, water and wastewater treatment, public health, and other environmental professions. The book is also an excellent resource for students interested in learning management skills prior to entering the workforce. Through nine sets of tools, the first volume explains the basic principles supervisors need to understand the structure of their organization, what leadership is, how to effectively plan and budget, how to manage other people, and best practices for achieving success in a management position.

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276 pages / Paperback
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JEH QUIZ

FEATURED ARTICLE QUIZ #2

Lead-Based Paint and Other In-Home Health Hazards in Las Vegas, Nevada: Findings of the Las Vegas Lead Hazard Control and Healthy Homes Program

Available to those with an active National Environmental Health Association (NEHA) membership, the *JEH* Quiz is offered six times per calendar year and is an easily accessible way to earn continuing education (CE) contact hours toward maintaining a NEHA credential. Each quiz is worth 1.0 CE.

Completing quizzes is now based on the honor system and should be self-reported by the credential holder. Quizzes published only during your current credential cycle are eligible for CE credit. Please keep a copy of each completed quiz for your records. CE credit will post to your account within three business days.

Paper or electronic quiz submissions will no longer be collected by NEHA staff.

INSTRUCTIONS TO SELF-REPORT A *JEH* QUIZ FOR CE CREDIT

1. Read the featured article and select the correct answer to each *JEH* Quiz question.
2. Log in to your MyNEHA account at https://neha.users.membersuite.com/home.
3. Click on Credentials located at the top of the page.
4. Select Report CEs from the drop-down menu.
5. Enter the date you finished the quiz in the Date Attended field.
6. Enter 1.0 in the Length of Course in Hours field.
7. In the Description field, enter the activity as "*JEH* Quiz #, Month Year" (e.g., *JEH* Quiz 2, October 2022).
8. Click the Create button.

JEH Quiz #6 Answers

May 2022

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

→ Quiz effective date: October 1, 2022 | Quiz deadline: January 1, 2023

1. Exposure to lead-based paint in homes constructed prior to 1978 poses multiple hazards to children, usually via
   a. inhalation of lead dust.
   b. ingestion of lead paint chips.
   c. all the above
   d. none of the above.
2. Blood lead concentrations of <10 µg/dL have been associated with behavioral issues, cognitive impairment, and neurological damage.
   a. True.
   b. False.
3. In 2021, the Centers for Disease Control and Prevention updated its blood lead reference value to __ for children.
   a. 2 µg/dL
   b. 3.5 µg/dL
   c. 5 µg/dL
   d. 10 µg/dL
4. In the U.S., asthma is recognized as the most common chronic illness among children, affecting __ in 15 individuals.
   a. 1
   b. 2
   c. 3
   d. 4
5. Approximately __ of Las Vegas households faced housing issues including substandard housing conditions, overcrowding, and housing cost burden in 2015.
   a. 10%
   b. 20%
   c. 30%
   d. 40%
6. Through the Las Vegas Lead Hazard Control and Healthy Homes Program (Las Vegas LHCHHP), a total of __ lead inspection and risk assessments and __ subsequent healthy homes visual assessments were completed through March 2020.
   a. 52; 59
   b. 59; 62
   c. 62; 52
   d. 62; 59
7. Of the primary participants included in the Las Vegas LHCHHP, __ self-identified as female.
   a. 39.5%
   b. 51.2%
   c. 76.7%
   d. 83.7%
8. Properties included in the Las Vegas LHCHHP were primarily
   a. owner-occupied.
   b. renter-occupied.
9. In the 43 homes that were assessed, __ lead dust hazards were more common than __ lead dust hazards.
   a. windowsill; floor
   b. floor; windowsill
   c. exterior; interior
   d. interior; exterior
10. Nearly __ of participant homes had ≥1 lead-based paint hazard on a wall, ceiling, or floor component.
    a. 53%
    b. 63%
    c. 73%
    d. 83%
11. The highest single hazard count was for structural issues in
    a. bathrooms.
    b. bedrooms.
    c. kitchens.
    d. exteriors.
12. A unique strength of the Las Vegas LHCHHP was its ability to not only identify lead-based paint and other healthy homes hazards but also coordinate remediation.
    a. True.
    b. False.

SAVE THE DATE

86th Annual Educational Conference & Exhibition

AEC 2023

National Environmental Health Association

presents

July 31 – August 3 | New Orleans, LA

Raising the Voice of the Environmental Health Workforce

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October 1

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December 1

NATIONAL ENVIRONMENTAL HEALTH ASSOCIATION

For additional details and information, visit
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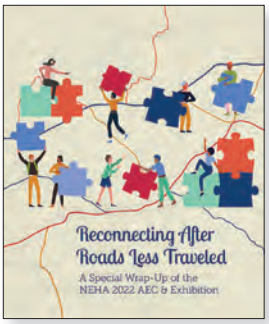

NEHA 2022 AEC *Wrap-Up*

Safeguarding a Road Less Traveled

The National Environmental Health Association's (NEHA) 85th Annual Educational Conference (AEC) & Exhibition highlighted our commitment to quality, timely, and innovative education with a new hybrid format. With the large variance in travel restrictions in place around the country and globe—coupled with the demand for in-person opportunities to network and engage—the 2022 AEC offered both in-person and virtual options. The 2022 AEC took place June 28–July 1 in beautiful Spokane, Washington, and virtually. A total of 1,400 environmental health professionals participated in AEC, with 1,000 people gathering in Spokane and 400 people engaging virtually. Attendees shared experiences, research, expertise, and best practices to reconnect and safeguard our communities in a postpandemic world.

A highly engaging keynote address was delivered by Dr. Umair Shah, MPH, MD, secretary of health for the Washington State Board of Health. Speaking to in-person and virtual attendees, he discussed the visibility crisis of environmental health that has been thrust to the forefront of public health during the COVID-19 pandemic. Dr. Shah also emphasized the greatest issues facing environmental health professionals including climate change, emergency preparedness, and vectors. He closed out the session by stressing the importance of focusing on transformational health compared to transactional health as we look to the future.

On the second day, the Grand Session Kickoff featured a moderated panel of environmental health leaders to discuss the challenges and difficult situations environmental health workers faced during the implementation of COVID-19 safety measures. NEHA President Roy Kroeger moderated the highly

engaging conversation that highlighted the use of education versus enforcement, as well as the importance of mental health. Panelists included Eric Bradley, deputy health director of Linn County Public Health; Tom Gonzales, public health director of the Larimer County Department of Health and Environment; and Niki Lemin, assistant health commissioner and director of environmental health for Franklin County Public Health.

The AEC featured multiple days of educational content on a variety of topics including food safety, water quality, climate and health, emergency preparedness, and much more. William (Bill) Marler, JD, attorney and food safety expert from Marler Clark, The Food Safety Law Firm, closed out the AEC by speaking virtually to attendees about a lawyer's view of modern foodborne outbreaks.

Nearly 250 educational sessions, preconference workshops, and meetings were held at the 2022 AEC. Of these events, 90 were available to the virtual audience. Approximately 300 speakers shared their expertise to full rooms and virtual attendees throughout the conference. The Exhibit Hall was filled with exhibitors from various industries to showcase their innovative products and services designed to improve the job functions and performance of environmental health professionals.

With the lack of in-person networking opportunities over the last couple of years, the Reconnecting on the River Networking Event proved to be an important aspect of the 2022 AEC. The event brought together 700 attendees who were able to relax and reconnect with their peers along the banks of the beautiful Spokane River.

NEHA thanks our attendees, members, board, technical advisors, presenters, exhibitors, sponsors, and staff who participated and contributed to the success of the 2022 AEC. We know the past couple of years have been especially challenging and we thank everyone who took the time to attend and participate in the 2022 AEC. We hope to see you next year in New Orleans, Louisiana, at the 2023 AEC. Check out the promotion for the 2023 AEC on page 47.

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NEHA 2022 AEC photos courtesy of Shanoah Eck, Shanoah Bri Photography, https://shanoahbriphotography.com.

Featured Speakers

Keynote speaker Dr. Umair Shah emphasized the importance of us coming together to keep people and communities safe and healthy.

Carol Evans, chairperson of the Spokane Tribal Council, shared the importance of the history of the land and its connection to the Spokane people.

The Grand Session Kickoff panelists addressed many of the challenges the environmental health workforce faced during the COVID-19 pandemic.

Keynote Address

NEHA President Roy Kroeger opened the 2022 AEC on June 28. After welcoming attendees to beautiful Spokane, he introduced Carol Evans, chairperson of the Spokane Tribal Council. Evans delivered a meaningful invocation and started it by saying, "For myself and my people, we always acknowledge our creator. Thank you, creator, for this beautiful day. We thank you for all of the gifts you provide for us—for the air, water, land, animals, and the people." She spoke of the importance of the history of the land and its connection to the Spokane people. Evans closed by delivering a land acknowledgement—a statement that recognizes, respects, and affirms the ongoing relationship between Indigenous people and the land—by stating, "For my people, this land that you sit on today is the historical home of the Spokane people since time immemorial."

The Keynote Address was presented by Dr. Umair Shah, MPH, MD. He was appointed secretary of health for the Washington State Board of Health by Governor Jay Inslee in December 2020. Prior to this role, Dr. Shah served as executive director and local health authority for Harris County Public Health in Texas—a nationally-accredited public health agency for the nation's 3rd largest county with 4.7 million people. Over his career, Dr. Shah has been a clinician, innovator, educator, and leader in health.

Dr. Shah began his address by saying, "It's not words on paper but action as we must all come together." His presentation—Health Where Equity, Innovation, and Engagement Meet—set the stage for the 45-minute address.

Dr. Shah continued by emphasizing, "It's what we do as a society collectively, as people, to be safe, healthy, and protected. If we do well, we get healthy people that create healthy communities." He added that "public health is inherently political" and creates an "invisibility crisis" for the environmental and public health workforce. He listed the three V's of this crisis: visibility, value, and validation. He likened the workforce as the "offensive line of a football team," not being seen but their impact crucial and needed.

Climate change was also addressed, including wildfires, mudslides, glacier melting, and excessive heat. "It's a challenge for all of us, what we are seeing across the country, we are all connected. We have the responsibility to call the signal and do more for our future generations," he stated. "We are connected and global health matters." He then addressed COVID-19 by saying, "We recognize we have a responsibility of what we learned from COVID-19 and ways to move forward."

Dr. Shah closed his address by sharing, "Environmental health for all, not just for some, by all of us coming together. I want to thank you for every single day of going to work to build communities. If we do this well, we can absolutely change the world and do good." He then read the proclamation from Governor Inslee that declared June 28, 2022, as Environmental Public Health Professionals Day.

Grand Session Kickoff

The Grand Session Kickoff on June 29 featured a panel discussion focused on the challenges the environmental health workforce has faced and still faces regarding COVID-19 practices. During the 90-minute session, the panel discussed the threats, violence, and unprecedented working conditions that environmental health professional faced during the last 2 years. The panel also explored how we can learn from this experience and move forward in a positive direction.

The panel, moderated by President Kroeger, included:

- Eric Bradley, deputy director for Linn County Public Health in Cedar Rapids, Iowa. During the first 2 years of the COVID-19 pandemic, he was environmental health manager for the Scott County Health Department in Davenport, Iowa.
- Tom Gonzales, public health director for the Larimer County Department of Health and Environment in Fort Collins, Colorado. Prior to this position, he served as deputy public

continued on page 52

Featured Speakers (continued)

health director at El Paso County Public Health in Colorado Springs, Colorado, and oversaw programs for environmental health and emergency preparedness and response.

- Niki Lemin, assistant health commissioner and environmental health director of Franklin County Public Health in Columbus, Ohio. Prior to her current position, she served in several state and local capacities. Lemin currently serves on the NEHA Board of Directors as regional vice-president for Region 6 and is cochair of the International Code Council/NEHA Pandemic Task Force.

Gonzales summed up the situation within his district by saying, "As the pandemic went on, we all got fatigued. Folks were getting tired of us. But I look back and say, 'Did we do the right thing?' We did, we saved lives every day. It was tough. We all have trauma over it and now we need to talk about it. What we do makes a difference."

Closing Session

The Closing Session provided attendees with insights on foodborne illness investigations and outbreaks from prominent foodborne illness lawyer William Marler.

The Closing Session—A Lawyer's View of Modern Foodborne Outbreaks—was given by William "Bill" Marler, an accomplished attorney and national expert in food safety. Marler Clark, The Food Safety Law Firm has represented thousands of individuals in claims against food companies whose contaminated products have caused life altering injury and death. Marler has become the most prominent foodborne illness lawyer in the U.S. and is a major force in food policy here and abroad. He began litigating foodborne illness cases in 1993 when he represented Brianne Kiner, the most seriously injured survivor of the historic *E. coli* O157:H7 outbreak that occurred in four states in the Northwest at Jack in the Box restaurants.

Marler outlined the pathway of a foodborne illness investigation, "The most important thing in an outbreak investigation, in my view, is the environmental investigation, the product traceback, and getting the product off the market." He continued with the necessity of proving a case using laboratory tests, adhering to strict product liability, defining the "manufacturer," and proving negligence. Marler claimed that the only defense to foodborne outbreak cases is prevention.

2022 AEC SESSION TRACKS

1. **Climate & Health**
   - » Climate Change
2. **Data & Technology**
   - » Environmental Health Tracking & Informatics
   - » Technology & Environmental Health
3. **Emergency Preparedness**
   - » Emergency Preparedness & Response
4. **Food Safety**
   - » Cannabis
   - » Food Safety & Defense
   - » Home Restaurants
5. **General Environmental Health**
   - » Air Quality
   - » Body Art
   - » Emerging Environmental Health Issues
   - » Food Waste
   - » General Environmental Health
   - » Global Environmental Health
   - » Hazardous & Toxic Materials
   - » Solid Waste
   - » Sustainability
6. **Healthy Communities**
   - » EH Health Impact Assessment
   - » Healthy Homes & Communities
   - » Land Use Planning & Design
   - » Lead
   - » Schools & Institutions
7. **Infectious & Vectorborne Diseases**
   - » Pathogens & Outbreaks
   - » Vector Control & Zoonotic Diseases
8. **Special Populations**
   - » Children's Environmental Health
   - » Environmental Justice
   - » Uniformed Services
9. **Water Quality**
   - » Onsite Wastewater
   - » Premise Plumbing
   - » Private Drinking Water
   - » Recreational Water (including shorelines)
   - » Water Quality
   - » Water Reuse
10. **Workforce & Leadership**
    - » Leadership, Management, & Enumeration
    - » Student & Young Professional Career Development

Education & Training

For the first time in our 85-year history of hosting the AEC, the conference was delivered in a hybrid format that allowed attendees to participate in person and virtually. Almost 1,400 registered individuals—991 in person and 394 virtually—attended more than 200 educational sessions, three featured sessions, and a poster session that showcased 25 research projects.

Included within the main session tracks (see page 52) were emerging environmental and public health issues such as the ongoing fentanyl crisis, climate change including flooding and wildfires, environmental justice and mental health after disasters, and COVID-19 and wastewater surveillance.

Two educational sessions focused on the current fentanyl crisis. Dr. Nicole Rodin, an assistant professor at the College of Pharmacy and Pharmaceutical Sciences within Washington State University, presented a captivating discussion on the current illicit fentanyl data and trends, what illicit fentanyl is, how it is a unique opioid, and current harm reduction strategies and their value. Dr. Rodin's session was followed by a presentation given by U.S. Drug Enforcement Administration (DEA) Special Agents Jacob D. Galvan from the Seattle Field Division and Mark T. Haigh from the Spokane District Office. They spoke of the primary mission of DEA to identify and target the most dangerous individuals and organizations who are causing harm and bringing violence to our communities, as well as how we as environmental and public health professionals can work together to address the skyrocketing number of lethal overdoses and reduce drug-related violence through education and awareness.

The NEHA Climate Health Adaptation and Mitigation Partnership (CHAMP) Framework and Program was unveiled during a panel discussion. The panel provided an overview of the program that featured a paradigm or modeling approach to shed light on climate change and the role of the environmental health workforce. The panel included members from state, tribal, local, and territorial jurisdictions who shared their perspectives on climate change and response to environmental health hazards as both emerging and ignored issues. The panel maintained a sharp focus on equity and environmental justice as they discussed the opportunities and dilemmas facing environmental health professionals who serve the diverse needs of vulnerable populations and communities.

The 2022 AEC brought with it a multitude of educational sessions that focused on a variety of aspects related to COVID-19. In a session titled, Addressing the Pandemic From the Sewer: Highlights From New Mexico's COVID-19 Wastewater Surveillance Program in Congregate Settings, T. Justin Garoutte, the health equity director for the New Mexico Department of Health, told the story of an innovative wastewater surveillance program. From December 2020 to October 2021, the New Mexico Environment Department launched and operated a wastewater surveillance program to monitor SARS-CoV-2 at congregate settings in the state to slow the spread of COVID-19.

The NEHA 2023 AEC is scheduled for July 31–August 3, 2023, in New Orleans, Louisiana. The Call of Abstracts was opened from August 29 to September 30, 2022. We are exploring many relevant topics for the 2023 AEC, including sessions on the latest data and technologies; emerging issues such indoor air quality, emerging pathogens, risk communications, and per- and polyfluoroalkyl substances (PFAS); infectious diseases such as monkeypox and polio; flooding, wildfires, and hurricanes; environmental justice; and workforce diversity. Visit www.neha.org/aec for all the latest 2023 AEC information and news.

Education & Training

Preconference Courses & Workshops

We continued the tradition of hosting a variety of beneficial preconference offerings on June 26–28, 2022. Over 250 attendees enhanced their AEC experience by attending one of 10 preconference offerings at the 2022 AEC.

The Registered Environmental Health Specialist/Registered Sanitarian (REHS/RS) Review Course prepared 13 attendees for the REHS/RS credential examination. The Certified Professional–Food Safety (CP-FS) Review Course prepared nine individuals for the CP-FS credential examination. Over 30 affiliate leaders came together for the Affiliate Leadership Workshop to learn about marketing, event planning, technology, and much more to better serve their environmental health associations. Nearly 20 attendees learned about the fundamentals of body art facility inspection in the Body Art Facility Inspector Training held in partnership with the Body Art Education Alliance. Motivational, inspirational, and educational speaker John Wilson presented the workshop, The 11 Principles of Leadership, to over 50 attendees. Attendees of the workshop were provided with tools they can use every day to provide purpose and direction to their daily lives and long-term goals.

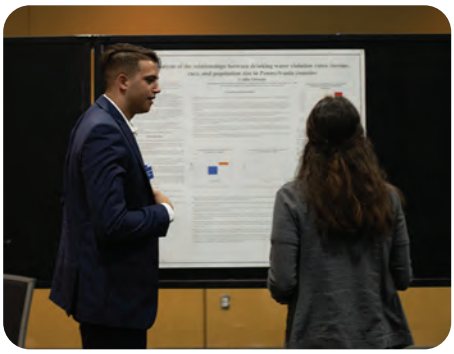
Some of the most successful virtual workshops from the 2021 AEC Virtual Series were translated to in-person offerings at the 2022 AEC. The Environmental Health and Land Reuse Certificate Program Workshop explored the environmental and health risks and social disparities associated with contaminated land properties, key players in land reuse planning and policy, and redevelopment techniques to improve community health. The NEHA Private Water Network hosted the Effective Education and Outreach for Private Drinking Water Systems Workshop. The workshop featured a combination of presentations and interactive sessions on effective resources and innovative approaches to positively influence well water testing behavior in private well owners, as well as how to overcome challenges related to well water testing.

As in previous years, we utilized partnerships to provide crucial training to preconference attendees. We once again partnered with ecoAmerica to offer the Climate for Health Ambassador Training, which addressed the growing concern of climate

change. Approximately 50 participants were equipped with knowledge, hands-on experience, and resources to speak and act confidently on climate change and solutions. In the NEHA/Food and Drug Administration National Retail Food Regulatory Program Standards Self-Assessment and Verification Audit Workshop, nearly 100 attendees were given an overview of the program standards criteria and hands-on experience in conducting a self-assessment or verification audit.

Two new preconference sessions were offered in Spokane. We partnered with the Washington State Environmental Health Association to hold the Putting Weather Data to Work for Public Health Prevention and Climate Readiness Workshop that focused on the use of meteorological data and climate services in the context of public health practice. In the Using a Health in All Policy Approach to Addressing Childhood Lead Poisoning Workshop, attendees learned about tools and resources to address lead contamination in homes.

Student Activities



Students continue to be an important part of our community. To recognize this key group of members, we held a Student Welcome Reception before the Keynote Address on June 28. During this networking event, students had the opportunity to connect with our leadership and get acquainted with the programs and services we offer for the next generation of environmental health professionals at the AEC and throughout the year.

Over 20 student posters were displayed at the in-person Exhibit Hall and 9 posters were displayed in the virtual Poster Hall. Posters provided insights on the latest research in a variety of topics including Lyme disease in West Virginia, informatics in environmental health, extreme weather impacts, and much more.

2022 AEC Evaluation Survey Results

The 2022 AEC Evaluation Survey showed that 91% of attendees who completed our survey rated the AEC as excellent (32%), very good (42%), or good (17%). Comments from the survey respondents included, "The schedule was well organized, the activities were engaging, and it was nice to have the option to attend many different tracks," and "I didn't attend one meeting that wasn't informational and well done."

Of the respondents, 91% said they would attend again. As one respondent stated, "The NEHA AEC fills my emotional cup, professionally speaking. I can attend training anywhere but being among my peers for this experience every year is worth every penny and then some."

The highest attended educational sessions were in the Food Safety, Workforce & Leadership, Climate & Health, Water Quality, and General Environmental Health tracks. The overall most attended session was the Grand Session Kickoff—Challenges Facing the Environmental Health Workforce Regarding COVID-19 Practices—with 78% of respondents indicating that they attended the session. Of those attending the AEC, the majority of individuals work in city, county, or state health departments or in the private sector.

Top reasons for attending the AEC included education (especially to earn continuing education contact hours) and networking with peers. "I always learn something useful from the sessions and the networking is wonderful," stated one respondent.

Social Events

Breakfast & Town Hall Assembly

Attendees packed the room on the morning of June 30 to get an update on the association. NEHA leadership opened the Town Hall with a brief review of the year. We wrapped up a comprehensive strategic planning process in the past year and as part of that process, we created a new vision (Healthy environments. Protected communities. Empowered professionals.) and a new mission statement (To build, sustain, and empower an effective environmental health workforce).

NEHA staff have worked hard over the last year on the creation of a new NEHA logo and brand, which was approved by the NEHA Board of Directors in April 2022 and will be launched in fall 2022. The new logo design reflects the development of both NEHA and the profession. Staff are also working on the design of a new website, which will be organized for easier navigation and function, as well as reflect the new logo and branding. Closing the year in review, NEHA President-Elect Dr. D. Gary Brown stated that "the organization remains focused on supporting the environmental health workforce."

The Town Hall also featured an update from the American Academy of Sanitarians on the state of their organization. Candidates for the position of NEHA second vice-president for the 2023 election were welcomed to address those in attendance. Long-time NEHA member Scott Holmes from Lincoln, Nebraska, took the opportunity to state his interest in the position and shared his platform. The Town Hall concluded after several minutes of questions and answers between attendees and NEHA leadership and staff.

Reconnecting on the River Networking Event

Approximately 700 attendees enjoyed a mild summer evening along the winding Spokane River on June 30 for the Reconnecting on the River Networking Event. Attendees spent the evening relaxing, mingling, and reconnecting with one another while enjoying live music by local performer Gavin McLaughlin. We have not had the opportunity to connect in person with old and new friends in a relaxed manner and many attendees stayed at the event long after it had ended.

Along with dinner, drinks, and live music, attendees were able to snap a photo in the event photo booth to commemorate the evening. Thank you to Tyler Technologies for sponsoring the event photo booth and providing our attendees with a small memento of the good times had while reconnecting with friends and colleagues. We also thank the attendees for making the Reconnecting on the River Event a night to remember.

2022 AEC SPONSORS, PARTNERS, AND CONTRIBUTORS

We appreciate the following sponsors, organizations, and individuals who helped make the 2022 AEC possible!

Sponsors

Presenting Sponsor
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Association of Environmental Health Academic Programs

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

Council on Education for Public Health

ecoAmerica, Climate for Health

Food and Drug Administration

Marler Clark, The Food Safety Law Firm

NEHA Endowment Fund Donators (see page 38)

NEHA Technical Advisors (see page 49)

Uniformed Services Environmental Health Association

U.S. Department of Health and Human Services

Washington Department of Health

Washington State Environmental Health Association

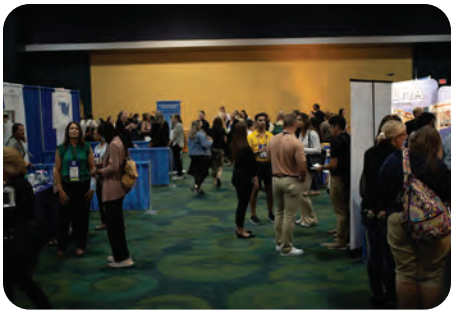
Exhibition

The Exhibit Hall at the 2022 AEC was an exciting place to be on June 28 and 29, especially as we have not been able to connect face-to-face in over 2 years. Since the 2022 AEC was a hybrid event, exhibitors connected with attendees in person in the Exhibit Hall and virtually through the conference app. A total of 38 companies exhibited at the 2022 AEC. Representatives from the companies and organizations were available for 2 days to answer attendee questions and highlight their products and services.

The Exhibit Hall opened on June 28 with the Exhibition Grand Opening. As in past years, this event was highly attended. Excitement was in the air and attendees were thrilled to connect with the exhibitors and to explore their booths. The exhibitors—both new and familiar—were able to share with attendees their products and services designed to make environmental health professionals more efficient and productive. The event was also a time for attendees to reconnect with old friends and make new ones.

Morning and afternoon beverage breaks sponsored by GOJO Industries were held in the Exhibit Hall on June 29. We also hosted an inaugural series of exhibitor demonstrations during both breaks and over the lunch hour. The demonstrations were well attended and well received by the attendees, and they made the Exhibit Hall the place to be during breaks between the educational sessions. The demonstrations were led by representatives from Hedgerow Software, HS GovTech, and Inspect2GO.

Located in the center of the Exhibit Hall was the NEHA booth—a popular place for people to interact with NEHA staff and board members. Attendees were able to learn about the many NEHA programs and educational offerings, as well as pick up a complimentary copy of the June 2022 *Journal of Environmental Health*.



The NEHA booth also incorporated a new game at the 2022 AEC to engage participants and help them learn more about the services and history of NEHA. The game was a spinning wheel with 12 categories: credentialing, scholarships/internships/awards, *Journal of Environmental Health*, training, AEC, advocacy, funding, NEHA history, workforce, membership, social media, and wild card (pick a category). Participants spun the wheel and were asked a question pertaining to the category they landed on. The game was a hit with Exhibit Hall goers and provided a fun way to engage and learn more about NEHA. While the questions were challenging, attendees found it interesting and often stayed to play multiple rounds. NEHA staff awarded players with their choice of a prize that included candy, fidget toys, or NEHA swag.

We thank all of the companies and organizations that exhibited at the 2022 AEC. We appreciate your dedication to the environmental health profession and appreciate your willingness to connect with our attendees.

EXHIBIT AT THE 2023 AEC

Join Us in New Orleans!

Registration for the 2023 AEC exhibition will open on October 1, 2022. The 2023 AEC Exhibit Hall will be held on July 31 and August 1, 2023, with additional networking opportunities available to exhibitors throughout the whole conference. Early-bird pricing will be offered until February 28, 2023 (if space is available). Contact NEHA Sales Manager Soni Fink at sfink@neha.org or (303) 802-2139 for questions regarding exhibition or sponsorship opportunities. Take advantage of this opportunity to showcase your products and services to over 1,300 environmental health professionals!

2022 AEC EXHIBITORS

- Accela
- American Academy of Sanitarians
- Association of Food and Drug Officials
- Bruker Scientific, LLC
- CDP, Inc.
- Centers for Disease Control and Prevention/National Center for Environmental Health/Division of Environmental Health Science and Practice
- Citizens For Radioactive Radon Reduction (CR3)
- Council for the Model Aquatic Health Code
- Craft3/Washington State Department of Ecology
- EcoSure—A Division of Ecolab
- Enthalpy Analytical LLC
- Environmental Information Association
- Glo Germ Company
- GOJO Industries
- Hedgerow Software
- HS GovTech
- Inspect2GO—Environmental Health Inspection and Permitting Software
- National Environmental Assessment Reporting System
- National Environmental Health Association
- National Environmental Health Science and Protection Accreditation Council
- National Environmental Public Health Internship Program
- National Registry of Food Safety Professionals
- NEHA-FDA Retail Flexible Funding Model Grant Program
- NSF International
- Pool & Hot Tub Alliance
- Private Water Network
- Procter & Gamble
- Relavent Systems, Inc.
- SciAps Inc
- StateFoodSafety
- Sweeps Software, Inc.
- Taylor Technologies, Inc.
- ThermoWorks, Inc.
- Tyler Technologies
- The University of Findlay
- U.S. Department of Housing and Urban Development/Office of Lead Hazard Control and Healthy Homes
- U.S. Environmental Protection Agency
- U.S. Environmental Protection Agency, Office of Research and Development

2022 AEC Mobile App Game

More than 400 in-person and virtual attendees participated in the 2022 AEC Mobile App Game and earned points by attending sessions, interacting with exhibitors, and networking with fellow attendees. Winners were selected in a random drawing from attendees who scored the highest point totals. Congratulations to our top winners: David Lerma, Jr. (2023 AEC registration) and Erin Miller (1-year NEHA professional membership). Thank you for participating!


AEC 2022
EcoSure
Inspect2GO
AEC 2022
PREMIER
SOLUTIONS


AWESOME
2022

Awards & Scholarships

We were proud to bestow several national awards and scholarships to outstanding individuals, groups, and programs throughout the country in 2022. From students excelling during unparalleled times and new leaders working on diversity efforts to some of the most recognized names in our professional community, the 2022 honorees illustrate the dedication and selflessness of those in our field. The following people were honored with awards and scholarships in 2022. For more information about our awards, please visit www.neha.org/awards.

AEHAP Student Research Competition Winners

Undergraduate

Collin Oriente
West Chester University
Pilar Santos
Montana State University

Graduate

Nana-Obaayaa Owusu
East Carolina University
Jordan Williams
East Carolina University

Each year the Association of Environmental Health Academic Programs (AEHAP) invites undergraduate and graduate students enrolled in a program accredited by the National Environmental Health Science and Protection Accreditation Council (EHAC) to submit original research projects. Winning entries receive $1,000 and travel stipends to present their research at the AEC.

Davis Calvin Wagner Sanitarian Award

CAPT Charles S. Otto, III, REHS, DAAS (retired)

This award represents the highest honor that the American Academy of Sanitarians (AAS) bestows on one of its diplomates.

Joe Beck Educational Contribution Award

Robert Powitz, MPH, PhD, RS, CP-FS, DABFET, DLAAS

This award is given annually by NEHA to recognize an individual or team for an educational contribution designed for the advancement and professional development of environmental health professionals.

AEHAP representatives Dr. Ben Ryan (far left) and Jamie Hisel (far right) stand with student winners Jordan Williams, Nana-Obaayaa Owusu, Collin Oriente, Pilar Santos, and Carli Koenig (from left to right). Photo courtesy of Carla Brown, AEHAP.

NEHA/AAS Scholarships

Undergraduate

Michelle Leonard
Montana State University
Haley Ritchie
The University of Findlay

Graduate

Mindy Chambrelli
University of New England

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

NEHA Affiliate Certificates of Merit

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

Individuals

Steve Alder (UT)
Everton Baker (Jamaica)
J. Victor Baldovinos (TX)
Jaqueline Summer Burpee Beard (posthumously, AL)
Ilda Bengui (National Capital Area)
Carolyn Picard Bombet (LA)
Nikki Burns Savage (NV)
Michael Crea (FL)

CAPT Charles Otto addressed the audience after being named the recipient of the Davis Calvin Wagner Sanitarian Award.

Tosa Dyer (MO)
Kira Flagstead (MT)
Jason Kloss (MN)
CDR Jamie Mutter (Uniformed Services)
Josie Prince (WY)
Aimee Puluso (NJ)
Robin Raijean (IA)
Joshua Skeggs (CO)
Rike Sterrett (MA)
Stephen Yenco (CT)

Teams

Ad Hoc Bylaws Committee: Mel Knight (chair), Alicia Collins, Brian Collins, Gary Coleman, and Robert Custard (Past Presidents)

Florida Environmental Health Association 2021 Annual Conference Committee: Ed Bettinger, Michael Crea, Greg Crumpton, Trisha Dall, Gary Frank, DaJuane Harris, Kimberly Stockdale, and Tim Wallace (FL)

Iowa Environmental Health Association Scholarship Committee: Sandy Bubke, Matt Even, Bridget Mohler, Robin Raijean, and Jessica Sheridan (IA)

Retail Food Standards Program: Environmental Health Section of Riverstone Health. Leadership for the Retail Food Team has been Clark Snyder and Marilyn Tapia. (MT)

Betsy Seals and M.L. Tanner: For their research projects, Emerging Compounds in Public Drinking Water and Is the Time Right for South Carolina to Develop a Lead Authorization Program (SC)

Statewide Accelerated Public Health for Every Community (SAPHE) Act 2.0: Massachusetts Public Health Nurses Association (MA)

Yankee Conference Organizers: Scott Cook, Kevin Elak, Dianne Harding, and Mariam Hosseini (CT)

NEHA Past Presidents Award

Michéle Samarya-Timm, MA, HO, MCHES, REHS, DLAAS

Each year, the NEHA Past Presidents Affiliate identifies a hero or group of heroes from the profession of environmental health.

NEHA Presidential Citations

Certificates are given to those individuals who made exemplary impacts on the association during the term of office of the NEHA president. President Roy Kroeger conferred Presidential Citations to the following individuals:

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

Rance Baker
Rosie DeVito
Art Johnstone
Jaclyn Miller
Maribeth Niesen
Dr. Manjit (Mike) Randhawa

For superior organization and execution in support of the 2021 NEHA office relocation:

Steven Dourdis
Michael Newman
Cole Wilson

Hedgerow Software CEO Neil Grinwis (left) and NEHA Past President Dr. Priscilla Oliver (right) presented Michéle Samarya-Timm (middle) with the NEHA Past Presidents Award and honorarium.

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

Dr. D. Gary Brown

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

Tiffany Gaertner

NEHA President Roy Kroeger announced his Presidential Citations to honor those individuals who made exemplary contributions during his presidency.

NSF Student Research Scholar

Carli Koenig
Missouri Southern State University

AEHAP, in partnership with NFS, offers a $3,500 internship to one undergraduate student from an EHAC-accredited program. The selected student completes an 8–10-week internship on a research project identified by NSF.

Walter F. Snyder Environmental Health Award

CAPT Luis O. Rodriguez, MS, REHS/RS, CP-FS, CPO, DAAS

The Snyder Award was created in 1971 in honor of Walter F. Snyder, cofounder and first executive director of NSF. Presented by NSF and NEHA, this award is given annually to individuals who continue Snyder's legacy through outstanding contributions to environmental and public health. NSF and NEHA are proud to announce that CAPT Luis O. Rodriguez, MS, REHS/RS, CP-FS, CPO, DAAS, is the 2022 recipient of the Walter F. Snyder Environmental Health Award. CAPT Rodriguez is a senior environmental health specialist for the U.S. Public Health Service (USPHS) assigned to the Centers for Disease Control and Prevention (CDC) and has dedicated his career of more than 20 years to safeguarding environmental health and safety.

"From improving emergency preparedness to strengthening environmental health programs nationwide, Luis has spent his entire career demonstrating his commitment to improving and protecting public health," said Pedro Sancha, president and CEO of NSF. "Luis has established an impressive track record of consensus-building and leadership throughout his career in environmental health, both in the U.S. and beyond," said Dr. David Dyjack, executive director of NEHA. "Most recently, his leadership has been leveraged through a total of four CDC deployments to mitigate the COVID-19 pandemic in cruise ships, emergency intake sites, and more. Luis continues to be called on by our nation in recognition of his expertise in environmental health, vessel sanitation, and emergency preparedness and response."

CAPT Luis Rodriguez graciously accepted the 2022 Walter F. Snyder Environmental Health Award given by NSF and NEHA.

For the past two decades, CAPT Rodriguez has served in fundamental roles addressing environmental hazards and improving environmental health services. In his role at CDC, he leads efforts to modernize the national environmental health workforce by helping state and local health departments improve the collection, integration, dissemination, and use of data related to environmental health services.

Through his extensive work in vessel sanitation, CAPT Rodriguez helped prevent the introduction of acute gastroenteritis into the U.S. from cruise ships sailing from foreign to domestic ports since 2010. He directed more than 3,000 operational and construction inspections, numerous outbreak surveillance and investigations, more than 50 training seminars for cruise ship managers, and served on deployments to address the COVID-19 pandemic.

CAPT Rodriguez has received numerous awards for his leadership and commitment to environmental health. He most recently received a USPHS Outstanding Service Medal as well as the National Center for Environmental Health and the Agency for Toxic Substances and Disease Registry's Excellence in Quantitative Sciences Award. He was also nominated for the USPHS Environmental Health Officer Advisory Committee's Ted Moran Award.

Read the full award press release at www.nsf.org/news/luis-rodriguez-recognized-nsf-national-environmental-health-association-neha-walter-f-snyder-environmental-health-award.

NEHA **NEWS**

NEHA Government Affairs Updates

By Doug Farquhar (dfarquhar@neha.org)

The National Environmental Health Association (NEHA) Government Affairs program has continued to represent and advocate for environmental health professionals over the summer months. Below is a list of our recent activities. You can also visit the Government Affairs webpage at www.neha.org/government-affairs to access NEHA-approved policy statements, letters and sign-ons, the Your Insider in Government Affairs Blog, and other information about our activities to inform policy makers on the importance of a well-supported and well-funded environmental health workforce.

Enacted State Legislation on Food Safety, Drinking Water, and Climate Change

NEHA has been tracking state legislation for the 2021–2022 session related to food safety, drinking water, and climate change. We have put together summaries of this legislation that are now posted at www.neha.org/government-affairs/neha-legislative-actions.

Food Safety

State legislators were active in the food safety arena. Legislators introduced 348 bills related to food safety with 69 bills enacted into law as of July 2022. Most every state legislature introduced bills related to food and food safety, and legislatures in 38 states introduced food safety legislation. California and New York enacted the most bills.

The foremost food safety issues in the legislation were related to retail foods, meat and cell-based meat, and food freedom. Other popular issues included food safety, nutrition, restaurant and food facilities, food deserts, and mobile food trucks. The full report can be viewed at www.neha.org/sites/default/files/2022-Food-Safety-Legislation.pdf.

Drinking Water

State legislatures introduced 2,081 bills related to drinking water during the 2021–2022 legislative sessions. We tracked 265 bills on drinking water and of those bills, 41 were enacted into law as of July 2022. California, Massachusetts, New Jersey, and New York introduced the most drinking water legislation with more than 40 bills a piece, followed by Florida and Minnesota with more than 30 bills. On the other hand, Alaska, Montana, Nevada, South Dakota, Washington, DC, and Wyoming did not introduce any legislation related to drinking water.

California enacted the most legislation, merging several different bills into larger omnibus legislation. New York and Virginia each passed several bills on drinking water. Most states enacted only one or two bills, if they enacted any at all. The foremost issues were the financing of drinking water programs, water testing, private wells, regulation of per- and polyfluoroalkyl substances (PFAS) in water, and regulation and removal of lead service lines. The full report can be viewed at www.neha.org/sites/default/files/2022-Drinking-Water-Legislation.pdf.

Climate Change

Over 4,200 bills listing climate change, greenhouse gas, or sequestration were introduced in the 50 state legislatures and Washington, DC, during the 2021–2022 session. Of these, we tracked 190 bills that had the most relevance to climate and health. As of July 2022, 86 bills were enacted in 25 states and Washington, DC.

California enacted the most bills with 19 bills enacted to date. The legislature in Maine enacted 13 bills, Hawaii enacted 8 bills, Rhode Island enacted 6 bills, and Washington enacted 8 bills. Read the full report at www.neha.org/sites/default/files/2022-Climate-Change-Legislation.pdf.

New NEHA Policy Statement

Over the years NEHA has researched and carefully crafted a series of policy statements in response to concerns from the environmental health professional. These statements include topics on body art, food safety, vector control, well water quality testing, mosquito control, the role of environmental health in emergency preparedness, and more. These statements are vetted by NEHA and adopted by the NEHA Board of Directors as official statements of the association. These statements set forth our beliefs on a specific subject related to environmental health and are shared with state, local, and federal policy makers, as well as relevant environmental and public health boards. These policies remain active for 3 years from their adoption.

Introduced in 2019, the NEHA policy statement on the Food and Drug Administration (FDA) model *Food Code* was updated earlier this year and was approved by the NEHA Board of Directors in July at the NEHA 2022 Annual Educational Conference & Exhibition. NEHA believes that complete adoption of the current FDA model *Food Code* in retail food establishments will likely reduce the incidence of foodborne illnesses. NEHA recommends the complete adoption and implementation of the most recent version of the FDA *Food Code* by all federal, state, local, tribal, and territorial governmental agencies to promote the most current knowledge on food safety.

View this updated policy statement, as well as all other active statements, at www.neha.org/policy-statements.

Support of the Inflation Reduction Act

The Inflation Reduction Act (H.R. 5376), formerly known as the Build Back Better Act, passed the U.S. Senate and House of Representatives in August 2022. The act was signed into law on August 16, 2022, by President Joe Biden.

We are dedicated to supporting environmental health professionals who are on the front lines of helping communities mitigate and adapt to climate change and support this act. The law makes the largest investment ever made by the U.S. federal government into climate change mitigation and adaptation. It encourages a transition to clean energy, protects the public's health, and advances environmental justice by ensuring the investments deliver significant benefits to traditionally underserved communities.

Specific to environmental health, the act will provide billions of dollars in tax credits, incentives, and grants for energy and water

efficiency, clean transportation, data collection and analysis, and air quality monitoring and reporting. "This legislation acknowledges the profound impacts of climate change on human health and the importance of funding the communities and experts who are on the front lines of mitigating and adapting to these impacts," said Dr. David Dyjack, NEHA executive director. "The environmental public health professionals who monitor our air, test our water, and stop the spread of disease in the environment are more important than ever."

The act ultimately aims to cut greenhouse gas emissions. Greenhouse gas emissions contribute to changes in the environment such as worsening air pollution that subsequently increases respiratory and cardiovascular conditions like asthma and heart disease, or increased precipitation giving rise to ideal conditions for the development and spread of animal-borne diseases.

The act is also aligned with NEHA's Climate Change Policy Statement (www.neha.org/sites/default/files/publications/position-papers/NEHA-Policy-Statement-Climate-Change-Oct2020.pdf) that advocates for funding for local and state public health departments and environmental and health agencies so they can support communities to:

- Conduct risk assessments and establish plans to anticipate risks for adaptation and build resilience for future generations.
- Incorporate green space and other technologies into the built environment to help reduce urban heat island effects since urban areas are usually warmer than adjacent rural areas.
- Conserve and replenish water sources. In many regions, groundwater sources have been depleted; flooding and drought can affect both the level and quality of remaining surface water sources.
- Address the need for more funding and local data.
- Take a multidisciplinary and global approach to addressing climate change to make incremental changes.
- Create a whole community approach to engage and empower the entire community.
- Strengthen community resilience to climate-related events.
- Collect baseline rates of disease and examine exposure outcome associations to quantify the impacts of climate change on health and determine direct attribution.
- Reduce barriers, share best practices, and evaluate metrics through stakeholder engagement strategies.
- Work with the Climate and Health Program within the Centers for Disease Control and Prevention to develop climate-ready states and cities.

Introduction of the Food Safety Administration Act of 2022

On July 13, 2022, House Appropriations Chair Rosa DeLauro (D-CT) and Senator Dick Durbin (D-IL) joined together to introduce a bicameral (i.e., both U.S. Senate and House of Representatives) bill to establish a single food safety agency at the federal level. The Food Safety Administration Act of 2022 (www.govtrack.us/congress/bills/117/hr8358) would create the Food Safety Administration, a single food safety agency responsible for keeping the food in our nation safe to consume.

This bill seeks to streamline the response of the federal government to food safety concerns with a single agency dedicated to safe food. The bill would establish the Food Safety Administration under the U.S. Department of Health and Human Services (HHS) by incorporating into this new and separate agency the existing food programs within FDA, including the Center for Food Safety and Applied Nutrition, Center for Veterinary Medicine, and the food safety responsibilities of the Office of Regulatory Affairs. The new agency would be led by a food safety expert confirmed by the U.S. Senate.

Environmental Justice Webinar

One of the foremost concerns of the Biden Administration is rectifying past environmental injustices. During a webinar on August 30, 2022, Dr. Sharunda Buchanan, interim director for the Office of Environmental Justice within HHS, spoke on efforts to integrate environmental justice into the department's mission to improve health.

In the webinar, Dr. Buchanan discussed the efforts of her office to:

- Lead initiatives that integrate environmental justice into the HHS mission to improve health in communities across the nation.
- Advise senior leadership at the Office of the Assistant Secretary of Health (OASH) and HHS on environmental justice and health issues.
- Provide leadership and subject matter expertise to develop and implement an HHS-wide strategy on environmental justice and health.
- Represent OASH and HHS at agency and interagency settings.

A recording of the webinar can be viewed at www.neha.org/government-affairs-webinars.

Successful Training With the Guam Department of Environmental Health

Staff from the Guam Department of Environmental Health discuss water safety principles at water vending and manufacturing facilities within their jurisdiction. Photo courtesy of Christopher Walker.

On July 18–20, 2022, we provided a 3-day training in Guam to the Guam Department of Environmental Health workforce on water vending and manufacturing facilities. The training included education aimed at assisting the Guam team in regu-

lating these facilities. We were also able to take the information from the classroom and apply it during field visits of water vending facilities.

Topics presented during the training included:

- general principles of water treatment,
- water treatment components,
- taking water samples, and
- maximum contaminant levels.

Prior to the training, we directed a tabletop exercise on protecting Guam's water supply during an emergency event. The exercise focused on partnership development and highlighted the value of bringing diverse organizations to the table to protect public health during a disaster or emergency event.

Special thanks to Nikki Burns Savage of the Southern Nevada Health District who helped with the training, as well as representatives from the Guam Department of Environmental Health, Guam Environmental Protection Agency, and Guam Waterworks Authority for participating in the exercise.

NEHA Staff Profiles

As part of tradition, we feature new staff members in the *Journal* around the time of their 1-year anniversary. These profiles give you an opportunity to get to know 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 four NEHA staff member. Contact information for all NEHA staff can be found on pages 48 and 49.

Faye Blumberg

I joined NEHA in October 2021 as an instructional designer with the Entrepreneurial Zone (EZ) department. Since starting at NEHA, I have been able to work on a variety of credentialing courses, as well as the Body Art Facility Inspector Training. One thing I love about this role is that I get to be involved in a lot of different things at once—it is never boring! Some of the projects I get to start from scratch, where others are revamping something existing. I absolutely love the EZ team and the culture of teamwork.

I am originally from the Detroit, Michigan, area and studied biology and chemistry at Michigan State University. My master's degree from Michigan State University is in curriculum and instruction. Before working at NEHA, I was in public education for 13 years. I started as a high school science teacher and then switched to an instructional coach and curriculum writer. I also taught with the U.S. Peace Corps from 2016–2018 on the slopes of Mount Kilimanjaro in Tanzania.

In my spare time I can usually be found outside with my dog, Lola. I love to trail run, mountain bike, fly fish, and teach yoga.

Chana Goussetis

I came to NEHA as the communications and marketing director after 20 years of work within local public health in Boulder, Colorado, in roles as a health educator, emergency preparedness planner, and communications and marketing manager. I hold a master's degree in integrated marketing communications and apply this knowledge and experience at NEHA daily to help the team get the word out about opportunities for education, funding, and community for the environmental health workforce, as well as help amplify the collective environmental health voice at the federal level.

I am passionate about raising the profile of NEHA nationally so that we can do even more for our members and for the profession as a whole. I am working toward this goal now by leading our rebrand and website redesign efforts, as well as developing a national campaign to bring visibility and understanding of the profession to the public and decision makers.

Nicole Kinash

Prior to my time as a NEHA employee (and as a Colorado resident), I grew up in Mahopac, New York, a small community in the Lower Hudson Valley. I attended The Ohio State University and graduated with a bachelor of science in earth sciences. During my time there, I was involved in numerous research projects as a research assistant within the School of Earth Sciences. After graduation I accepted a role as a hydrogeologist at an environmental consulting firm based in Columbus, Ohio.

I moved to Denver in 2021 in search of new adventures and growth opportunities. I am currently a part-time graduate student at the University of Denver, pursuing a master's degree in environmental policy and management with a concentration in energy and sustainability. I aim to take on the urgent environmental challenges of our time and help develop meaningful policies and practical, sustainable solutions. In my free time I love being outdoors and exploring Colorado's endless trails and parks, whether by walking, hiking, or snowboarding. I am also passionate about playing music and following hockey and college football.

I joined NEHA in October 2021, accepting an administrative and logistical support role with the EZ department. My responsibilities mainly include being the participant manager for the FDA training courses. My goal is to help enable a good learning environment for those in the environmental health profession taking our courses. During my first year with NEHA, I have enjoyed getting to meet and work with so many amazing individuals, as well as developing a more comprehensive understanding of food safety and environmental health.

Melodie Lake

I joined NEHA in October 2021 as the editor/copywriter for the EZ department. I provide different levels of editing support to EZ depending on the project, giving me the opportunity to work on a variety of materials. I love that I never know what sorts of things I might be asked to edit on any given day, from a training course given via PowerPoint to a textbook, or even video subtitles. The EZ team has been incredibly welcoming and supportive, and I am so glad to have joined them. It is heartening to know that my opinions and skills can help NEHA make a difference for environmental health professionals.

The road that led me here has been a winding one. I grew up in central Arizona and received my bachelor of arts degree in English from Northern Arizona University. From there, I moved to Tucson, where I spent several years working various jobs and eating excellent food. I found that I have a talent for technical writing and pursued both a career and my masters of science from Northeastern University in that field. After spending 10 years working as a technical writer and manager of a content management system in the health insurance industry, I decided to broaden my horizons. I worked briefly for an engineering firm as a technical editor, then came to work at NEHA.

My partner and I moved to Denver in 2016 because we love the outdoors and Colorado's summer and fall are pretty much perfect. We have an adventure-loving dog named Mocha and we enjoy taking her hiking, snowshoeing, paddle boarding, and camping. I also enjoy reading in my spare time and I cohost a women's comic book club.

Outside of writing for my job, I also write creatively. I have finished two novels and am getting ready to pitch one to agents and editors in the fall. My short stories have appeared in several places around the web and I am always trying to find time and energy (not to mention ideas) for more.

DirecTalk

continued from page 66

in our nation's capital and it was virtually standing-room only. Everyone drinks and eats, and these legacy chemicals are seemingly everywhere and in everything. This issue is not red or blue—it is a universal public health issue.

So where do we go from here? I tender a few thoughts for our network of environmental health professionals.

I believe all of us should be modestly knowledgeable with the PFAS conversation. I encourage you to keep abreast of emerging health advisories and related guidance with an eye to being the voice of science in your local communities. We should be the chief science officers of our communities. As I craft this column, the World Health Organization has declared monkeypox a global health emergency. While not an environmental health issue per se, we should use opportunities like monkeypox and PFAS to share the breadth and depth of our knowledge. Let us stay on top of these issues to minimize misinformation and disinformation.

I feel PFAS is, as some have characterized, the asbestos of this generation. While there is not currently a signature disease associated with it, like lung cancer and emphysema (tobacco), mesothelioma (asbestos), and cognitive brain damage (lead), I bet that day is coming. Our profession should show up and speak up when the inevitable public hearings occur—it is our opportunity to lead.

Per- and polyfluoroalkyl substances (PFAS) on the agenda at the 76th Interstate Environmental Health Seminar held on July 20–22, 2022, in Ellicott City, Maryland. Photo courtesy of David Dyjack.

Our association should consider crafting and publishing a strong policy statement that is suitable for adoption by state and local jurisdictions. A formal association statement would provide a template for others to duplicate and provide a more homogenous voice in this major environmental health challenge.

Beginning in 2023, U.S. EPA will require some of the largest public drinking water systems to monitor for 29 different PFAS chemicals. Let us get prepared now to provide useful science-based recommendations to assist our communities with difficult decision making. Our offices and agencies should be prepared to help them interpret data and, in the process, raise our visibility and value to society.

The breadth and depth of environmental health issues our profession is asked to address is daunting on most days. We feel like traffic cops in a busy urban intersection after school recesses for the day. But when the giant issues of our era are upon us, such as PFAS, let us own them. We at NEHA will do our part to ensure you have access to the information you need to know when you need to know it.

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DirecTalk

David Dyjack, DrPH, CIH

Seersucker Thursday

The smothering heat index of 107 on Thursday, July 21, 2022, visibly produced copious sweat in most of the pedestrians and casually dressed tourists. The day oozed moisture, honoring the sweltering sauna reputation that Washington, DC, is renowned for. I had anticipated the humidity but did not forecast the sobering discussion that left me overheated by its implications.

I exited the coffee shop and plunged into the late afternoon sun, fully charged by the animated dialogue and double espresso. My caffeinated beverage partner was Dr. Rebecca Aicher, project director of the Center for Scientific Evidence in Public Issues (EPI Center) within the American Association for the Advancement of Science (AAAS). AAAS is an international association of 120,000 members dedicated to advancing science, engineering, and innovation. You might recognize them for a variety of reasons but perhaps most visible are their publications—the *Science* family of journals. The mission of the EPI Center is to deliver clear, concise, and actionable scientific evidence to policy makers and other decision makers. The EPI Center makes it easier for policy makers and others to access relevant scientific evidence and then integrate that evidence into their decision-making process. Dr. Aicher and I discussed developments centered on per- and polyfluoroalkyl substances—known as PFAS to many of us.

PFAS were introduced and widely used in the 1960s and continue to be ubiquitous in commercial applications. These chemicals are long lasting with half-lives ranging from 4–5 years. In other words, some public health scientists characterize them as forever chemicals because once you have been exposed, you will likely have the residuals in your body for the balance of your life. These chemicals possess admirable properties and are beneficial for their nonstick and grease-, oil-, and water-resistant qualities. In that context they have many useful applications: grease-resistant fast-food wrappers. nonstick cookware, stain-resistant coatings on carpets, and water-resistant clothing (think of all that camping gear), among many other products. The U.S. Environmental Protection Agency (U.S. EPA) PFAS website indicates that there are over 9,000 individual chemicals in the PFAS family.

> *We should be the chief science officers of our communities.*

These chemicals accumulate in the ecosystem and subsequently bioaccumulate into human tissues over time, potentially leading to adverse health conditions including many that we fear most—cancer and birth defects. Additionally, the Agency for Toxic Substances and Disease Registry research involving humans suggests that elevated levels of certain PFAS chemicals may give rise to increased cholesterol levels, decreased vaccine response in children, increased risk of high blood pressure or preeclampsia in pregnant individuals, and increased risk of kidney or testicular cancer.

U.S. EPA reports that PFAS and its sibling chemicals have been discovered in drinking water systems throughout the globe. Regretfully, that is just the beginning. Many processed foods, including organic products, have detectable PFAS levels. Research into biosolids (i.e., sewage sludge) shows evidence of PFAS contamination, with implications for tens of millions of acres of agriculture that have historically been sprayed with this product.

U.S. EPA released four drinking water health advisories for PFAS on June 15, 2022. The health advisories identify the concentration of chemicals in drinking water at or below which adverse health effects are not anticipated to occur: 0.004 ppt for perfluorooctanoic acid (PFOA) and 0.02 ppt for perfluorooctanesulfonic acid (PFOS)—both are members of the PFAS family. Think about it: 1 ppt is a single drop in 18 million gallons of water. Please note that health advisories are nonregulatory and reflect an assessment by U.S. EPA of the best available peer-reviewed science.

The PFAS saga is not new. We hosted a hill briefing for Congress in November 2019 with speakers from the Centers for Disease Control and Prevention, Association of Public Health Laboratories, and National Association of County and City Health Officials. We convened the program in a large room

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