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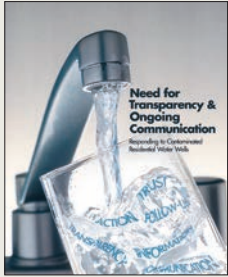
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ABOUT THE COVER



This month we feature an article that highlights one example related to the growing issue of drinking water quality within the U.S. As of press time, stories regarding Flint, Michigan, and lead

in New Orleans schools can be found on numerous Internet news sites. Through this issue's cover article, "Need for Transparency and Ongoing Communication After Residents With Contaminated Water Wells Are Connected to City Water," the story of one health department is shared regarding its response to groundwater contamination, its actions to remediate the issue, and the focus groups that were convened to address resident needs and concerns. The article provides some valuable lessons learned that can be used in other jurisdictions struggling with drinking water quality issues.

See page 26.

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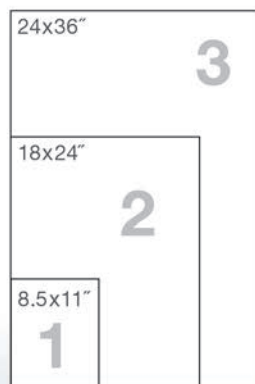


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► PRESIDENT'S MESSAGE



Vince Radke, MPH, RS,
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Professional Relationships

As mentioned in my first column, I was born and grew up in Detroit, Michigan, in the late 1940s to 1960s. As a kid there were three things that occupied my time: automobiles, Motown music, and sports (e.g., the Detroit Tigers, Lions, Pistons, and Red Wings). With my father, grandfather, and uncle, I would head down to Olympia Arena on Grand River Avenue to watch the Red Wings play. Besides the hockey games, what I remember most about the Olympia Arena was the smell of stale beer.

At the time, Detroit was synonymous with cars (Chrysler, Ford, and General Motors). My grandfather, who worked at the Ford Rouge Plant, would talk about the production (i.e., assembly) line. There was another production line, however, in Detroit that had nothing to do with cars. Production Line was the nickname of the most famous scoring line in the history of the National Hockey League (NHL), which played for the Detroit Red Wings. When the Production Line stepped out on the ice for a game, they would inevitably score a goal. This forward line consisted of Sid Abel (center), Ted Lindsay (left wing), and Gordie Howe (right wing).

Abel, Lindsay, and Howe were the best of friends on and off the ice. They were colleagues and respected each other. Each member of the Production Line had his own strengths and weaknesses. Abel was older and slower, but knew the opposing team's defense and had the vision to see the play developing as they came up the ice. Lindsay and Howe were younger, faster, and agile, but they were also inpatient. Abel would bring the puck up the ice, size up the position of the defense,

In our professional relationships, are we setting up others to succeed?

and then angle the puck so only Lindsay or Howe could reach it before the defensemen could react. Abel knew that with their speed, Lindsay and Howe would get to the puck and take a shot on goal.

Many years later, a famous hockey player by the name of Wayne Gretzky was asked what made him so great. He said, "I go where the puck is going to be." The Production Line was doing that 30 years earlier. In the 1949–1950 NHL season, Lindsay, Abel, and Howe would finish 1, 2, and 3 in scoring, respectively—a feat that had never been done before and has not been done since.

Other aspects made the Production Line great. The three of them would practice. Of course, they would practice with the rest of the team; however, many times they would stay late and practice between themselves. They would practice to not only improve their individual skills but also their skills and abilities as the Production Line. Abel would say he knew what Lindsay and Howe were going to do before they did it. After practice, the three of them would hang out together over a beer or two. Their families would get together for birthdays and other special occasions. Finally, and this point

is most important, they would constantly study their opponents' strengths, weaknesses, and tendencies. In their time, Abel, Lindsay, and Howe understood that the goalie would not come out from the goal crease and they would take advantage of that fact.

In our environmental health profession, what do professional relationships mean?

Well, I see two words.

When I see "professional," I think knowledge, skills, and abilities (KSAs) to solve a problem. Just like the Production Line of the Red Wings, I bring my KSAs to the team to help defeat an environmental health opponent. That opponent could be a pathogen, pollutant, safety hazard, or toxic substance.

When I see "relationships," I think interaction, conduct, trust, respect, and passion with others. You might have other words. The relationships could be with colleagues, partners, local officials, your boss and employees, community leaders, boards of health, those we regulate, and those who regulate us. This construct is very similar to the relationships the Production Line had with colleagues, coaches, management, referees, and fans. Furthermore, each member of the Production Line set the others (and ultimately their team) up for success. In our professional relationships, are we setting up others to succeed? When they succeed, do not we succeed?

I've got another quick example of professional relationships for you to consider. In the mid-1990s, while working at Virginia's Alexandria Health Department, I was asked by my boss to form a task force in Northern Virginia (Arlington County, Fairfax County, and the City of Alexandria) to get the Food

and Drug Administration's (FDA) *Food Code* passed. I got colleagues from the Northern Virginia area health departments, restaurant owners in Alexandria, the local restaurant association in Northern Virginia, and subject matter experts on the *Food Code* from FDA to come together to help pass a version of the code in this jurisdiction. This task was not easy and it took 2 years to complete. What helped the process, however, were my professional relationships with these different partners over the years while I was a member and later president of the National Capital Area Environmental Health Association.

As the task force worked toward completion of its goal, there were differences in some parts of the *Food Code* among the partners that were too difficult to overcome. In the end, we compromised. We agreed on 90% of FDA's *Food Code*. I went before the Alexandria city council with my partners and presented the proposed code. The council had a few questions, but the main question was, "Did all the partners agree to the proposed code?" Our combined answer was, "Yes!" The proposed code was passed unanimously. The story does not, however, end here. A year later, with a little more effort, the remaining 10% of FDA's *Food Code*

was passed. Many of those professional relationships are still in play today.

I wish to leave you with a quote that is often attributed to Harry S. Truman, 33rd President of the United States. As president, Truman said to his staff, "It is amazing what you can accomplish when you do not care who gets the credit." 🐼

Vince _____
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Landlord–Tenant Hotline Study: Characterizing Environmental Hazards in Renter-Occupied Units in Clark County, Nevada

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Abstract The Southern Nevada Health District (SNHD) began operation of a landlord–tenant hotline to address residential habitability complaints in 2011. There are limited studies describing such hotlines and the types of complaints experienced by callers in renter-occupied units (ROUs) anywhere in the U.S., much less in Clark County, Nevada. This study examined the hotline operation and found that it received almost 5,000 calls from March 2014–July 2016. Callers with complaints covered by the Nevada Revised Statute Chapter 118A, habitability of a dwelling, were eligible for participation in the Clark County Landlord–Tenant Hotline Study. The study collected additional data on 1,283 participants characterizing the population using the hotline and types of housing complaints reported. Callers typically were 38 ± 13.9 years old, female (75%), and the majority identified as non-Hispanic or Latino, Black/African American, or White. General maintenance, mold-like substances, and cockroaches were the top three complaints reported. SNHD inspectors conducted 290 site inspections of participant dwellings and validated the presence of the complaint(s) in the majority of cases. The findings presented here indicate a need for further investigation and continuation of services provided by the hotline.

Introduction

The relationship between housing conditions and health has been documented for centuries (Krieger & Higgins, 2002; Mood, 1993). Home-based health hazards are heavily researched due to their contributions to the development or exacerbation of asthma, as well as increased risks for unintentional injuries in the home (DiGuseppi, Jacobs, Phelan, Mickalide, & Ormandy, 2010; Jacobs et al., 2010; Kanchongkittiphon, Mendell,

Gaffin, Wang, & Phipatanakul, 2015). Further, the high prevalence of poor conditions in renter-occupied units (ROUs) intensifies these negative housing and health associations. According to the 2013 American Housing Survey (AHS) conducted by the U.S. Census Bureau (2016a), 35.6% of occupied units are estimated to be ROUs. Furthermore, 9.1% of ROUs were reported to have moderate to severe physical problems, which is 3 times higher than was reported by their

owner-occupied counterparts (U.S. Census Bureau, 2016b). The differences between the quality of housing stock of ROUs versus owner-occupied units creates a disparity that cannot be overlooked by the public health community.

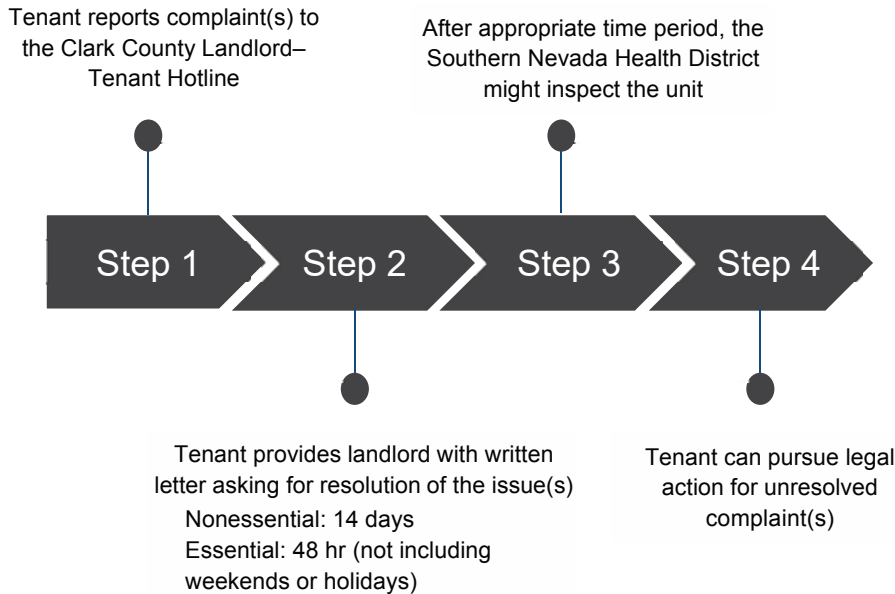
We spend the majority of our time indoors, so it is especially meaningful to improve the indoor home environment (Baker, Keall, Au, & Howden-Chapman, 2007). The public health community responded to the need to address housing-related health concerns by publishing *The Surgeon General's Call to Action to Promote Healthy Homes* (2009), which declared that healthy housing would consider characteristics such as “structural and safety aspects of the home (i.e., how the home is designed, constructed, and maintained; its physical characteristics; and the presence or absence of safety devices), quality of indoor air and water, and the presence or absence of chemicals” (p. vii).

This call to action became a starting point for public health agencies to increase efforts placed on housing that supports health. Since then, the U.S. Department of Housing and Urban Development (HUD) has also adopted a Health in All Policies approach to encourage health as the foundation of housing policy (Bostic, Thornton, Rudd, & Sternthal, 2012, p. 2,130).

The Southern Nevada Health District (SNHD) recognized the deficiencies in renter-occupied housing quality and created the Clark County Landlord–Tenant Hotline in May 2011. The hotline has become a tool used by the local community to address concerns about habitability issues encountered by occupants of ROUs. Clark

FIGURE 1

Overview of the Process a Clark County Landlord–Tenant Hotline Participant Would Follow Based on Nevada State Code NRS 118A (Residential Landlord and Tenant Act)



County, Nevada, contains a greater percentage of renter-occupied housing units (46.9% versus 35.6%) compared with the U.S. as a whole. For the first time in 2013, AHS included the Las Vegas, Nevada, metropolitan area, providing an additional picture of the housing conditions SNHD already identified as poor. Of the households surveyed in the Las Vegas area, 5.2% of ROUs had moderate to severe physical problems (U.S. Census Bureau, 2016b), almost 6 times higher than owner-occupied units. A vast number of these units are occupied by sensitive populations, including minorities (55% non-White), low income (24% living below poverty), and children (39%) (U.S. Census Bureau, 2016b). In order to confront the knowledge gap in the literature surrounding low-cost interventions for addressing healthy homes issues in ROUs, SNHD partnered with the University of Nevada, Las Vegas (UNLV) to study local ROU housing quality and build local capacity to operate a sustainable program to help address housing issues in rental units.

The purpose of this article is to describe the hotline operations and characterize the pop-

ulation using the service, the types of housing complaints most frequently reported by ROU residents, and the complaints observed by SNHD environmental health specialists during the Clark County Landlord–Tenant Hotline Study (CCLTHS).

Methods

CCLTHS was funded through a HUD Office of Healthy Homes Technical Studies Grant Program from November 2013 through October 2016. The primary purpose of the study was to determine whether a landlord–tenant hotline is an effective method to address home-based hazards (i.e., healthy homes issues) that can adversely impact health, specifically in ROUs. CCLTHS staff took over operation of the hotline in March 2014 and worked in concert with SNHD to respond to local tenants and landlords experiencing habitability issues in their units or properties. Callers to the hotline were instructed to leave a voicemail message with their self-reported complaint(s) and a call-back phone number; CCLTHS staff made at least two attempts to return calls during typical business hours.

To each caller they reached, a staff member would explain the Nevada Revised Statute (NRS) Chapter 118A regarding the habitability of a dwelling unit and the written notification process the law entails. The statute (Nevada Revised Statute § 118A.380) delineates complaint types as either essential or nonessential services. Essential services include “heat, air-conditioning, running water, hot water, electricity, gas, a functioning door lock, or another essential item or service” (Residential Landlord and Tenant Act, n.d.). Nonessential services include effective waterproofing and weather protection; plumbing facilities; hot and cold water; adequate heating facilities; properly installed and maintained electrical components; an appropriate number of trash receptacles; clean, sanitary buildings and grounds, free of debris, filth, trash, and pests; building components in good repair; and ventilation, air-conditioning, and other facilities in good repair (Nevada Revised Statute § 118A.290) (Residential Landlord and Tenant Act, n.d.). Per existing SNHD protocols, attempts are made to collect baseline data from hotline callers, including caller name, ROU address, and the nature of the complaint(s). All complaints were characterized by best fit into the following categories: mold; general maintenance; bed bugs; cockroaches; other insects; heating, ventilation, and air conditioning (HVAC) outage; odor; water outage; sewage; utility outage; rodents; domestic animal; pigeons; hoarder; environmental tobacco smoke; or other.

Participants

People who called the hotline from March 17, 2014, through July 1, 2016, and met certain criteria were eligible for consent into CCLTHS as approved by the Institutional Review Board at UNLV (protocol #1312-4664, approved 02/07/14). To be deemed a qualified caller, a person had to meet the following criteria: lived in or owned a private, residential ROU located in Clark County; was at least 18 years old; landlord or tenant had a current lease agreement; tenants did not receive HUD-sponsored housing assistance; and caller’s self-reported complaint was referenced under NRS 118A concerning the habitability of dwellings. There were 2,864 eligible callers offered participation in CCLTHS using a verbal consent agreement script. This

TABLE 1

Total Calls Received to the Clark County Landlord–Tenant Hotline, March 17, 2014–July 31, 2016

Call Type	#
Nonqualified	1,469
Administratively closed	610
Qualified (declined)	1,581
Qualified (participant)	1,283
All calls	4,943

script explained the purpose of the study, why the caller was eligible, and what could be expected by participating. Verbal consent also acknowledged that additional data, beyond that required by SNHD for the hotline’s basic functioning, were to be collected and could be analyzed for research purposes and reported as de-identified primary data. CCLTHS consented 45% of qualified callers for a total of 1,283 participants.

Participants were also advised to contact the hotline again if their complaint was not resolved in the appropriate timeframe according to NRS 118A (i.e., within 48 hr, not including weekends and holidays for essential service issues, and within 14 days for nonessential service issues) after proper written notification had been provided to the alleged offending party. At this time, participants were advised to provide a copy of the written notification by fax, e-mail, or mail to CCLTHS staff. Once appropriate documentation was received, SNHD was notified and a complaint number was generated. SNHD environmental health specialists would then schedule and complete a site inspection of the dwelling in question to record observations about the presence or absence of the reported complaints. SNHD completed 290 site inspections during the study. When unresolved complaints exist after a site inspection has been completed, the participant could pursue legal action for resolution. An overview of this entire process can be seen in Figure 1.

Data Collection

The data used in this article were collected during initial callbacks to eligible callers to the hotline from March 17, 2014, through July 1,

TABLE 2

Qualified Participant Demographic Information for the Clark County Landlord–Tenant Hotline Study (N = 1,283)

Characteristic	#	%
Age		
<20 years	15	1.2
20–30 years	465	36.1
31–40 years	302	23.5
41–50 years	203	15.8
51–60 years	192	14.9
61–70 years	81	6.3
71–80 years	19	1.6
>81 years	5	0.5
Not available	1	0.1
Sex		
Male	323	25.2
Female	959	74.7
Not available	1	0.1
Ethnicity		
Hispanic or Latino	264	20.6
Non-Hispanic or Latino	986	76.9
Not available	33	2.6
Race		
American Indian or Alaska Native	16	1.2
Asian	12	0.9
Black or African American	550	42.9
Native Hawaiian or other Pacific Islander	14	1.1
White	388	30.2
Multiracial	67	6.4
Other	236	18.4

2016, and via observations recorded by SNHD environmental health specialists during the site inspections associated with the participant callers. Initial callbacks collected baseline data on callers, per SNHD protocol, and additional information for those callers providing consent to participate in CCLTHS. Participants were also asked questions regarding basic demographics (age, sex, race, and ethnicity), length of time in ROU, type of ROU they lived in, and their perceived severity of the reported complaint(s). Additionally, the age of each ROU was determined using the Clark County Assessor record.

Study-related site inspection data consisted of observations recorded by SNHD environmental health specialists on a healthy homes

checklist. SNHD and UNLV staff created the checklist for the purposes of this study. It was based on the seven principles of a healthy home as outlined in the 2012 *Healthy Homes Program Guidance Manual* (U.S. Department of Housing and Urban Development, 2012). General categories of observations for home-based hazards collected included water heater setting, indoor air quality (ventilation, mold-like substances, and odors), deteriorated paint surfaces, structural issues including water damage, energy efficiency, pests, cleanliness, clutter, smoke and carbon monoxide detectors, and heating and air-conditioning systems. Data were dichotomously collected as presence or absence of the hazard.

TABLE 3

Relationship of the Clark County Landlord–Tenant Hotline Caller to Renter-Occupied Unit (N = 1,283)

Relationship	#	%
Tenant	1,242	96.8
Landlord/manager	6	0.5
On behalf of tenant	35	2.7

Data Analysis

Analysis consisted of generating summary information for data collected during the initial callbacks and from healthy homes checklists completed during site inspections. We generated frequencies and descriptive statistics for demographic information of the callers (age, sex, race, and ethnicity), ZIP codes of ROUs, housing demographics (age of ROU, year of construction, and type of ROU), nature of complaint(s), type of service according to NRS 118A, perceived severity of complaint(s), observed healthy homes complaints during site inspections, and validation of complaint(s) during site inspections. We conducted all statistical analysis using SPSS version 22.

Results

Overall Call Volume

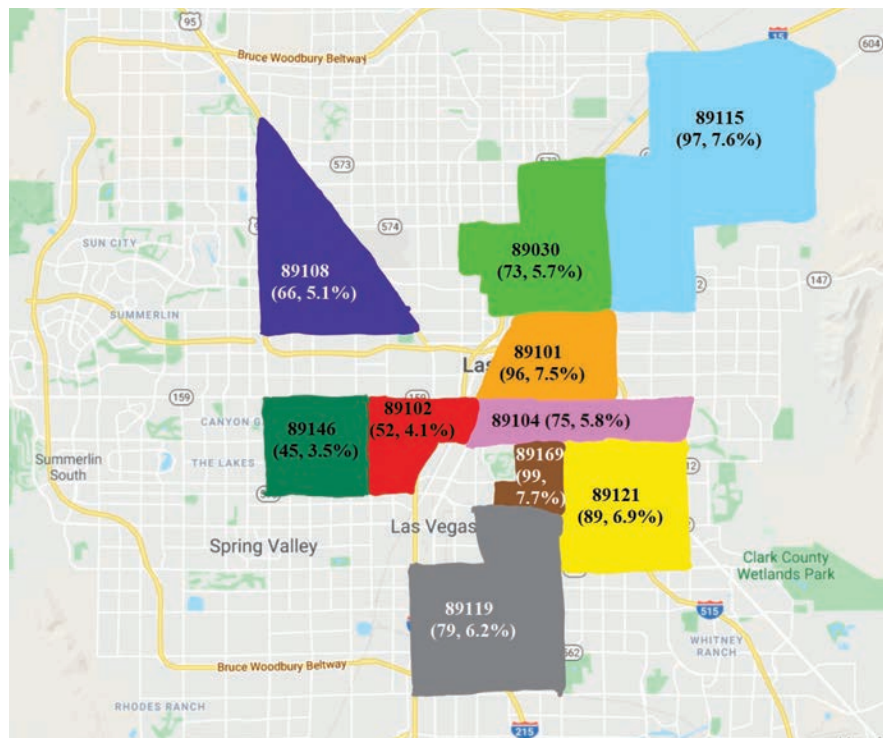
CCLTHS staff first took over operation of the hotline on March 17, 2014, and completed study data collection on July 31, 2016. During this time, the hotline received a total of 4,943 unique calls for an average of 1,647 calls per year. Of the total call volume, calls were categorized as nonqualified, administratively closed, qualified-declined, or qualified-participant (Table 1).

Participant Demographics

Demographic information was collected from the 1,283 consented CCLTHS participants only (Table 2). Participants ranged from 18–99 years of age and the mean age was 38 ± 13.9 years. Females made up the majority (959, 74.7%) of hotline callers. One participant declined to provide information regarding age and sex. Study participants mainly identified as Non-Hispanic or Latino, Black/African American, or White; 67 participants

FIGURE 2

Geographic Representation of Qualified Participants' Top 10 ZIP Codes of the Clark County Landlord–Tenant Hotline Study



The figure also gives the number and percentage of qualified participants per ZIP code.

identified as more than one racial background and 236 declined to answer or declared they identified as Other. The majority of callers were tenants (1,242, 96.8%) and the remainder were either calling on behalf of the tenant or as the landlord/manager (Table 3).

Calls to the hotline were received from 59 of the 73 residential ZIP codes in Clark County. The 10 ROU ZIP codes most frequently reported by participants were 89030, 89101, 89102, 89104, 89108, 89115, 89119, 89121, 89146, and 89169. A geographic representation of these ZIP codes can be seen in Figure 2.

Housing Demographics

Study participants were also asked questions specific to their ROU (Table 4). Participants reported having lived in their ROU for a minimum of a couple of days to the maximum of 33 years. The mean length of stay was 1.17 ± 2.19 years. Only one partici-

participant declined to respond to this question. ROUs were built between 1929–2012. The mean year of construction for ROUs was 1982 ± 13.5 years. The year of construction was not available on the Clark County Assessor record for 173 cases; 33 of those cases were mobile homes. ROUs were also characterized by type of dwelling. The majority of participants lived in multifamily dwellings (1,061, 82.7%); participants also resided in single-family dwellings (196, 15.3%) and mobile homes (26, 2.0%). Of the multifamily dwellings, most were apartment complexes (806, 76.0%), followed by condominiums (99, 9.3%), townhomes (52, 4.9%), duplexes (17, 1.6%), or other dwellings such as fourplexes, and weekly or monthly rentals (87, 8.2%).

Characterizing Complaints

Qualified callers reported at least one category of complaint type about their ROU.

Callers could report as many issues as they were experiencing. The top five complaints for all qualified callers were general maintenance, mold-like substance, cockroaches, HVAC outage, and bed bugs. Specifically for CCLTHS participants, the top 10 complaint types are broken down in Table 5. Based on the NRS 118A, these complaints were primarily nonessential services (960, 74.8%) rather than essential services (180, 14.0%). Participants could report multiple complaint types; in 143 cases (11.1%) they had both essential and nonessential service issues. Participants were also asked to rate the severity of their complaint as mild, moderate, severe, or worst case (Table 5). The majority of the time they identified complaints as severe or worst case. Four participants declined to answer this question.

Site Inspection Observations

If CCLTHS participants followed the written notification process outlined by NRS 118A and their complaint was not resolved, they were eligible for a site inspection by SNHD environmental health specialists. During a site inspection, SNHD would observe and document the presence or absence of participant-reported complaint(s) (Table 6). SNHD completed 290 site inspections during the study. One site inspection was completed on the exterior only; therefore inspectors were not able to collect a complete healthy homes checklist for that case. All healthy homes hazards identified at a ROU were identified on the checklist, so there could be multiple observed hazards per unit. The top 10 most frequently observed issues during site inspections were no carbon monoxide detector present, past water damage, cockroaches, plumbing problems, mold-like substances, current water damage, odor, missing weather stripping, presence of pest control products, and code violations. Caller self-reported complaints were typically completely validated (195, 67.2%). In instances where there was more than one complaint type, the complaint could be deemed partially validated (51, 17.6%) when at least one, but not all, complaints were supported by inspector observation.

Discussion

The Clark County Landlord–Tenant Hotline is a tool used by the southern Nevada community. With over 1,600 calls per year on average, a characterization of callers revealed

TABLE 4

Qualified Participant Housing Demographics of the Clark County Landlord–Tenant Hotline Study (N = 1,283)

Characteristic	#	%
Length of stay in renter-occupied unit		
<1 month	177	13.8
1–3 months	205	16.0
3–6 months	237	18.5
6–9 months	169	13.2
9–12 months	154	12.0
1–2 years	174	13.6
2–4 years	119	9.3
4–9 years	31	2.4
≥10 years	16	1.2
Not available	1	0.1
Year of construction		
Before 1950	15	1.2
1950–1965	162	12.6
1966–1980	280	21.8
1981–1995	437	34.1
1996–2012	216	16.8
Not available	173	13.5
Renter-occupied unit type		
Single family	196	15.3
Multifamily	1,061	82.7
Mobile home	26	2.0
Type of multifamily dwelling		
Apartment	806	76.0
Condominium	99	9.3
Townhouse	52	4.9
Duplex	17	1.6
Other (e.g., weekly, monthly, fourplex)	87	8.2

a majority of callers were female (75%) with a mean age of 38 ± 13.9 years old, identified as non-Hispanic or Latino (76.9%) and non-White (70.9%), and lived in multifamily units (82.7%) that were built pre-1996 (69.7%). The hotline provided assistance to callers living throughout 80% of Clark County, even without any additional advertisement of the hotline or study by CCLTHS and SNHD staff. It is important to note that while calls originated from a large proportion of Clark County, the number of calls were not equally distributed among the 59 represented ZIP codes.

This finding is consistent with a previous study of pilot hotline data, where it was determined that even after adjusting for the number of units in each ZIP code, the rate of complaints varied greatly (Sokolowsky, 2014). Sokolowsky also found a strong inverse correlation between the median income of ZIP codes and their rate of complaints. This correlation further drives home the need for programs to serve a population caught in substandard housing conditions due to socioeconomic status. Evans and Kantrowitz (2002) expand on the links between

TABLE 5

Characterization of Qualified Participant Complaints Reported by the Clark County Landlord–Tenant Hotline Study

Characteristic	#	%
Top complaint ^a		
General maintenance	596	46.5
Mold	512	39.9
Cockroaches	282	22.0
HVAC outage	250	19.5
Bed bugs	173	13.5
Other	102	8.0
Other insects	82	6.4
Water outage	65	5.1
Sewage and odor (tie)	56	4.4
Rodents	42	3.3
Severity ^b		
Mild	18	1.4
Moderate	125	9.7
Severe	610	47.5
Worst case	526	41.0
HVAC = heating, ventilation, and air conditioning. ^a Callers could report more than one complaint type at a time. ^b N = 1,283		

socioeconomic status, housing, and health. They found that the lower the income of a neighborhood, the lower the housing quality and health of the occupants. Therefore, the hotline could be used as a screening tool to locate areas with the greatest need to provide healthy homes interventions to the most disenfranchised tenants.

Future programs could also focus intervention services and education on the most frequently reported and observed healthy homes issues from CCLTHS. The top five complaints from this study point to increased education about general maintenance type issues (i.e., cracks, holes, and leaks), mold-like substances, cockroaches, HVAC outages, and bed bugs. It is not surprising that many of the top complaints are related. For instances, a crack or hole in a wall can allow pests like cockroaches or bed bugs to travel easily between multifamily units. Leaks can also lead to larger plumbing problems over time and potential growth of mold-like substances.

The compounding issues of leaks, water damage, and mold-like substances were verified in units during SNHD inspections as well. Conditions in the home like these can be addressed by home remediation or intervention programs and have been shown to improve occupants' health status when environmental health triggers have been reduced (Breyse et al., 2014; Breyse et al., 2004; Jacobs et al., 2010). Environmental health hazards identified in participant ROUs, such as pests and mold-like substances, are related to adverse health outcomes, particularly asthma (Breyse et al., 2014; Institute of Medicine, 2000, 2004; Kanchongkittiphon et al., 2015; Krieger et al., 2010; Wang, Abou El-Nour, & Bennett, 2008).

In addition, over 50% of ROUs inspected by SNHD were missing a carbon monoxide detector. Without this device in a home, the occupants are at an increased risk for injury or death from carbon monoxide poisoning (DiGuseppi et al., 2010; Gielen, McDonald,

& Shields, 2015). Lack of proper heating or cooling, especially during winter and summer months, can put residents at risk for extreme indoor temperatures that are dangerous for the health of vulnerable populations (DiGuseppi et al., 2010). These circumstances and the other complaints by CCLTHS participants are indicators of housing units that do not meet minimum habitability requirements.

Beyond education and home intervention programs, the data from the hotline could be used to show the need for changes to the NRS 118A that provide stronger regulations to SNHD for enforcement of habitability violations. SNHD environmental health specialists also observed and documented the habitability conditions of ROUs during site inspections. Many of the reported issues were either validated (67.2%) or partially validated (17.6%) during SNHD site inspections.

This concurrence indicates that participants could generally identify when their home environments were not meeting the minimum requirements for habitability according to NRS 118A. The hotline provided callers with guidance on how to follow the steps laid out in the law. At this time, the hotline is the only public health avenue available for renters who require assistance with documentation of NRS 118A violations. There are free legal aid services in Clark County, but they are limited in availability and to assisting with legal questions and paperwork pertaining to civil action or eviction notices.

Tenants not wanting to pursue legal action for fear of eviction or rent increases are left to seek out their only other options: SNHD or media outlets. These issues are not unique to Clark County; Desmond and Bell (2015) and Hernández (2016) determined renters across the U.S. face rising rents, substandard housing, environmental inequality, and fear of the legal system that should provide protections. Unfortunately, NRS 118A does not give SNHD the authority to enforce resolution of the landlord–tenant complaints; SNHD can only provide information about the law and document presence or absence of the issue. Further analysis, beyond the scope of this article, of CCLTHS is needed to determine whether participants were able to resolve their habitability complaints within the confines of NRS 118A.

Conclusion

Healthy homes issues are occurring in ROUs in Clark County, Nevada. If left unresolved, these issues could lead to uninhabitable conditions and create negative health risks for tenants. Operation of a landlord-tenant hotline is one way to, at a minimum, provide callers with information pertaining to local habitability laws and to generate a snapshot of renter-occupied housing deficiencies. Efforts to make the hotline a sustainable public health tool are underway to ensure that these services will remain available and inform future housing policy. 🐞

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TABLE 6

Characterization of Site Inspection Observations by the Southern Nevada Health District During the Clark County Landlord-Tenant Hotline Study (N = 290)

Characteristic	#	%
Top observation*		
Carbon monoxide detector not present	161	55.5
Past water damage	133	45.9
Roaches	124	42.8
Plumbing problem	109	37.6
Mold-like substance	105	36.2
Current water damage	99	34.1
Odor	79	27.2
Missing weather stripping	71	24.5
Pest control products present	63	21.7
Code violations	61	21.0
Validity		
Validated	195	67.2
Partially validated	51	17.6
Not validated	44	15.2

*n = 289 for site inspections, as one inspection was conducted on the exterior only.

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Male–Female Differences in the Prevalence of Non-Hodgkin Lymphoma and Residential Proximity to Superfund Sites in Kentucky

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Abstract Non-Hodgkin lymphoma (NHL) is a category of cancers that arise from lymphocytes. Previous work by the authors demonstrated a significant association between residential proximity to Superfund sites in Kentucky and cumulative incidence rates of NHL. In both the U.S. and Kentucky, age-adjusted NHL rates in males consistently exceed rates in females, despite NHL often arising later in the lifespan when females outnumber males. The current investigation sought to determine whether the NHL rate difference by sex is associated with proximity to environmental toxicants. Cancer data for a period of 18 years were obtained from the Kentucky Cancer Registry. Superfund geospatial coordinate data were obtained from the U.S. Environmental Protection Agency. Cumulative incidence rates per 100,000 males and females were calculated at the 2010 U.S. Census Bureau tract level, within <5 km and 5–10 km buffer zones around Superfund sites. Ordinary least squares and geographically weighted regression analyses were conducted. Significant associations existed between residential proximity to Superfund sites and cumulative NHL incidence rates in male and female populations. At all exposures levels, incidence rates were significantly higher for males than females. Possible reasons for this male–female imbalance in outcomes are presented, along with implications for public health.

Background

Throughout much of the 20th century, the rates of non-Hodgkin lymphoma (NHL) have increased in the U.S. and other developed countries for reasons that are still not fully understood. A recent article indicated that residential exposure to U.S. Environmental Protection Agency (U.S. EPA)-designated Superfund sites was a significant risk factor for an individual's risk to develop NHL (Webber & Stone, 2017). In this article, we are reporting on the disparities in the age-

adjusted prevalence rates of NHL for males and females as associated with individual residential proximity to Kentucky's Superfund sites. In Kentucky, like national and global trends, age-adjusted NHL rates in males consistently exceed rates in females (Al-Hamadani et al., 2015; Devesa & Fears, 1992; Roman & Smith, 2011), even though NHL is typically a cancer that impacts the older population where females outnumber males.

Although there are known links between autoimmune diseases and NHL (Ekström

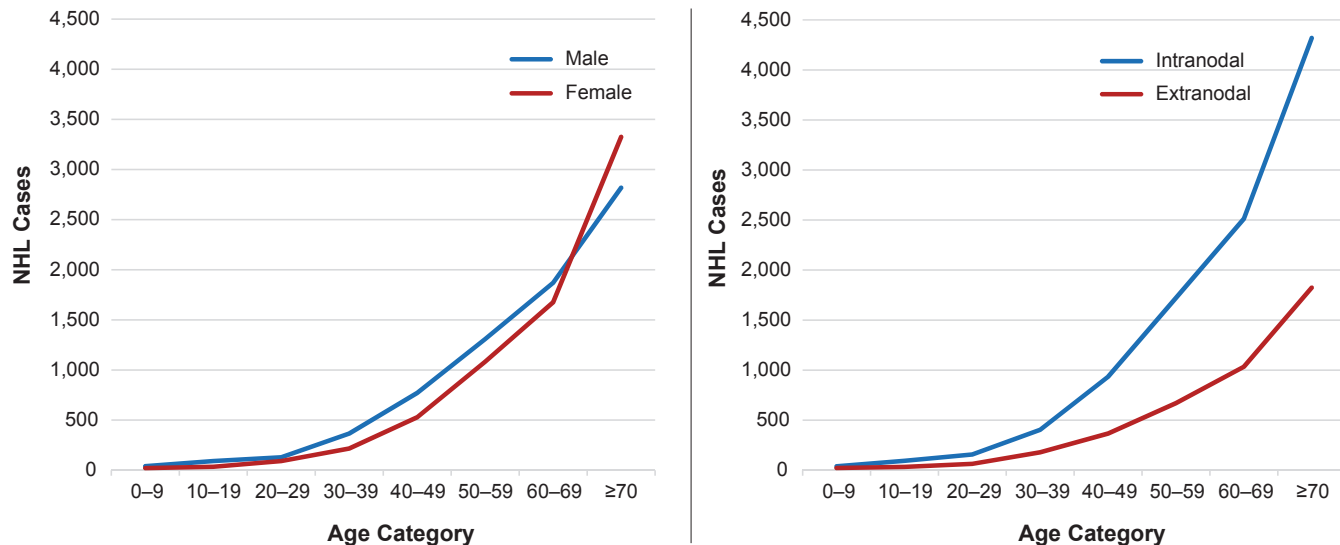
Smedby et al., 2008), and autoimmune diseases are more frequent in females (Ansell et al., 2011), males continue to experience higher rates of all types of NHL. Differences among males and females are less pronounced in regions of the world with the highest human development indices; however, those areas experience higher cases of Burkitt's lymphoma (Roman & Smith, 2011). Higher NHL rates in males are seen across all subtypes, from more common intranodal subtypes such as diffuse large B-cell lymphoma (Hedström et al., 2015), follicular lymphoma (Nabhan et al., 2016), and mantle cell lymphoma (Aschebrook-Kilfoy, Caces, Ollberding, Smith, & Chiu, 2013), to the rarest forms of extranodal NHL such as primary central nervous system lymphoma (Villano, Koshy, Shaikh, Dolecek, & McCarthy, 2011) and primary gastric lymphoma (Padhi et al., 2012).

Male–female differences were observed not only in NHL rates but also in NHL comorbid diseases. A European observational study, including 40 countries, reported that males were more likely to be diagnosed with cutaneous melanoma and NHL, whereas in females the association between NHL and melanoma was negative (Allam et al., 2015). In addition, significant associations were found between NHL and renal cell carcinoma in males, but not in females (Lossos, Ferrell, Duncan, & Lossos, 2011). Another study found that a high body mass index at age 18 is associated with a significantly higher NHL risk for females, but there was no such association observed in males (Kelly et al., 2012).

Males with certain subtypes of NHL do not appear to respond as well to the immunotherapeutic compound rituximab as females do (Pfreundschuh et al., 2010; Riihijärvi, Taskinen, Jerkeman, & Leppä, 2011).

FIGURE 1

Non-Hodgkin Lymphoma (NHL) Age-Adjusted Prevalence Rates by Age at Diagnosis (by Sex and SEER Type)



SEER = Surveillance, Epidemiology, and End Results Program of the National Cancer Institute.

Yet, other studies showed that only female patients responded well to the chemotherapeutic compound lenalidomide (Eve et al., 2012) and that, based on a murine T-cell lymphoma model, aspirin demonstrated greater antitumor properties in females than in males (Kumar, Vishvakarma, Bharti, & Singh, 2012).

Endocrine regulation might partially explain the differences noted in the prevalence of NHL, survival rates, and differences in response to NHL treatments in males and females (Yakimchuk et al., 2011). In vivo murine models revealed that the estrogen receptor beta-agonists inhibited the proliferation, vascularization, and dissemination of lymphoid tumors (Yakimchuk et al., 2014). Reduction in serum interleukin-6 triggered by 17-beta-estradiol is another mechanism by which estrogen might lower NHL risk (Horesh & Horowitz, 2014; Rachón, Myśliwska, Suchecka-Rachoń, Wieckiewicz, & Myśliwski, 2002). Pregnancy has also been shown to be a protective factor for NHL prevalence (Horesh & Horowitz, 2014; Prescott et al., 2009), as has the use of oral contraceptives (Lee, Bracci, & Holly, 2008).

Differences among males and females in NHL prevalence and treatment response appear to indicate that efficacy of chemotherapeutics is possibly connected to unidentified and sex-specific polymorphisms in genes that code for glutathione S-transferases (Cho et al., 2010; Riihijärvi et al., 2011).

Methods

This correlational study used 1998–2012 cancer registry records, obtained in 2014 from the Kentucky Cancer Registry, for the first diagnosis of intranodal or extranodal NHL; cancer records from adjacent states were not available for analyses. The following variables were included in the analyses at the individual level: sex, race, and ethnicity; age at diagnosis; family history of NHL; county of residence; Appalachia residence; and Beale Code for the level of urbanization. Using the geographic coordinates for the patient’s residential address, the census tract was identified for 82.3% of the NHL cases, while for 17.7% the residential ZIP centroid was used instead. We obtained the census tract Topologically Integrated Geographic Encod-

ing and Referencing (TIGER) file from the 2010 U.S. Census website. With the TIGER file, we could identify the residential census tract only for 82.3% of cases; the rest (17.7%) could not be placed in a census tract, most likely because their listed address was a post office box or rural route. For those we could not place in a census tract, we had to estimate where they lived by placing their residence in the exact middle (centroid) of their ZIP code.

According to the 2010 U.S. Census, Kentucky included 1,115 census tracts. Of the 1,115, 734 tracts reported cases of NHL between 1995 and 2012. Only 145 census tracts (13%) in Kentucky had Superfund sites located within their borders and there was a maximum of 5 sites per tract. At the time of this study in 2014, the U.S. EPA website listed 133 Superfund sites located in Kentucky. The exposure risk is defined as the patient’s residential proximity to Superfund sites and it was operationalized as an ordinal variable with three categories: 0 = exposure risk beyond 10 km; 1 = exposure risk within 10 km, but beyond 5 km; and 2 = exposure risk within a radius of 5 km. Thus, exposure risk is based on the distance to the nearest Superfund site.

The dependent variables in this study are the age-adjusted prevalence rates for males and females for each type of NHL cancer, extranodal or intranodal. Data were age-adjusted using the 2000 U.S. Census standard population to account for aging effects on health. We estimated the age-adjusted prevalence rates of NHL at the census tract level with the tract 2010 population in the denominator and the 1995–2012 NHL cases as the numerator, along with the 2000 U.S. standard population weighting factors. We performed spatial regression analyses for each dependent variable and the presence of spatial autocorrelation and clustering were tested with diagnostic tools. Finally, we confirmed the appropriateness of ordinary least squares (OLS) and geographically weighted regression (GWR).

Results

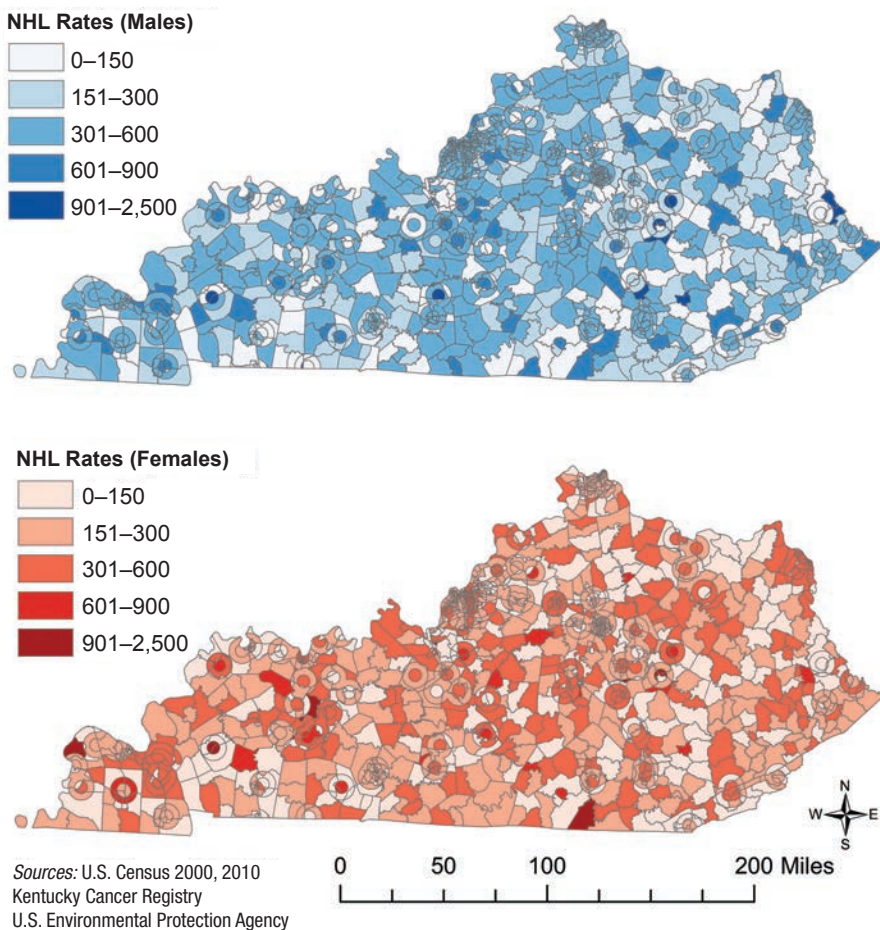
There was a total of 14,373 NHL cases in Kentucky from 1995–2012 and 70.8% were classified as intranodal NHL. The distribution of NHL cases was slightly lower in females (48.5%) than in males (51.5%), almost all patients with NHL were white (94.7%), and a majority (67.4%) of patients were ≥60 years with no known prior family history (52.2%). About one third of the patients in the records we looked at lived in the Appalachian region (28.1%); very few were residents of rural areas (9.6%). Figure 1 shows the distribution of cases by age categories separated by sex and tumor classification of intranodal and extranodal types.

As expected, an age-related increase in NHL prevalence was observed in both males and females for both nodal types. There was only a small difference across sex between ages 20 and 60, but there was a sharp increase of NHL prevalence in females who were 60–69 years. Intranodal NHL cases were consistently more than double the extranodal cases across all age groups; both cases exhibited sharp increases within the 60–69 age group.

In Figure 2, we illustrate the 1995–2012 age-adjusted prevalence rates for NHL per 100,000 males and 100,000 females by U.S. Census tracts, with 5-km and 10-km buffer zones around the 133 Superfund sites in Kentucky. Some areas—mostly around the western and central regions of Kentucky—had noticeably higher NHL prevalence rates for males while other areas had higher NHL prevalence rates for females.

FIGURE 2

Non-Hodgkin Lymphoma (NHL) Age-Adjusted Prevalence Rates for Males and Females



Bivariate descriptive analyses were conducted for sex, race, residence in Appalachian regions, Beale code, family history of NHL, and primary surveillance, epidemiology, and end results (SEER) tumor type by the three categories of residential proximity to the nearest Superfund site. Results show (Table 1) that the few non-White NHL patients were more likely to live within 5 km of the Superfund sites, whereas residents of Appalachian- and Beale Code-designated rural areas were less likely to live near the sites.

Specifically, Table 1 displays the number and proportion of NHL patients by various demographic characteristics by exposure risk zone. Although data on race were missing for

a large proportion of patients, among those for whom the information was available, the majority (55.4%) resided within 5 km from the Superfund sites ($p < .001$); the majority (68.6%) of the Appalachian residents resided more than 10 km away from the Superfund sites ($p < .001$); the majority of the urban residents (58%) were split between the two areas closer to the Superfund sites; and the majority (89.8%) of the rural residents resided at a distance greater than 10 km from the Superfund sites. It is noteworthy that among those with a known family history of NHL, 50.7% resided 10 km or more from the Superfund sites. The percentage of NHL cases with no family history of NHL (or without a known

TABLE 1

Case Data by Exposure

Demographic Variable		Indicator		Residential Proximity to Superfund Site						F-Statistic	p-Value
				<5 km		5–10 km		>10 km			
				#	%	#	%	#	%		
Sex	Male	6,978	48.5	2,170	29.4	1,793	24.2	3,432	46.4	3.54	.170
	Female	7,395	51.5	2,055	29.4	1,777	25.5	3,146	45.1		
Race	White	13,617	94.7	3,826	28.1	3,400	25.0	6,391	46.9	234.04	<.001
	Non-White	756	5.3	351	55.4	133	21.0	150	23.7		
Appalachian region	No	10,337	71.9	3,459	33.5	3,070	29.7	3,808	36.8	1,198.44	<.001
	Yes	4,036	28.1	766	19.0	500	12.4	2,770	68.6		
Beale Code classification	Urban	12,997	90.4	4,157	32.0	3,497	26.9	5,343	41.1	1,186.59	<.001
	Rural	1,376	9.6	68	4.9	73	5.3	1,235	89.8		
Family history of NHL	Yes	7,495	52.2	133	25.0	130	24.4	270	50.7	9.94	<.001
	No	533	3.7	2,234	29.8	1,817	24.2	3,444	46.0		
	Unknown	6,345	44.1	1,858	29.3	1,623	25.6	2,864	45.1		
SEER type	Intranodal	10,181	70.8	2,969	29.2	2,547	25.0	4,665	45.8	1.12	.572
	Extranodal	4,192	29.2	1,256	30.0	1,023	24.4	1,913	45.6		

NHL = non-Hodgkin lymphoma; SEER = Surveillance, Epidemiology, and End Results Program of the National Cancer Institute.

family history) was significantly higher for the cases residing within 5 km of Superfund sites. It is noteworthy that there were no significant differences in the distribution of males and females ($p = .170$) or in the distribution of NHL SEER type ($p = .572$) across the three exposure risk zones.

The results of a one-way analysis of variance (ANOVA) indicate that the average age-adjusted overall NHL prevalence rates were significantly different across the three exposure risk zones (Table 2), with rates significantly greater within 5 km than in the other two zones. In addition, ANOVA results show that the prevalence rates for individuals residing in the second zone (5 km–10 km from Superfund sites) were significantly greater than the rates in the areas beyond 10 km. For all types of prevalence rates, except for the intranodal NHL in females ($p = .064$), the differences between the “unexposed” areas—beyond 10 km—were statistically significant ($p < .05$). Specifically, the NHL prevalence rates were significantly smaller in the unexposed group (beyond 10 km) than those in the two exposure risk groups (<5 km, respectively 5–10 km). These data reflect

the observed national trends, in that males have a higher prevalence rate of intranodal and extranodal NHL than females have.

Hot spot analysis was conducted to identify areas of significant high or low spatial clustering of NHL age-adjusted prevalence data using the Getis-Ord G_i^* statistic. Hot and cold spots were mapped at the 99%, 95%, and 90% confidence limit (Figure 3). The hot spots were more prominent for male cases, particularly in the western (Paducah area) and central regions of the state (metro Louisville and Hardin County). The Anselin's Local Indicators of Spatial Association (LISA) confirmed the presence of autocorrelation, clustering, and spatial outliers.

Figure 4 shows that for the sex-stratified NHL rates, there are multiple geographic areas where significant high and low clustering of NHL rate data were reported, along with areas where significant spatial outliers occurred. In other words, low-NHL local areas were more likely to be adjacent to high-NHL areas, and vice versa. The pattern was slightly different from the hot spot analysis data from Figure 3. The high clusters for male subjects remained in the western and central regions, whereas

low clusters and high-low outliers were predominately located in the eastern and southern regions of Appalachia in Kentucky.

Table 3 depicts the sex-specific OLS base models (exposure risk categories) and full models (exposure risk categories, Appalachian status, and Beale Code). The OLS models explained only a small amount of the variability, as shown by the coefficients of determination ranging from 2.7–8.9%. The variance inflation coefficients were within acceptable levels, but the significant Koenker (BP) statistics for males indicated nonconsistent relationships between the dependent and independent variables (nonstationarity).

When compared with the reference areas of beyond 10 km, the NHL prevalence rate for males increased by an average of 147.4/100,000 within a 5 km buffer zone and by 59.2/100,000 in the areas between 5 km and 10 km. For females, the NHL prevalence rate was 85/100,000 greater within the 5 km buffer zone and 44.6/100,000 greater in the areas between 5 km and 10 km buffer zones when compared with the reference areas. Next, the regression model showed that as the Beale Code value increases by one unit,

TABLE 2

Age-Adjusted Non-Hodgkin Lymphoma Prevalence Rates by Proximity to Superfund Sites in Kentucky

Variable	Residential Proximity to Superfund Site Mean (SD)			F-Statistic	p-Value
	<5 km	5–10 km	>10 km		
Overall	457.0 (244.7)	308.6 (100.6)	290.9 (215.7)	17.8	<.001
Male	542.4 (341.2)	338.3 (113.3)	325.8 (249.5)	21.6	<.001
Female	382.9 (240.2)	285.3 (116.7)	262.4 (303.6)	5.1	.006
Intranodal	323.4 (200.2)	218.7 (73.3)	208.5 (180.6)	12.3	<.001
Extranodal	133.7 (82.8)	89.9 (49.6)	82.5 (76.6)	13.4	<.001
Intranodal (male)	384.1 (294.8)	239.7 (89.6)	235.8 (196.6)	15.8	<.001
Intranodal (female)	267.7 (215.1)	202.4 (84.6)	185.9 (281.1)	2.8	.064
Extranodal (male)	158.3 (154.3)	98.6 (60.2)	90.0 (102.1)	12.3	<.001
Extranodal (female)	115.2 (83.5)	82.8 (60.3)	76.5 (97.4)	5.0	.007

and areas become more rural, and the intranodal NHL rate increased 8.3/100,000 males and 3.6/100,000 females. Appalachian status was not significant in males or females.

To verify whether results of the standard OLS regression modeling alone would suffice or if GWR would be necessary, exploratory regression and diagnostic tests were conducted (Table 4). The Global Moran's *I* tool in ArcGIS quantifies the presence of spatial autocorrelation among residuals; it showed that there was significant spatial autocorrelation that might affect the results of the OLS models.

Using the ArcMap software, spatial regression models were developed with the exposure risk areas beyond 10 km used as the reference group for the analyses. Results from full and base models are depicted in Table 4. When the Akaike's information criterion (AIC) values were compared between each GWR model and their analogous OLS models from Table 3, the lower AIC values for the GWR models indicate a better fit for the data. Comparing the adjusted *R*² values from the OLS models, the GWR models explain a larger percentage of the variability. Adjusted *R*² values should not be used to make inferences about the proportion of variance explained by GWR models, as these values are sensitive to bandwidths used to calculate degrees of freedom (ESRI Resources, 2009). The best-fitting model is the GWR base model for male subjects, which

explains approximately 24.6% of the variability in NHL prevalence rate.

Discussion

This ecological study supports the hypothesis that residential proximity to Superfund sites in Kentucky is significantly correlated with the prevalence of NHL. More specifically, the prevalence rates in males and females were significantly associated with the residential proximity to Superfund sites, even though the distribution was not statistically significant across the three exposure risk zones. The nature and pathways of exposure to potentially hazardous substances from Superfund sites in Kentucky are unknown; however, hypotheses for future research could be drawn from existing, although limited, data.

Among the 20 sites in Kentucky reported on the National Priorities List that had the highest scores in the U.S. EPA's Hazard Ranking System, the majority had one or more on-site contaminants known or suspected to increase NHL prevalence. The most commonly found contaminants in these 20 Superfund sites were benzene, lead, polychlorinated biphenyls (PCBs), cadmium, trichloroethylene, organochlorines other than PCBs, and perchloroethylene. It is important to note, however, that the type of contaminant plausibly attributable to higher rates of contracting NHL was not the focus of this

article, as data on contaminants were not available for all 133 Superfund sites included in this study.

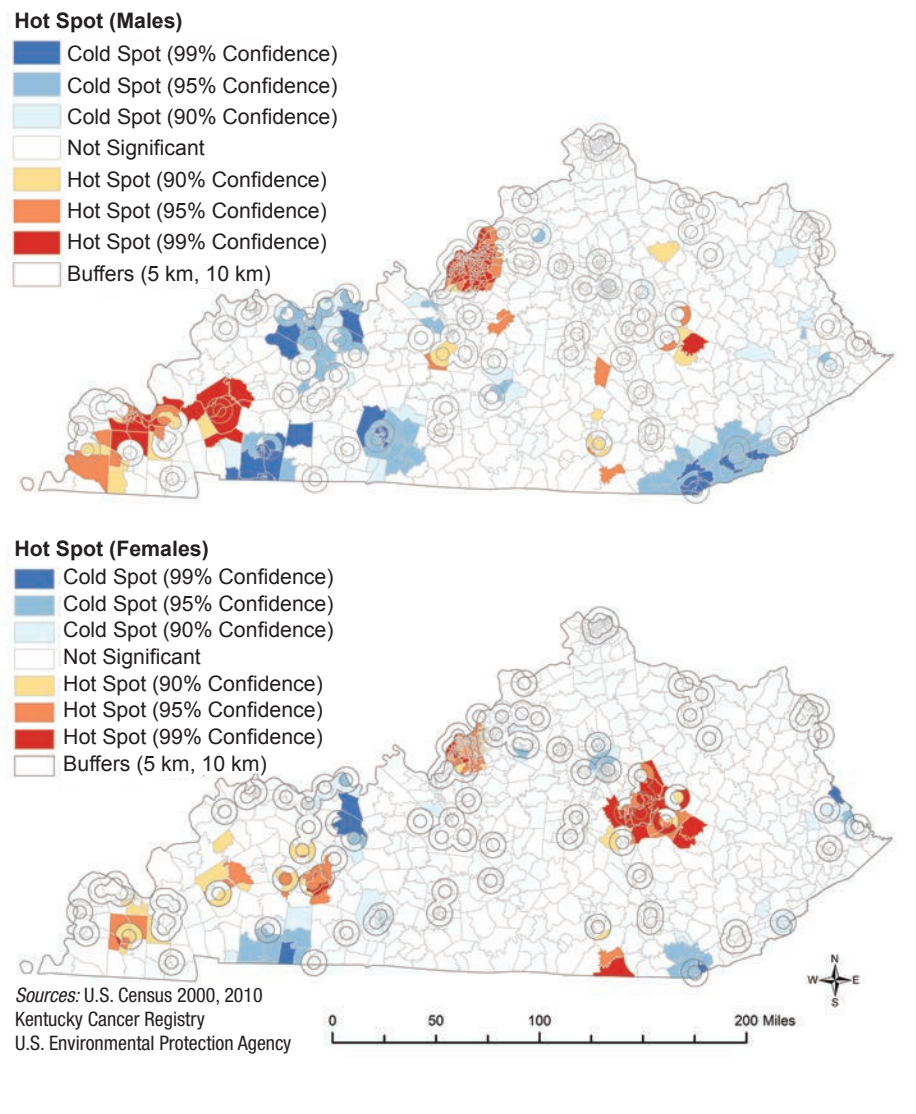
Limitations to the present work are specific to observational ecological studies. While we recognize the relationship between health and individual sociodemographic characteristics, key social determinants of health factors were not present in the cancer records made available for this research. Data on occupational history were not available; we attempted to account in our analysis for the patient's employment position at the time of diagnosis.

As the data were not collected for research purposes, it was extremely difficult to code qualitative information into meaningful categories. Indeed, it is well documented that housing in the proximity of industrial or commercial sites are lower in value than those located in more pristine areas; implicitly, lower housing values attract individuals and families with lower incomes—such as minorities and migrant populations—populations that have higher rates of chronic diseases.

The socioeconomic and demographic variables at the census tract level obtained from the 2010 U.S. Census were not significant, likely due to the confounding effect that property values are lower in the proximity of industrial sites, making them more affordable for economically disadvantaged populations. The small proportion of minorities with NHL in Kentucky was more likely to reside in closer

FIGURE 3

Hot Spot Analyses of Non-Hodgkin Lymphoma Age-Adjusted Prevalence Rates for Males and Females



proximity to the Superfund sites when compared with white individuals. The coefficients of determination (R^2) and standardized GWR regression residuals suggest unmeasured or missing explanatory variables contributed to NHL prevalence.

Finally, we would like to emphasize that the main purpose of our paper is to establish whether the prevalence of NHL for males and females is significantly different in residential areas that are located closer to Superfund sites than in areas located farther away.

This study shows that although there was no significant difference in the sex distribution across the three exposure risk zones, there were significant differences in the prevalence of NHL for males (intranodal and extranodal) and for females (extranodal).

Conclusion

NHL age-adjusted prevalence rates in the U.S. and many other developed countries around the world increased throughout the 20th century, possibly due to greater expo-

sure to chemicals stemming from the onset of the industrial revolution. This study reports on the significant association between residential proximity to Superfund sites and the age-adjusted prevalence rates of NHL in male and female populations residing in Kentucky, despite no differences in sex distribution across the three exposure risk zones. More specifically, this study found that the prevalence rates of intranodal and extranodal NHL are consistently higher in males than in females in all three exposure risk zones (<5 km, 5–10 km, >10 km).

In addition, the age-adjusted prevalence of intranodal and extranodal NHL in males and the age-adjusted prevalence of intranodal NHL in females were significantly greater in the proximity of the Superfund sites. Specifically, the areas within 5 km had greater prevalence rates than the areas located beyond 5 km but less than 10 km away, which had higher rates than the areas located beyond 10 km. There was no significant difference (95% confidence level) in the prevalence rate of intranodal NHL in females ($p = .064$).

These findings raise new questions regarding sex differences in susceptibility to NHL associated with exposures to environmental toxicants. Despite higher prevalence of NHL in males, the association between NHL and residential proximity to Superfund sites is significant for both males and females. Thus, public health interventions such as cancer screenings should target the entire population living near an environmentally hazardous site. There is continuing need to improve the public knowledge and awareness of NHL, screening and early detection for NHL, and to continue to elaborate on existing research and advocacy, as rates of NHL are likely to increase with the aging population. 🐾

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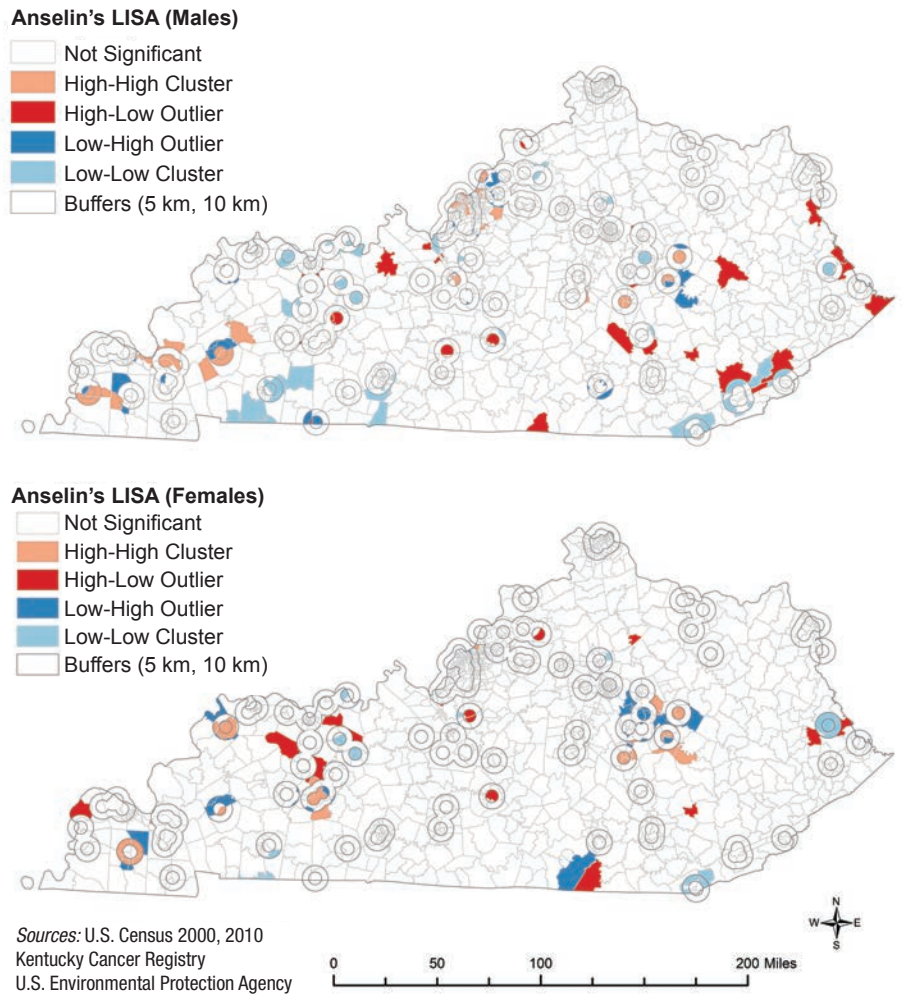
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FIGURE 4

Anselin's Local Indicators of Spatial Association (LISA) of on-Hodgkin Lymphoma Age-Adjusted Prevalence Rates for Males and Females



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TABLE 3

Predicting Age-Adjusted Prevalence Rates For Males and Females: Ordinary Least Squares Regression Coefficients

Model	Variable	Coefficient	SE	Probability	Wald (Pr > χ^2)	Koenker (BP) Statistic (Pr > χ^2)	Akaike's Information Criterion	Adjusted R^2
Male cases	Intercept	292.56	9.70	<.001	137.81*	29.59*	25,825.84	8.2%
	Exposure <5 km	147.43	13.01	<.001				
	Exposure 5–10 km	59.19	10.36	<.001				
	Intercept	269.53	11.61	<.001	141.04*	47.17*	25,814.09	8.9%
	Appalachian region	-23.89	14.36	.10				
	Beale Code classification	8.28	2.38	<.001				
	Exposure <5 km	157.92	14.17	<.001				
	Exposure 5–10 km	65.03	10.52	<.001				
Female cases	Intercept	235.61	11.30	<.001	50.01*	4.20	25,938.92	2.7%
	Exposure <5 km	85.05	13.10	<.001				
	Exposure 5–10 km	44.61	11.80	<.001				
	Intercept	215.19	13.13	<.001	66.92*	7.25	25,933.66	3.0%
	Appalachian region	16.51	18.60	.38				
	Beale Code classification	3.56	2.49	.15				
	Exposure <5 km	94.96	13.91	<.001				
	Exposure 5–10 km	51.42	11.80	<.001				

* $p < .001$.
Pr = Poisson regression.

TABLE 4

Geographically Weighted Regression Modeling Results

Model	Variable	# of Neighbors	Sigma	Akaike's Information Criterion	Moran's I	R^2
Male cases	Exposure <5 km	241	185.75	25,569.11		24.6%
	Exposure 5–10 km					
	Appalachian region	834	194.50	25,720.15	.039*	15.2%
	Beale Code classification					
	Exposure <5 km					
	Exposure 5–10 km					
Female cases	Exposure <5 km	241	196.84	25,791.99		15.4%
	Exposure 5–10 km					
	Appalachian region	836	204.10	25,905.25	.022*	6.6%
	Beale Code classification					
	Exposure <5 km					
	Exposure 5–10 km					

* $p < .001$.

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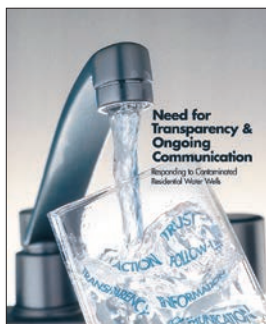
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Need for Transparency and Ongoing Communication After Residents With Contaminated Water Wells Are Connected to City Water

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Abstract In 2009, groundwater contamination was discovered in a west Wichita neighborhood; the contamination was later attributed to the disposal of tetrachloroethylene (also called PERC or PCE) from dry cleaning facilities. Although the dry cleaning businesses were in operation for approximately 50 years, the extent of resident exposure to the contamination is unknown. Many residents in the affected area relied on nonpublic water wells for drinking, cooking, bathing, and irrigation. The residents were not aware that their wells had become contaminated by PERC at levels exceeding the Safe Drinking Water Act standard of 5 ppb.

In 2014, the Kansas Department of Health and Environment connected these homes to the City of Wichita's public water system. In 2015, our team conducted focus groups with area residents to address any lingering needs and concerns. Participants reported general satisfaction with their homes' connectivity to city water. Participants reported poor communication, however, regarding the initial notification about the groundwater contamination in their neighborhood; most were notified through the media. This communication failure continued after their homes were connected to Wichita's public water supply. Participants shared many potential health concerns and requested that a health study be conducted of their neighborhood. Needs and concerns are ongoing among focus group participants, most of which could be addressed through regular communication with affected residents.

Introduction

Contaminants, such as volatile organic compounds (VOCs), are mobile in the environment and often are a source of groundwater contamination (U.S. Geological Survey, 2016). These compounds can migrate from the soil

surface into groundwater from spills, accidental releases, and poor disposal practices. VOCs include compounds such as vinyl chloride, tetrachloroethylene (PERC), and trichloroethylene (TCE), which pose developmental, cardiovascular, neurological, respiratory, immu-

nological, and carcinogenic risks to humans (Agency for Toxic Substances and Disease Control [ATSDR], 2011, 2018a, 2018b; U.S. Environmental Protection Agency, 2018). PERC exposure can lead to dizziness, headaches, sleepiness, confusion, nausea, difficulty in speaking and walking, unconsciousness, increased risk of Parkinson's disease, and death (ATSDR, 2015). Chronic exposure to PERC in contaminated drinking water can lead to specific risks such as liver and kidney damage, stillbirths, pregnancy complications, non-Hodgkin lymphoma, and leukemia, as well as rectal, bladder, breast, and lung cancers (ATSDR 2000, 2018a).

Industrial solvents, such as VOCs, including PERC and TCE, are used in the dry cleaning industry (ATSDR, 2018a). An estimated 27,000 dry cleaning sites in the U.S. are thought to be contaminated by PERC and an additional 90% of all former or abandoned dry cleaning sites are thought to have PERC contamination (Auger Group, 2011). In fact, because of its common use in dry cleaning, historical disposal practices, and ability to contaminate water supplies, PERC has been found in more than half of all the U.S. Environmental Protection Agency (U.S. EPA) National Priorities List Sites (ATSDR, 2015).

West Wichita, Kansas, Contamination

In 2009, the Kansas Department of Health and Environment (KDHE) discovered groundwater contamination at a former industrial site in west Wichita when U.S. EPA sponsored testing for radium at a former

business that produced radium dials used for aircraft instrumentation (KDHE, 2009). An environmental assessment included three groundwater samples, analyzing for radium-226, metals, mercury, and VOCs. The groundwater samples were obtained using Geoprobe direct-push borings. Two of the groundwater samples were taken on the former business property and one sample was taken upgradient of the facility. Results of the sampling indicated that one contaminant posed a health risk: PERC. The upgradient groundwater sample was 8.1 ppb, exceeding the maximum contaminant level (MCL) of 5 ppb. Based on this assessment, it was concluded that the source of PERC in groundwater might be off site (KDHE, 2009).

At the time of the contamination's discovery, much of the area was not served by a public water supply; many in the area relied on nonpublic wells for drinking water. Area residents using nonpublic water wells with contaminated water were at risk of exposure to PERC (among other contaminants) via oral consumption of the water (e.g., drinking), inhalation vapors (e.g., showering, vapor intrusion), and through dermal contact (e.g., bathing, washing).

In fact, 200 nonpublic wells were located in the contaminated area, with residents in the area having exposure to PERC potentially dating back to the 1960s ("Wichita residents," 2014). The final investigation of the site was completed in 2014. The investigation into the source of contamination identified two former dry cleaning operations approximately 1.6 miles north of the site of the initial discovery.

In 2014, groundwater samples were collected from 222 residences in the area of concern, with PERC levels above the Safe Drinking Water Act's MCL of 5 ppb. The highest concentration level of PERC was 900 ppb; this level is 180 times the MCL for PERC (Jurgens, 2014). Excluding the nondetects, the average level of PERC was 55.87 ppb and the median was 11.6 ppb. By late summer 2014, KDHE had coordinated with the City of Wichita to connect all 200 affected homes to Wichita's water distribution system (KDHE, 2015). The number of people affected by the contamination, however, remains unknown as it is not evident yet when the contamination started impacting groundwater quality, and many families have moved in and out of

the 200 affected homes. Moreover, we do not know the amount of contamination to which residents in the area were exposed from their nonpublic drinking water wells.

The threat to public health posed by contamination of nonpublic water wells has been noted in the academic literature (Charrois, 2010), and the impact of widespread contamination by a specific contaminant, such as PERC or arsenic, in nonpublic water wells on individual well owners has also been documented in the literature (Boyle, Kuminoff, Zhang, Devaney, & Bell, 2010; Lewandowski, Montgomery, Rosen, & Moncrief, 2008). Since 2000, 216 instances of contamination have been reported in the U.S. that were linked to dry cleaning operations and have had remediation systems in place for at least one year (State Coalition for Remediation of Drycleaners, 2017).

Additionally, contamination exceeding benchmarks for human health has been found in nearly one in four (23%) nonpublic wells in the U.S. (De Simone, Hamilton, & Gilliom, 2009). Accounts of a public response to nonpublic well water contamination, however, such as what occurred in Wichita, are absent from the academic literature. The aim of this study was to assess the needs and concerns of the affected residents 1 year after their homes were connected to the City of Wichita drinking water distribution system.

Methods

Participants

Adults (18 years or older) who resided in the affected area were eligible to participate in focus group meetings. Flyers about the focus groups were distributed door-to-door within the affected community. Participants were not incentivized to participate in focus groups.

Instrument

The focus group script contained introductory material that was read to participants prior to the commencement of the focus groups. Participants were informed about the purpose of the study and that the proceedings would be audio recorded and transcribed for analysis. Participants were asked how and what they learned about the groundwater contamination; how satisfied they were with the response to the contamination; and whether they had any remaining needs, questions, or concerns.

Procedures

The Human Subjects Committee (HSC) at the University of Kansas School of Medicine-Wichita (KUSM-W) developed and approved the focus group script. It also approved the study protocol (STUDY00002828, approved July 24, 2015). A waiver of informed consent was provided by HSC at KUSM-W. This study was a partnership between KUSM-W and Wichita State University's Environmental Finance Center. Funding for the study was provided by the Wichita Medical Research and Education Foundation. The sponsor had no role in the collection, analysis, or interpretation of the data; writing this paper; or deciding to submit the article for publication.

The flyers distributed within the affected community included the purpose, dates, and times of the focus groups. The meetings were held at four different locations across the affected community. To increase the likelihood of affected community members' participation, two meetings were held during the day (one at 11:00 a.m. and one at 2:00 p.m.), and three were held in the evening (two at 5:30 p.m. and one at 7:00 p.m.). A local public radio station and a local news station provided some media coverage, and Public Affairs at KUSM-W promoted the meetings via a targeted (by ZIP code) message on Facebook. Meetings were held at a public venue, such as the local county extension office or an area school. Focus groups were conducted in October and November of 2015.

A trained facilitator conducted the focus group meetings, which were scheduled for 90 min each. For consistency, the same team members conducted the focus groups, and other team members assisted with audio recording and observing the focus groups.

The focus group proceedings were transcribed into Word documents verbatim. Four different members of the research team then independently reviewed and coded the transcripts to identify common themes in participants responses.

Results

Five focus groups were conducted with a total of 27 adult residents, with each focus group having 2–7 participants. No resident participated in more than one focus group, and all participants arrived alone or with a partner. Six themes emerged from the focus groups: 1) the extended length of time participants

TABLE 1
Focus Groups Themes

1	Extended length of time participants resided in the affected area
2	Severity of the contamination
3	Perceptions of officials' response to the contamination
4	Residents want improved communication systems and follow-up
5	Concerns of long-term exposure to contaminated water and health implications
6	Remaining questions

had resided in the affected area, 2) severity of the contamination, 3) perceptions of officials' response to the contamination, 4) desire for improved communication and follow-up, 5) concerns of long-term exposure to contaminated water and the associated health implications, and 6) remaining questions (Table 1). We include below quotes that are representative of comments collected.

Extended Length of Time Participants Resided in the Affected Area

Residents reported living in the area for an average of 26 years (a range of 7–60 years). Several commented on how many had been residing in their homes long term. “Well and those people who live east of Tyler, they have lived there for a long time. There is not a lot of turnover.” Another participant, referring to concerns about long-term exposure to contaminated water, stated, “We’ve been drinking well water since we bought our property. We’ve been there 16 years and, uh, used it for everything. Drank it, filtered it through, you know, a Brita Filter, but it was uh, but it was the primary source of our water for quite a while.”

Severity of the Contamination

Residents reported a wide range of contamination levels in wells. “Some of our neighbors had 400 and 500 [ppb]. They wouldn’t even let them shower in it ’til they put in a double carbon filter set-up.” Others with less-severe levels (that still exceeded the 5 ppb MCL for PERC) reported either a sense of relief that their well PERC levels were lower (“Apparently, the chemicals are scary in high concen-

trations, but we didn’t have that.”) or they discounted the severity of their wells’ PERC levels (“A contamination of 20 [ppb] is really not that severe. Um, my well was over 80 [ppb], it depended on how deep your well was, part of it.” or “Well, like my well was 80 [ppb], and I know that over on [street name] there were some that were way over 100 [ppb] into 200 [ppb], um, so 20 [ppb], to me, I would have been thrilled.”).

Additionally, several respondents reported being confused about the MCL for PERC. One reported, “Across the street from our house, because their well water, the numbers on theirs were skyrocket—It was like 500 or 600 parts per million [sic], which you know, ours was nondrinkable, right at borderline... I want to say 82, 83 or something like that, parts per million [sic]. You never know what it’s supposed to be.”

Perceptions of Officials’ Response to the Contamination

The response to the groundwater contamination consisted of initial notification and public meetings to inform the residents of the problem. This response was followed by remediation efforts that included temporary (e.g., bottled water, carbon filters) and more permanent (e.g., provision of city water service) solutions to ensure residents had access to clean water.

The initial notification of the contamination was reported as somewhat problematic. First, participants were perplexed by KDHE’s delay in notifying residents in the affected area of the contamination; residents were notified in 2013 of the contamination. “We’ve learned a whole lot about [the groundwater contamination], but we learned they learned about it in 2009.” Another asked, “Yeah, why did it take so long? Why didn’t they do something quicker if they knew all this stuff was contaminated, and people were drinking well water? And they just let it go?”

Second, most participants stated they were not notified by KDHE; most reported learning of the groundwater contamination in their area from the television news. Some learned about the contamination from friends or family. One person learned about the contamination from the “newspaper, and then my son called and said, ‘Mom, you’d better get your water tested.’” Another focus group participant reported, “I first learned by a friend at church saying, ‘I saw this on television, are you

involved?’ We hadn’t gotten a letter. I didn’t like that very much. I thought we should have known before the television.” In fact, several participants reported that they learned of the groundwater contamination when water samples were being collected. “Well, there was a man came to our neighborhood wanting a water sample, but we had no idea what was going on.” One person reported being notified “by the letter that was sent out by the state.”

Overall, participants reported being satisfied with the public meetings that KDHE hosted. “We attended two of them and they were quite informative, actually.” One reported that the meetings included “where it originated from, with the dry cleaners, and the scope of the contamination, and whether you were borderline or not borderline or in the hot zone, so to speak. Um, and then there was some literature that was given regarding the chemicals.”

Most residents reported being satisfied with their receipt of bottled water and carbon filters, KDHE’s short-term response to the contamination. One reported, “They brought us drinking water while we were in that transition from can’t use your well anymore to having city water hooked up.” Describing the response, one reported, “I thought it was immediate...I thought they did a good job.”

One participant talked about KDHE’s loan of carbon filters. “Before they put our city water in, they came and put in carbon filters, big giant carbon filters down in our basement so well water would run through it and the carbon takes the chemicals out. And I pleaded with them to leave them with us because I wanted to water my dog, water my garden. And they said that they could not leave them.”

To address the contamination more permanently, the City of Wichita facilitated the connection of affected resident homes to city water, on behalf of KDHE and funded by the Kansas Dry Cleaner Trust Fund. Most residents reported that the job was satisfactorily done. “Actually, I thought we were pretty well taken care of considering the problems.” Many positive comments revolved around resident satisfaction with their costs. “They paid everything. I mean, we did not pay a cent for the hook up, and our street had petitioned for city water two or three years before that....That was like \$15,000 per homeowner, so it went boom!”

Residents Want Improved Communication Systems and Follow-Up

Many residents commented on the lack of communication after being connected to the City of Wichita's water. In fact, several reported having contacted KDHE directly, and no response was returned. One respondent stated, "I would say in general we're struggling with what you'd call communication breakdown." One person reported, "Well, it's been a year, it's been over a year now and uh, we haven't heard anything." Another stated, "As soon as they put the lines in, they quit talking to us." Addressing the difference in treatment by KDHE before and after connecting homes to city water, one participant noted, "I think they did a good job of preparing us all and bringing us up to date on what was happening and gave us all this information, but then it's like you've never heard another word since." Another stated, "I just want to be kept in the loop, simplest way to put it I suppose. If they have some additional information, it's easy enough for the state to drop us a letter, particularly the location of the plume."

Residents reported wanting to know what further action would be taken, especially if their health would be studied or assessed. One respondent summed up her frustrations by stating, "They've checked the water, but they haven't checked the people." This theme of frustration was present among many participants. Another stated, "They must have run out of money so badly they don't have stamps or can't use the phone."

One participant suggested there were consequences to the lack of communication, especially when health could be impacted. "A lack of knowledge or information can pretty quickly trigger fear and paranoia, where if more information's given sooner to people, you know, they might have been more comfortable with what is going on." Another participant stated, "Well, so far as I know, we've really heard nothing back from them, and I really think they should be studying those people who [have had long-term exposure]."

Finally, one participant said, "But I don't see, if you're interested in community health, I don't see a lot of what I'd call, 'coming out here,' somehow, or sending surveys, or doing focus groups, or walking door-to-door, random sampling, or whatever. I don't see what

I would call strong community health assessments...but in the long run if you're talking 20 plus years of drinking...chemically dirty water, I think you would want to know the long-term effects in the people that drank it for 10 years or 5 years or 20 years."

Concerns of Long-Term Exposure to Contaminated Water and Health Implications

Multiple concerns were raised by focus group participants about the health of residents exposed to contaminated water. Many reported wanting to know if their current health problems might be connected to the contamination. Another person stated, "We went to every meeting they'd had about it because we'd had several strange incidents of illness. We'd been there 8 years and uh, we drank the well water until the city put in the city water last year. Some of our illnesses are better um, now. Yeah. Still have them, but they're better."

In fact, many remarked on what they identified as temporal relationships between exposure (and postexposure) and their own health concerns. One spoke about her husband who had been chronically ill, "Uh, we went to California during this time for 3 weeks. After a week, he felt great out in California. We came back and he got sick again...like, not functional...severe fatigue. Terrible different types of rashes on his legs and his back, uh, in his hair." Another reported, "Across the street, we have a man that moved in there, oh, maybe 10 years after I lived there, and he has been sick the whole time with no one being able to diagnose what his problem is. But they were, they put city water in for them, and he no longer has a problem." One participant pointed to her husband, "His mother lived with us at that time and was perfectly healthy, and within 8 months of living in there, she passed away of cancer." A family reported, "We lost a dog and a cat that were perfectly healthy when we moved there. Um, and then I've had health problems, and he's had health problems." Another said, "Over this past year, his health has improved, and the doctors can't find anything wrong with him now, whereas before they couldn't find out what was wrong with him." Another concluded, "We don't know if it's connected, but it's a strange circumstance if it isn't connected."

Several participants reported having concerns and asked questions about the long-term health consequences of long-term exposure. One participant asked, "What about the long-term effect of chronic illness? I mean we're talking about a lot of years of drinking contaminated water with chloroethylene." Some rattled off a list of potential health consequences, most of which included cancer. One participant added, "So you could have kidney damage, you could have liver damage, uh, you could have, uh, some bone damage with some of those chemicals."

Others simply wanted health information. One asked, "Is there any blood tests that can be done [to check for chemicals]?" Another stated, "And I'd like to know more health issues, on what, you know, what my daughters could be facing." Another participant succinctly summarized the health concerns by asking, "Is it gonna kill us?"

Remaining Questions

Participants reported having dozens of unanswered questions. The most common questions were regarding the extent of the contamination and the need to continue monitoring. Primarily, participants wanted to know if the plume has changed, and "how long it takes for it to spread, if it spreads." One person reported, "They said at one point that this could continue to spread, would not necessarily be isolated to that area, and I've not heard anything further about whether they are monitoring that."

Several reported uncertainty regarding safe uses for their well water. Most reported that they water their lawns and gardens with well water without much concern, yet providing well water to animals was more concerning. One person stated, "We were told about the chickens, we need to run the water and let it sit for 24 hours and then we could give it to them. They said it would dissipate out of the water." Another argued, "It's not right. Yeah, that's what they said about my dog."

Discussion

Participants were long-term residents of the area, with an average length of residence of 26 years. Long-term residents in a given neighborhood generally have a stronger sense of attachment to place that is distinct from their attachment to the larger city or region (Lewicka, 2010). With this attachment, members of the

neighborhood likely were more aware of environmental concerns and more apt to take action to protect the environment in their neighborhood (Forsyth, van Vugt, Schlein, & Story, 2015). When impacted by environmental contamination, however, the ability and likelihood of long-term residents to move away from the area is less than short-term residents (Crowder & Downey, 2010), making an effective and timely response that much more essential.

The primary concern most commonly identified by participants centered on poor or no communication. Participants expressed concerns with a lack of official notification at the time the contamination was discovered, and they also reported frustration with a lack of communication following the provision of city water to impacted residents. Additionally, focus group participants had questions and concerns about the safety of using their wells now for nonpotable purposes (e.g., gardening) and for the safety of their families, including pets.

Public anxiety and mistrust following an emergency are exacerbated only if the messages provided are inconsistent or intermittent (Tateno & Yokoyama, 2013). In the case of radiation exposure in Fukushima, individuals reported wanting concrete information, such as what foods to eat on a daily basis, rather than more abstract scientific explanations of the exposure (Tateno & Yokoyama, 2013). Similarly, focus group participants expressed a need for specific information and instruction. The many unanswered questions reported by participants likely are related to a larger sense of anxiety related to their exposure.

Among focus group participants, these breakdowns in communication resulted in

lingering questions and concerns, especially regarding health. Participants had deep concerns about potential health impacts, especially cancer, as exposure to chemical solvents such as PERC in contaminated groundwater has been linked to breast cancer, childhood cancers, cervical cancer, skin cancer, epilepsy, neuropsychological disruptions such as memory and mood disorders, and birth defects (Aschengrau et al., 2009, 2015; Gallagher, Webster, Aschengrau, & Vieira, 2010; Janulewicz et al., 2012; Ruckart, Bove, & Maslia, 2013).

During and after an emergency, the public often relies on experts, so it is vital that public agencies establish trust and credibility with the affected populace. In fact, trust in the source (e.g., local or state health departments) can alter the public's responses to health data. Those who distrust the source will be inclined to react one way, while those who trust the source often react differently (Johnson & Waishwell, 2014). Due to the importance of establishing this public trust, the feelings of nonresponsiveness expressed by many focus group participants must be addressed, especially prior to any follow-up efforts planned by public agencies.

Limitations

A limitation of this study is the convenience sample and size of the sample used with regard to the focus groups. Though participation was open to all residents of the impacted area and multiple focus groups were held at various times and locations, the focus groups were relatively small. It is possible that residents who participated might not be representative of all residents of the area, resulting

in potential selection bias. The themes that emerged from the focus groups were consistent, however, suggesting the project team achieved data saturation.

Conclusion

The contamination detected in west Wichita occurred in an established neighborhood of approximately 200 homes that largely relied on nonpublic water wells for drinking water and domestic purposes. With many water wells having PERC concentration levels clearly exceeding the Safe Drinking Water Act's MCL of 5 ppb, long-term residents likely have a large exposure window. Respondents described the initial response focusing on the water supply itself largely as adequate, but lingering questions and concerns remain, especially regarding health.

Beginning with the initial notification of residents regarding the presence of contamination and continuing long after the initial installation of city water, participants reported a lack of communication about the contamination and residents' potential health concerns. Participants reported a strong desire for increased and continued communication and for access to updated information about any continuing efforts, especially efforts to assess and track their health. Participants reported that clearly and consistently communicating with them and providing practical information, especially regarding environmental and health risks, is critical. 🐼

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Did You Know?

NEHA is hosting its first private water virtual conference—Enhancing Safety in Private Drinking Water Systems (EnSafe)—on October 16–17. EnSafe has been designed to enhance the knowledge of water safety specialists and public health professionals to help close the water quality gap in unregulated private drinking water. Learn more at www.neha.org/node/60151.

▶ DIRECT FROM CDC ENVIRONMENTAL HEALTH SERVICES



Samantha Dye, MSEH, REHS
Gaston County Department of Health and Human Services



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Centers for Disease Control and Prevention

Benefits of Collaboration Between a County Health Department and a Local University in North Carolina

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

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

Samantha Dye has been with Gaston County Department of Health and Human Services for 19 years, where she has served as the assistant environmental health administrator since 2013. Max Zarate-Bermudez has been an environmental epidemiologist at CDC’s National Center for Environmental Health since 2008. He works with 7 of the 19 grantees in the Safe Water for Community Health Program.

Groundwater quality is of great importance in the U.S. to protect public health. In Gaston County, North Carolina, more than 8,000 households use private wells for their drinking water supplies. The county’s 220,000 inhabitants (U.S. Census Bureau, 2017a) face economic challenges with a median household income lower than the neighboring city of Charlotte (Figure 1) (U.S. Census Bureau, 2017b).

The Gaston County Department of Health and Human Services (GCDHHS) implements and enforces state rules and regulations on private wells. Its environmental health staff

issue permits for the construction of private wells, ensure well drillers are licensed, inspect wells before issuing certificates of completion, collect water samples for mandatory testing, and assure that wells are repaired and abandoned properly.

To address resource constraints, GCDHHS is working with partners to evaluate groundwater quality and protect human health. Through a funding opportunity from the Centers for Disease Control and Prevention’s (CDC) Safe Water for Community Health (Safe WATCH) Program, GCDHHS is working with the University of North Carolina at Charlotte (UNCC)

to enhance its ability to assess and manage groundwater issues (CDC, 2018). The goal is to help private well users reduce exposures to potential contaminants in their water.

Challenges

Data on Existing Wells

Environmental health staff at GCDHHS have completed and filed paper forms with data on private wells since the county assumed responsibility of the well program in 1989. Recognizing that paper forms were difficult to search and lacked durability, GCDHHS planned to convert them to a more usable and durable form by digitizing data and maintaining records online. A limited workforce and lack of funds to contract the work were barriers to implementing the plan.

Groundwater Contamination: Past and Present

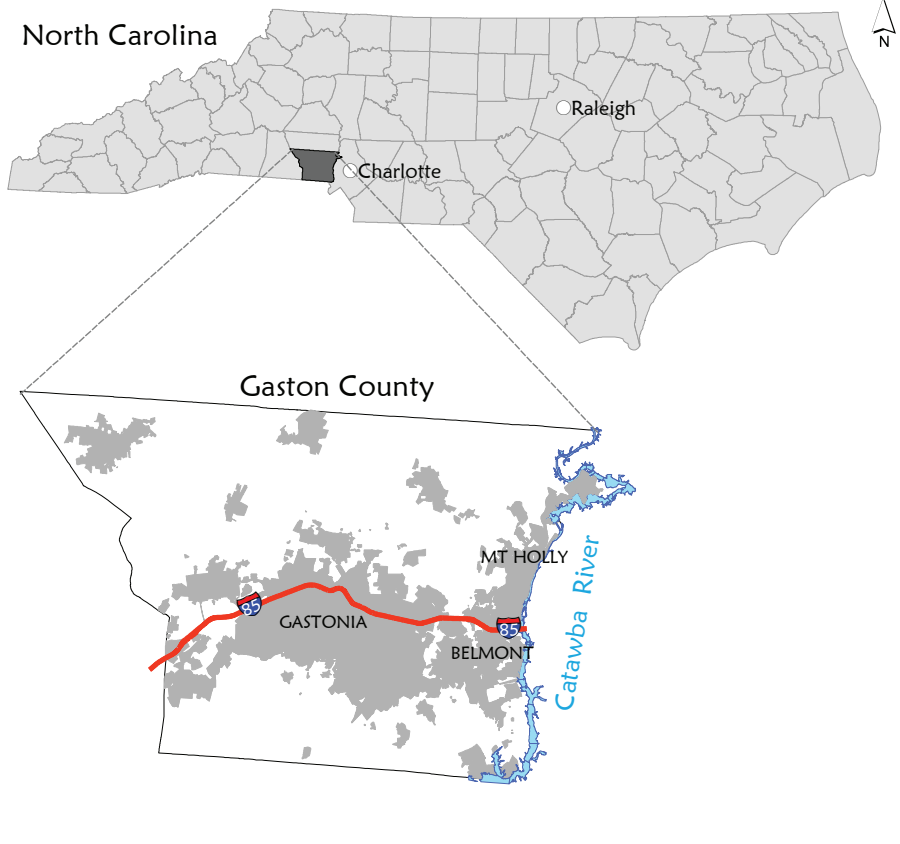
GCDHHS staff know about groundwater contamination issues caused by six active Superfund sites in the county (U.S. Environmental Protection Agency, 2018). Additionally, the North Carolina Department of Environmental Quality (NC DEQ) lists 55 sites as hazardous waste generators in Gaston County (NC DEQ, 2018a).

Other threats to potentially contaminate the county’s groundwater include

- leachate from coal ash ponds at Duke Energy power generation plants in Mt. Holly and Belmont (NC DEQ, 2018b);
- naturally occurring arsenic in the western part of the county;

FIGURE 1

Location of Gaston County, North Carolina



- point and nonpoint sources of pollution along the Catawba River (recharging county aquifers);
- cycles of decreased rainfall causing groundwater depletion and compromising water quality;
- septic systems that might be malfunctioning; and
- a growing number of older wells possibly ending their functional capacity.

Collaboration With the University of North Carolina at Charlotte

When CDC announced Safe WATCH, the GCDHHS special projects administrator assembled a team with the GCDHHS environmental health assistant administrator and faculty members from the Department of Public Health Sciences and Department of Geography and Earth Sciences at UNCC.

The team proposed digitizing existing private well data, developing a system for future

data input in the field, and creating a database that will interface with a publicly available GIS website. The proposal integrated expertise available at both GCDHHS and UNCC and involved graduate and undergraduate students from both UNCC departments.

Achievements of the Collaboration

In 2017, students from UNCC scanned paper permits for more than 8,000 private wells, entered data into a digital database, and geocoded locations using state-of-the-art geospatial technologies (Owusu, Lan, Zheng, Tang, & Delmelle, 2017). As of March 2018, students have visited 3,431 homes and gathered field data on private well locations and characteristics (Table 1). Students collected 520 well water samples for total coliform and *E. coli* tests; 132 samples (25.4%) tested positive for total coliform and 6 samples (1.2%) for *E. coli*.

To date, 35 undergraduate and 6 graduate students have worked on the grant.

TABLE 1

Data Gathered During Visits to Homes Listed as Having a Private Well in Gaston County, North Carolina

Result of Home Visit	# of Homes Visited	%
Homes with missing data	3	0.1
Well water sampling to test for nitrogen, total coliform, and <i>E. coli</i> only	56	1.6
Getting geospatial coordinates only	7	0.2
Survey to gather private well location and characteristics only	2	0.1
Well water sampling and getting geospatial coordinates only	370	10.8
Well water sampling and survey to gather private well location and characteristics only	18	0.5
Survey to gather private well location and characteristics and getting geospatial coordinates only	5	0.1
Well water sampling, getting geospatial coordinates, and survey to gather private well location and characteristics	206	6.0
Homeowner requested a revisit at a later date	97	2.8
Homeowner declined to participate	386	11.3
Serviced by city water and only uses well water for irrigation	3	0.1
Serviced by city water and does not use well water	18	0.5
Did not enter property (i.e., no trespassing, beware of dog, or private property signs present)	805	23.5
No one home	1,235	36.0
House uses community well	8	0.2
Could not locate home	212	6.2
Total	3,431	100.0

TABLE 2

Dissemination of Preliminary Findings of the Gaston County Department of Health and Human Services–University of North Carolina at Charlotte Collaboration

Date	Author(s)	Presentation	Event Proceedings
November 20–22, 2016	Owusu, C., Delmelle, E., Tang, W., Lan, Y., Major, E., Shi, J., Silverman, G., and Dye, S.	Improving Geocoding Accuracy of Private Water Wells in Gaston County, North Carolina, Using a Context-Based Approach	2016 Annual Meeting, South Eastern Division of the Association of American Geographers, Columbia, South Carolina
March 15, 2017	Dye, S., Delmelle, E., Tang, W., and Silverman, G.	Healthy Wells Collaboration With the University of North Carolina at Charlotte (UNCC)	Water Resources Research Institute (WRRI) of the University of North Carolina System, Raleigh, North Carolina
April 5–9, 2017	Owusu, C., Delmelle, E., Tang, W., Lan, Y., Major, E., Shi, J., Silverman, G., and Dye, S.	Hybrid Geocoding and Text Matching: A Multistage Process to Improve Geocoding Accuracy and Match Rate of Historical Records	2017 Annual Meeting, Association of American Geographers, Boston, Massachusetts
June 21–24, 2017	Silverman, G., Delmelle, E., Tang, W., and Dye, S.	Protecting Rural Groundwater Quality in Gaston County, North Carolina, Through a Collaborative and Integrated GIS-Based Data Management and Educational Project	2017 Annual Conference, Association for Environmental Studies and Sciences, Tucson, Arizona
July 14, 2017	Dye, S., Delmelle, E., Tang, W., and Silverman, G.	Healthy Wells Collaboration With UNCC	2017 Annual Educational Conference & Exhibition, National Environmental Health Association (NEHA), Grand Rapids, Michigan
February 14–15, 2018	Dye, S.	Healthy Wells	Integrating Data to Empower Advancement Virtual Conference, NEHA
March 15, 2018	Delmelle, E.	A Spatially Explicit Database of Private Wells for the Monitoring of Water Quality in Gaston County, North Carolina	2018 Annual Conference, WWRI, Raleigh, North Carolina

Students have gained field experience generating useful information to enhance the GCDHHS private well program and website. This introduction to the environmental health practice has motivated some students to pursue a career in environmental health after graduation.

The GCDHHS–UNCC collaboration has improved the practice of environmental health in Gaston County and led to dissemination of findings at many professional events (Table 2). The experience has been mutually beneficial for faculty, students, and GCDHHS environmental health staff while serving the county and enhancing a program aimed to protect the quality of local groundwater.

What’s Next

Students will continue entering data in the database and working in the field to physically visit and verify well coordinates

using GPS. They will continue to educate well owners on the importance of testing well water, provide educational materials, administer a survey, and collect samples to test for total coliform and *E. coli* at no cost to residents.

The collaborators will continue to create maps of private wells and display them on the GCDHHS website. A data layer in the website will include well attributes such as depth, flow, static water level, type of casing, name of well driller, and test results for well water. Information will be accessible to the public and GCDHHS environmental health staff working in the field.

GCDHHS and UNCC collaborators will analyze the database to determine potential health hazards that water from private wells might pose to users. This analysis will allow GCDHHS environmental health staff to better target educational outreach, recommend corrective

actions, and propose revisions to county and state private well rules and regulations. 🚧

Acknowledgements: We would like to acknowledge Alexandra Alcorn, a recent Master of Public Health graduate from UNCC for her meaningful contribution summarizing the data presented in Table 1. Alcorn has collaborated with field and data analyses work since the beginning of this project. Also, we would like to acknowledge the contributions of the staff at GCDHHS and faculty and students at UNCC in planning, conducting, analyzing, and disseminating findings of this project.

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Did You Know?

NEHA's new membership structure will be introduced on October 1. The new structure will include five different membership categories—Professional, Emerging Professional, Retired Professional, International, and Life. All members within these categories will continue to receive the electronic version of the *Journal*. Members based in the U.S. also have the option to purchase a print subscription of the *Journal* for just \$35. Learn more about NEHA's membership and its benefits at www.neha.org/membership-communities.



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EH CALENDAR

UPCOMING NEHA CONFERENCES

October 16–17, 2018: **EnSafe: Ensuring Safety in Private Drinking Water Systems Virtual Conference**. For more information, visit www.neha.org/node/60151.

July 9–12, 2019: **NEHA 2019 Annual Educational Conference & Exhibition**, Nashville, TN. For more information, visit www.neha.org/aec.

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

July 12–15, 2021: **NEHA 2021 Annual Educational Conference & Exhibition**, Spokane, WA.

NEHA AFFILIATE AND REGIONAL LISTINGS**Alabama**

October 17–19, 2018: **2018 AEHA Conference**, hosted by the Alabama Environmental Health Association, Lake Guntersville, AL. For more information, visit www.aeha-online.com.

Alaska

October 10–12, 2018: **Annual Educational Conference**, hosted by the Alaska Environmental Health Association, Anchorage, AK. For more information, visit <https://sites.google.com/site/aehatest>.

California

October 12, 2018: **CEHA Update**, hosted by the Southwest Chapter of the California Environmental Health Association, San Diego, CA. For more information, visit www.ceha.org.

Idaho

March 12–14, 2019: **Annual Education Conference**, hosted by the Idaho Environmental Health Association, Boise, ID. For more information, visit <https://ieha-idaho.com>.

Iowa

October 3–4, 2018: **Fall Conference**, hosted by the Iowa Environmental Health Association, West Des Moines, IA. For more information, visit www.ieha.net.

Missouri

October 4–5, 2018: **Fall Training**, hosted by the Missouri Environmental Health Association, Columbia, MO. For more information, visit <https://mehamo.org/new-event>.

Nebraska

October 3, 2018: **Annual Education Conference**, hosted by the Nebraska Environmental Health Association, Ashland, NE. For more information, visit www.nebraskaneha.com.

New Mexico

October 23–24, 2018: **2018 NMEHA Conference**, hosted by the New Mexico Environmental Health Association, Albuquerque, NM. For more information, visit www.nmeha.org.

North Dakota

October 22–24, 2018: **Fall Education Conference**, hosted by the North Dakota Environmental Health Association, Bismarck, ND. For more information, visit <http://ndeha.org/wp/conferences>.

Ohio

April 11–12, 2019: **73rd Annual Educational Conference**, hosted by the Ohio Environmental Health Association, Worthington, OH. For more information, visit www.ohioeha.org.

Texas

October 22–26, 2018: **Annual Educational Conference**, hosted by the Texas Environmental Health Association, Austin, TX. For more information, visit www.myteha.org.

TOPICAL LISTING**Recreational Waters**

October 10–12, 2018: **15th Annual World Aquatic Health Conference**, hosted by the National Swimming Pool Foundation, Charleston, SC. For more information, visit <http://thewahc.org>.

Did You Know?

NEHA is offering an in-person, two-day training for its Professional Food Safety Auditor Credential program on November 12–13 at the Food Safety Summit in Chicago, Illinois. The training will provide a comprehensive review of good auditing practices, written and verbal communication skills, and technical knowledge for preventive controls. The training is recommended for those wanting to pursue one or both of the food safety auditor credentials—the Certified in Food Safety Supplier Audits and Registered Food Safety Auditor. Learn more at www.neha.org/node/60212.



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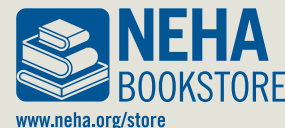
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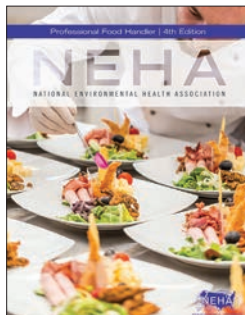
RESOURCE CORNER

Resource Corner highlights different resources that NEHA has available to meet your education and training needs. These timely resources provide you with information and knowledge to advance your professional development. Visit NEHA's online Bookstore for additional information about these, and many other, pertinent resources!



NEW! Professional Food Handler (4th Edition)

National Environmental Health Association (2018)



The fourth edition of NEHA's *Professional Food Handler* provides culinary and hospitality professionals and students with the knowledge they need to ensure food safety in the workplace. Based on the 2017 Food and Drug Administration *Food Code*, this book provides the latest trends and information about food safety, microbiology, and pathogens. This book shares best practices to prevent

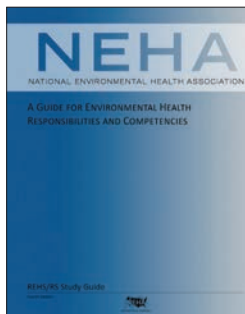
foodborne illness in food facilities and contains useful graphics, photographs, and a practice quiz to assist readers in retaining information. The *Professional Food Handler* meets state and local food handler employee training, is an accredited ANSI certificate training program, and prepares employees to pass their food handler certificate exam.

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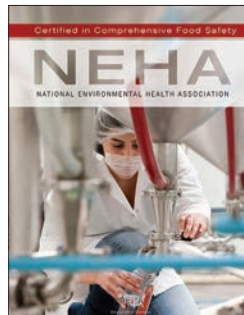
general environmental health; statutes and regulations; food protection; potable water; wastewater; solid and hazardous waste; zoonoses, vectors, pests, and poisonous plants; radiation protection; occupational safety and health; air quality; environmental noise; housing sanitation; institutions and licensed establishments; swimming pools and recreational facilities; and disaster sanitation.

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National Environmental Health Association (2014)



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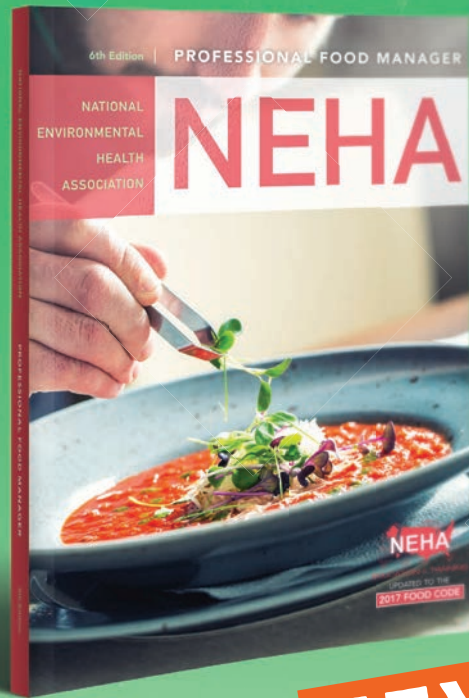
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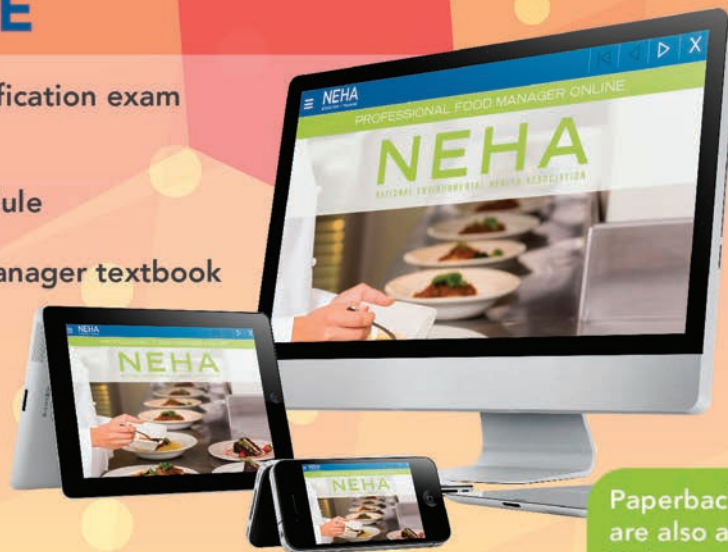
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JEH QUIZ

FEATURED ARTICLE QUIZ #2

Male–Female Differences in the Prevalence of Non-Hodgkin Lymphoma and Residential Proximity to Superfund Sites in Kentucky

Available to those holding an individual NEHA membership only, the *JEH* Quiz, offered six times per calendar year through the *Journal of Environmental Health*, is an easily accessible means to accumulate continuing-education (CE) credits toward maintaining your NEHA credentials.

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JEH Quiz #6 Answers May 2018

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

→ Quiz deadline: January 1, 2019

1. Throughout much of the 20th century, the rates of non-Hodgkin lymphoma (NHL) have __ in the U.S. and other developed countries.
 - a. decreased
 - b. not changed
 - c. increased
2. In Kentucky, age-adjusted NHL rates in males consistently exceed rates in females.
 - a. True.
 - b. False.
3. For this study, which of the following variables was not included in the analyses at the individual level.
 - a. Age at diagnosis.
 - b. Sex, race, and ethnicity.
 - c. County of residence.
 - d. Annual household income.
4. Of Kentucky's 1,115 census tracts, __ had Superfund sites located within their borders between 1995 and 2012.
 - a. 13%
 - b. 18%
 - c. 25%
 - d. 31%
5. At the time of this study in 2014, the U.S. Environmental Protection Agency's website listed __ Superfund sites located in Kentucky.
 - a. 115
 - b. 133
 - c. 145
 - d. 153
6. There was a total of 14,373 NHL cases in Kentucky from 1995–2012 and __ were classified as intranodal NHL.
 - a. 48.5%
 - b. 51.5%
 - c. 67.4%
 - d. 70.8%
7. Of the 14,373 NHL cases, __ of patients were ≥60 years.
 - a. 48.5%
 - b. 51.5%
 - c. 67.4%
 - d. 94.7%
8. Intranodal NHL cases were consistently __ the extranodal cases across all age groups.
 - a. less than
 - b. the same as
 - c. more than double
 - d. more than triple
9. Among those with a known family history of NHL, __ resided 10 km or more from Superfund sites.
 - a. 50.7%
 - b. 55.4%
 - c. 58.0%
 - d. 68.8%
10. The hot spots were more prominent for __ cases, particularly in the western and central regions of Kentucky.
 - a. male
 - b. female
11. There was a significant difference in the prevalence rate of intranodal NHL in females.
 - a. True.
 - b. False.
12. This study found that the prevalence rates of intranodal and extranodal NHL are consistently __ in males than in females in all three exposure risk zones.
 - a. lower
 - b. the same
 - c. higher

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www.aehap.org

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<https://health.baltimorecity.gov/programs/health-resources-topic>

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www.houstontx.gov/health/Environmental/community_childrens.html

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Erie County Department of Health

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Georgia Department of Public Health, Environmental Health Section

<http://dph.georgia.gov/environmental-health>

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www.gilariver.org

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Jackson County Environmental Health

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Jefferson County Public Health (Colorado)

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Kanawha-Charleston Health Department

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Louisiana State Board of Examiners for Sanitarians

www.lsbes.org

Marathon County Health Department

www.co.marathon.wi.us/Departments/HealthDepartment.aspx

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Metro Public Health Department

www.nashville.gov/Health-Department.aspx

MFC Center for Health

drjfl4@aol.com

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Nashua Department of Health

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New Mexico Environment Department

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New York City Department of Health and Mental Hygiene

www1.nyc.gov/site/doh/index.page

Nova Scotia Environment

<https://novascotia.ca/nse>

NSF International

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Oklahoma Department of Environmental Quality

www.deq.state.ok.us

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www.steritech.com

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Texas Roadhouse

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www.tchd.org

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www.co.washington.or.us/hhs/environmentalhealth

Waukesha County Environmental Health Division

www.waukeshacounty.gov/ehcontact

Wegmans Food Markets, Inc.

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Yakima Health District

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Eastern Kentucky University

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www.odu.edu/commhealth

The University of Findlay

www.findlay.edu

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www.uis.edu/publichealth

University of Illinois, Illinois State Water Survey

www.isws.illinois.edu

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NEHA 2018 AEC WRAP-UP



NEHA 2018 AEC and HUD Healthy Homes Conference

Anaheim • California • June 25-28, 2018

presented by
Green & Healthy Homes Initiative®

Building Bridges, Bonds, and Benefits

Jonna Ashley
Kristie Denbrock
Soni Fink
Faye Koeltzow
Robert Stefanski
*National Environmental
Health Association*

The NEHA 2018 AEC and HUD Healthy Homes Conference, presented by Green & Health Homes Initiative, proved to be an exciting, groundbreaking, and very successful event. This year, NEHA cohosted the conference with the U.S. Department of Housing and Urban Development (HUD), bringing together more than 1,500 environmental health professionals to discuss and learn how their peers work with multiple agencies, industries, and levels of government to build bridges, bonds, and benefits to ensure the safety of the public and environment.

The 2018 AEC took place June 25–28 in sunny Anaheim, California, which provided the perfect atmosphere and energy for the over 1,500 environmental health professionals who attended. Kicking things off was a fireside chat with HUD Deputy Secretary Pamela Hughes Patenaude, which was moderated by NEHA Executive Director Dr. David Dyjack. Patenaude highlighted the importance of ensuring adequate resources for healthy housing and protecting families by promoting the prevention of hazards in the home.

Next up was Frank Yiannas, vice president of food safety and health for Walmart, who delivered a powerful Keynote Address to a packed house of 1,100 attendees. Yiannas discussed the importance of thinking about human behavior and how it relates not only to food safety but also all of environmental health. “The future of environmental health is both high tech and high touch. We have to also change human behavior. It’s all about helping Americans live better,” he stated.

The 2018 AEC offered a record 320 educational sessions spanning 4 days, covering



NEHA 2018 AEC photos courtesy of Michael Kitada, michael@michaelkitada.com

10 informative tracks (plus tracks from HUD and the Centers for Disease Control and Prevention’s National Center for Environmental Health) on emerging environmental health issues such as emergency preparedness, food safety, water quality, and healthy homes and communities. Over 450 speakers and presenters from around the globe were featured. The Exhibition was packed with 55 exhibitors from a wide range of industries. With so much diversity and variety, there was something of interest for every attendee.

Each year, AEC attendees look forward to the social events and this year did not disappoint! Underwriters Laboratories (UL) hosted another exciting UL event, this time at Angel Stadium, home of the Los Angeles Angels baseball team. Over 850 people attended

the Good Vibrations! Reception, enjoying festive music, dancing, and food from various California regions (we’re told the In-N-Out Burger line was long the entire time!).

We would like to thank HUD for its hard work in helping to make the 2018 AEC so successful. HUD has become more than a cohost of the event—we have become proud partners in advancing the field of environmental health. Thank you!

We also want to thank our attendees, members, staff, presenters, exhibitors, and sponsors. Without you the conference could not be possible.

We look forward to seeing everyone next year in Nashville, Tennessee, for the 2019 AEC. Check out the 2019 AEC promo on page 59.

KICKING OFF THE 2018 AEC



Fireside Chat

A Fireside Chat with HUD Deputy Secretary Pamela Hughes Patenaude, moderated by NEHA Executive Director Dr. David Dyjack, kicked off the 2018 AEC's opening night events. "Identifying the addressing housing hazards that have an impact on the health of children and families is a top priority," Patenaude expressed. She answered questions from the attendees ranging from disaster relief effects to onsite wastewater.



Keynote Address

Frank Yiannas, vice president of food safety and health for Walmart, educated and entertained during the Keynote Address titled, "Food Safety = Behavior." He focused on how behavior science can be utilized to advance workplace behaviors to create sustainable food safety practices and overall, environmental health. Yiannas stated that the NEHA AEC "was a wonderful opportunity to build working relationships between industry and environmental health agencies."



Opening Panel

The Association of State and Territorial Health Officials presented the Opening Panel Discussion. Seema Dixit, director of the Division of Environmental Health, Rhode Island Department of Health; Dr. Chris Rustin, director of environmental health, Georgia Department of Public Health; and Dr. Rick Kreutzer, chief of the Division of Environmental and Occupational Disease Control, California Department of Public Health, discussed emerging environmental health issues and prioritization in their respective states, coordination with local and state health departments, and the skills necessary to be a successful environmental health professional.



Grand Session Kickoff

RADM Dr. Stephen Redd, director of the Office of Public Health Preparedness and Response, Centers for Disease Control and Prevention, delivered the Grand Session Kickoff for the educational sessions with an informative and inspirational presentation on disaster relief efforts and the importance of environmental health. "As a runner and a swimmer, I like to compare a public health response to a race," said Dr. Redd. "Like a race, an emergency response requires preparation and endurance. You must be able to hold a steady pace that will get you to the finish line, but there are times when you are required to sprint, to learn on your feet, and to respond to changes as they are thrown at you. The key to entering the race is being mentally and physically prepared to take on the challenge and commit to getting to the finish line."

EDUCATION & TRAINING

The 2018 AEC educational program demonstrated the need, importance, and benefit of environmental health professionals working together across issue silos, agencies, and levels of government. As such, NEHA staff and technical advisor created an educational program that featured 320 educational sessions and more than 450 speakers, including representatives from a variety of countries around the globe, that covered the wide scope of environmental health issues and topics. The educational program highlighted the idea that in order to ensure and improve the protection of the health and environment of the public, we must all continue to research, educate, and cross boundaries to work together.

This year's conference welcomed its biannual partner and cosponsor, the U.S. Department of Housing and Urban Development, whose educational sessions focused on a large variety of healthy home topics including lead poisoning, prevention and awareness, air quality and asthma, land reuse and sustainability, and climate and health.

Educational sessions on emergency preparedness were well received featuring sessions related to Hurricane Harvey, wildfire health risks, and the management of natural disasters. The food safety aspects of cannabis were discussed to standing room only crowds.

We wish to thank the presenters, attendees, and the many volunteers who moderated the sessions to keep the 18 educational rooms running smoothly over the course of the 2018 AEC. We also thank the 2017–2018 NEHA technical advisors who were tasked with reviewing the submitted abstracts—over 400 were submitted—to assist us in putting together the 2018 AEC's educational program.



Closing Session

“Opening the Big Black Box: Partnering With Public Health Laboratories to Address Community Environmental Health Programs” was the 2018 AEC's Closing Session, which was hosted by the Association of Public Health Laboratories. Public health testing needs, the importance of high quality defensible data, and how environmental health professionals and laboratories can best work together were discussed by Dr. Christine Bean, director of the New Hampshire Public Health Laboratories; Dr. June-Soo Park, research scientist at the California Department of Toxic Substances Control Environmental Chemistry Laboratory; and Dave Boxrud, molecular epidemiology supervisor of the Minnesota Public Health Laboratory Division.



2018 AEC Session Tracks

This year's educational program featured 320 sessions within 10 tracks and 32 disciplines, as well as over 20 research posters.

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

Preconference Courses & Workshops

The 2018 AEC offered a variety of preconference review courses and workshops to advance the careers of environmental health professionals. Over 150 people attended the preconference offerings, gaining valuable knowledge and tools to improve important skills vital to their success.

NEHA Credential Review Courses

Review courses for NEHA's Certified Professional-Food Safety (CP-FS) and Registered Environmental Health Specialist/Registered Sanitarian (REHS/RS) credentials were offered for those planning to take the credential exams. The courses provided attendees with the knowledge needed to prepare for the exams. Those who attended the review courses gave excellent feedback, noting how the course content was very instrumental in taking their exams.

Affiliate Leader Workshop

A leadership workshop was hosted for members of our affiliate organizations. This annual workshop helps affiliate leaders learn association management best practices from each other, as well as from experts in the association field. This year's workshop focused on providing affiliates with tips and tricks for running successful state and regional conferences. Topics focused on hotel contract negotiations, timeline tracking, exhibitor relations, and exchanging information and ideas among the group.

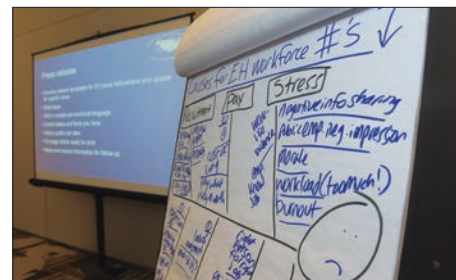
Survival Skills Workshop

NEHA members from around the country attended the Survival Skills Workshop, hosted by Dr. Sandra Whitehead, director of NEHA's Program and Partnership Development. Attendees learned important leadership skills necessary for emerging leaders such as dealing with the media, the environmental health career ladder, and budgeting. Individuals from

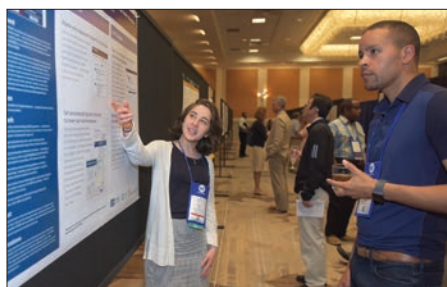
NEHA's board of directors and membership participated in the workshop, including NEHA Past-President Bob Custard, current NEHA President Vince Radke, NEHA Region 9 Vice-President Larry Ramdin, Elke Ursin from the Florida Department of Health, and Niki Lemin (who participated in last year's workshop).

Body Art Training

The Body Art Training: Inspection Basics for Body Art Establishments Workshop took place on opening day of the 2018 AEC and had over 70 attendees. The workshop focused on best practices for the body art industry and body art standards based on the forthcoming Body Art Model Code. Attendees learned how to perform a body art establishment inspection, how an establishment should be properly set up, sterilization within an establishment, and more. The workshop was led by industry expert Steve Joyner from the Association of Professional Piercers, along with Laurel Arrigona, Regulatory Affairs at Ceutical Labs Inc., and Matthew Bavougian, owner and senior piercer at Onyx Piercing Studio.



Poster Session



NEHA 2018 AEC WRAP-UP

2018 AEC SPECIAL EVENTS CELEBRATED THE MANY FLAVORS OF CALIFORNIA

UL Event

Angel Stadium, home of the Los Angeles Angels, provided a spectacular backdrop for attendees to consume ballpark-style foods, network and enjoy the spirit of the Diamond Club level, and experience behind the scenes tours of the fourth-oldest active Major League Baseball stadium.



Good Vibrations! Reception

Over 850 people enjoyed a perfect Anaheim evening amongst palm trees and gentle breezes in the courtyard just outside the Anaheim Marriott. Several food stations representing flavors from San Francisco, San Diego, Hollywood, and the beach (including an In-N-Out Burger food truck!) set the tone for much fun and laughter while the Pacific Coast DJ "spun" music for dancing.



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We appreciate the following sponsors and organizations that helped make the 2018 AEC possible!

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U.S. Environmental Protection Agency, Office of Research and Development

EXHIBITION

As in previous years, the Exhibition opened on the first night of the conference with an enormous amount of excitement and electrifying energy. Attendees had the opportunity to visit with people from companies that provide the products and services they use and recommend. In addition, attendees were introduced to a variety of new companies that offer products and services that can make their positions as environmental health professionals easier and more efficient.

The Exhibition also provided attendees with the opportunity to catch up with old friends, make new friends, and build networks. Attendees were scanning each other's badges via the conference app to stay connected during the conference, as well as to help them connect after the conference.

Along with all the exhibitors and their products and services, the Exhibition was the host location of the Poster Session. Over 20 posters offered a variety of relevant and innovative environmental health topics and attendees had the opportunity to engage with poster presenters to learn more.

NEHA's booth, located in the center of the Exhibition, was the place to go to learn more about the association and its programs and to meet with board and staff members. A drawing for a full registration to the 2019 AEC in Nashville, Tennessee, was held in the NEHA booth. Congratulations to Peggy Sarcomo, winner of the 2019 AEC registration!

Overall, the Exhibition was the place to be! We would like to thank all the exhibitors who helped to make the event a success.



2018 AEC Exhibitors

Accela	Hedgerow Software US, Inc.
Advanced Business Software	Heuresis Corp
Air Chek, Inc.	Hoot Systems, LLC
American Academy of Sanitarians	IAPMO R&T
American Chemistry Council	Industrial Test Systems, Inc.
American Public Health Association	Inspect2GO, Inc.
American Society of Home Inspectors	Keys to a Healthy Home
Association of Environmental Health Academic Programs	LeadSmart/ePIPE
Association of Food and Drug Officials	National Library of Medicine
Association of Professional Piercers	National Restaurant Association
California Department of Public Health for Environmental Health	NEHA Business and Industry Affiliate
CPD, Inc.	NSF International
Centers for Disease Control and Prevention, National Center for Environmental Health/Agency for Toxic Substances and Disease Registry	Ozark River Portable Sinks
Centers for Disease Control and Prevention, Radiation Studies	Prometric
ColInspect	Protec Instrument Corporation
Columbia Southern University	Radon Supplies
DHD/Tyler Technologies	SALCOR UV Disinfection
The Earth Institute, Columbia University	Serim Research Corporation
Eljen Corporation	SneezeGuard Solutions/McCourt Manufacturing
Environmental Hazards Services, LLC	StateFoodSafety.com
Food and Drug Administration	The Steritech Group
Glo Germ Company	Sweeps Software, Inc.
GOJO Industries	Taylor Technologies, Inc.
Green & Healthy Homes Initiative	ThermoWorks
Green Home Solutions	Underwriters Laboratories
Hach	The University of Findlay
HealthSpace USA Inc	U.S. Department of Housing and Urban Development, Office of Lead Hazard Control and Healthy Homes
Healthy Housing Solutions, Inc./National Center for Healthy Housing	U.S. Environmental Protection Agency, Indoor Environments Division
	U.S. Environmental Protection Agency, Office of Research and Development

NEHA 2018 AEC WRAP-UP





AWARDS & HONORS

Numerous notable individuals and organizations were recognized at the 2018 AEC. For more information about NEHA's awards, please visit www.neha.org/about-neha/awards.

Accela/NEHA 2018 AEC Scholarships

Accela Environmental Health and NEHA partnered to award scholarships to nine professionals to attend to 2018 AEC.

Allen Alexander
Jennifer Corrigan
Chris Ellis
Bryan Escamilla
Katie Keiffer
Emmanuel McCarrell
Tinika McIntosh-Amouzouvi
Ryan Mercado
Bonnie Simpson

AEHAP Student Research Competition Winners

Presented by the Association of Environmental Health Academic Programs (AEHAP), this award recognizes students who have conducted outstanding research benefiting the field of environmental health.

Heidi Knecht
Joseph Kusi
Kellyn Reese

Davis Calvin Wagner Sanitarian Award

This award represents the highest honor that the American Academy of Sanitarians bestows upon one of its diplomats.

Herman Koren

Dr. R. Neil Lowry Grant

Given by the Association of Pool & Spa Professionals, this award honors and recognizes public health officials who have made outstanding contributions to advance the public's healthy and safe use of recreational water.

Arizona Department of Health Services

HUD Secretary's Award for Healthy Homes

The U.S. Department of Housing and Urban Development (HUD), in partnership with NEHA, gives this award to recognize excellence in making indoor environments healthier through healthy homes research, education, and program delivery, especially in diverse, low-to-moderate income communities.

City of Fort Collins, CO, Healthy Homes Program (Policy and Education Innovation)
Green and Healthy Homes Initiative, Baltimore, MD (Cross Program)

North Carolina State University and Tulane University, NC and LA, Interventions That Eliminate Cockroaches, Reduce Cockroach Allergies, and Asthma Morbidity in Children (Research)

Wisconsin Housing and Economic Development Authority, WI, Thurgood Marshall Apartments in Milwaukee (Public Housing)

Innovating for Environmental Health App Award

Teams of developers and creatives competed to build apps that solve environmental health issues in app challenges sponsored by Hedgerow Software.

Team Silicon Valley (2017)
Team Get-A-Way (2018)

Jack B. Hatlen Distinguished Service Award

Presented by AEHAP, this award is given to an individual who has demonstrated dedication to the profession through mentorship, education, and promotion.

David Dyjack

Joe Beck Educational Contribution Award

This award recognizes a NEHA member for developing an educational or training tool designed for the advancement and professional development of environmental health professionals.

Leif Albertson

NEHA Affiliate Certificates of Merit

Awarded to affiliate members and teams who made exemplary contributions to the profession. Each affiliate selects winners based upon its own criteria for recognition.

Individuals

Pamela J. Althoff (IL)
Melanie Boggan (AL)
Eric Bradley (IA)
Jeff Brown (MN)
Paul DePasquale (OH)
Mylene Dunn (MO)
Temesgen Jemaneh (DC)
Karla Todd (MA)

Teams

CT—2018 CEHA Executive Board
FL—2017 FEHA Annual Education Meeting Planning Committee
National Capital Area—STAMP Program Development Team
NC—Environmental Health Executive Committee

NEHA Past Presidents Award

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

San Bernardino Environmental Health Services Staff

NEHA Presidential Citations

This award is given to individuals who have made exemplary contributions to NEHA during the president's term of office. President Adam London presented seven citations.

Robert Custard
Michael Ells
Harry Grenawitzke
Representative Brenda Lawrence
Anne London
Vince Radke
Senator Debbie Stabenow

NSF International Scholarship Program

AEHAP, in partnership with NSF International, offers a paid internship project to students from National Environmental Health Science & Protection Accreditation Council-accredited programs.

Caitlin Adams

Samuel J. Crumrine Consumer Protection Award

This award is given annually to local environmental health jurisdictions that demonstrate unsurpassed achievement in providing outstanding food protection services to their communities. The purpose of the award is to encourage innovative programs and methods that reduce or eliminate the occurrence of foodborne illnesses, recognize the importance of food protection at the local level, and stimulate public interest in foodservice sanitation.

Maricopa County Environmental Services Department

Walter S. Mangold Award

Keith L. Krinn RS, MA, DAAS, CPHA

NEHA presented the 2018 Walter S. Mangold Award to Keith L. Krinn RS, MA, DAAS, CPHA. The Mangold Award recognizes and honors individuals for outstanding contributions to the advancement of the environmental health professional. It is the highest honor that NEHA can bestow upon one of its members.

Upon receiving this honor, Krinn said, "I am deeply honored and humbled to receive the 2018 Walter S. Mangold Award. When one looks at the environmental health professionals who have been recognized in years past and the award's namesake, it is very sobering to think the Mangold Selection Committee would feel that I am qualified to stand with those giants of our profession."

Since taking the helm of the Environmental Health Division of Columbus Public Health in Ohio, Krinn has been instrumental in establishing continuous quality improvement initiatives within his agency. Some of his accomplishments include a major reorganization, the institution of an environmental health internship program, procurement of field inspection hardware for digitizing inspectional operations, the introduction of an innovative public information initiative



Keith Krinn gratefully acknowledged his wife Peggy during his Mangold Award acceptance speech.

called Columbus Signs, and formation of a city health code and program enforcing fines on tobacco retailers who attempt to sell to youth under 21 years of age.

Krinn has developed the Environmental Health Division of Columbus Public Health into a nationally recognized program of excellence. Under his leadership, Columbus Public Health was selected as the recipient of the 2009 Samuel J. Crumbine Consumer Protection Award for Excellence in Food Protection. Additionally, the Environmental Health Divi-

sion was the recipient of the 2015 Dr. R. Neil Lowry Grant for its recreational water program and the City of Columbus received the 2015 NEHA Excellence in Sustainability Award. The Environmental Health Division also secured three Best Practice Awards from the National Association of County and City Health Officials.

Krinn is active in the Ohio Environmental Health Association (which nominated him for the 2018 Mangold Award), the Michigan Environmental Health Association (where he served as president in 1999–2000), and the Ohio Association of Food Protection. Currently, Krinn serves on the advisory council of two National Environmental Health Science & Protection Accreditation Council-accredited environmental health programs—Ohio University and The University of Findlay. He served on the Samuel J. Crumbine Award Jury, the NEHA/American Academy of Sanitarian's Scholarship selection committee, and is a peer reviewer for the *Journal of Environmental Health*. Krinn has been a NEHA member for 29 years, served on the NEHA board of directors from 2007–2012, and was NEHA president in 2010–2011.

To read an interview with Krinn on NEHA's Day in the Life Blog, visit www.neha.org/node/60012.

Walter F. Snyder Environmental Health Award

Brian J. Zamora, REHS, MPH

Brian J. Zamora, REHS, MPH, received the 2018 Walter F. Snyder Environmental Health Award in recognition of more than 40 years of significant and lasting contributions to environmental and public health through leadership, collaboration, and consensus national standards development.

The Snyder Award honors NSF International's cofounder and first executive director, Walter F. Snyder, who provided outstanding contributions to the advancement of environmental and public health.

"Brian Zamora's accomplishments reflect the principles expressed by Walter F. Snyder and the public health mission of NSF International," says Kevan P. Lawlor, NSF International president and CEO. "Brian initiated many significant programs, particularly in potable water and wastewater protection, and developed numerous successful health initiatives. As chair of several NSF/ANSI standard joint committees,



Brian Zamora (left) receives the 2018 Walter F. Snyder Award from Kevan Lawlor (right), NSF International president and CEO.

his knowledge and proficiency were instrumental in successfully advancing standards development through the consensus process."

Zamora led many public health initiatives during his 40-plus-year career in environmental health roles. He retired in 2015 from the

County of San Mateo in California after 27 years of service, most recently as its director of Family Health Services. In this role, he spearheaded an electronic health record system that enabled public health nurses to easily record details during home visits and access other county services provided to patients.

Zamora is the longest serving member of NSF International's Council of Public Health Consultants, serving 10 terms over 28 years. He also chaired NSF International joint committees developing standards for dietary supplements, pharmaceutical excipients, sustainable textiles, and sustainable wallcoverings, and served on a technical committee for environmentally preferable products. Zamora has been a member of NEHA and the California Environmental Health Association for 35 years.

To read more about Zamora's career, visit www.nsf.org/newsroom/brian-j-zamora-earns-walter-f-snyder-environmental-health-award.

NOW TRENDING: 2018 AEC

The 2018 AEC dominated social media throughout the week, with attendees using Twitter, Facebook, and Instagram to share their comments and photos. Attendees were encouraged to post using the hashtags #NEHAAEC, #HealthyHomes, and #EHMatters, and it was quite clear that everyone had a wonderful time.



#NEHAAEC, #HealthyHomes, and #EHMatters Twitter Posts

Michele Samarya-Timm @MicheleSamaryaT
Last minute prep for the 2018 #NEHAAEC networking, learning AND seeing #Disneyland! It should be a memorable week for #EnvironmentalHealth! @nehaorg @NEHA_BIA #WomenofNEHA @WomenofNEHA

EnviroHealthLink @EnviroHealthKy
So happy to be here! #NEHAAEC #HealthyHomes #EHMatters

Dr. Umair A. Shah @ushahmd
Here's to the incredibly #strong #Environmental #publichealth #team representing @hcphtx at #NEHAAEC this week - gr8 job esp during #HurricaneHarvey #response but beyond every day! #invisibilitycrisis / @nehaorg @ASTHO @CDCgov @NACCHOalerts

Pam Patenaude @HUDDepSec
It's been our goal @HUDgov this #NHHM2018 to promote the prevention of hazards at home & to protect families where they should feel safest. #NHHM is all about unlocking the potential of America's future & it all starts in the home. Learn more: <https://www.hud.gov/healthyhomes>. #NEHAAEC

Got Food Poisoning? @iwaspoisoned
"...empowered to discover new and practical solutions to environmental health issues," it was a pleasure presenting at the NEHA Annual Education Conference. [@nehaorg #NEHAAEC #EHMatters #HealthyHomes #lapublichealth @lapublichealth](https://iwaspoisoned.com/news/IWP-at-NEHA-Annual-Education-Conference)

Women Of NEHA @NehaWomen
Women (& men!) of NEHA gather 2 show the desire & need 2 support women in #EnvironmentalHealth careers! #NEHAAEC #WomenofNEHA

HealthyHomesPartners @HealthyHomes4
Presenting the Healthy Homes Partnership Apps to a packed room at the National Healthy Homes Conference. #NEHAAEC #EHMatters

Climate for Health @Climate4Health
Thank you @nehaorg for a wonderful conference and reception of two @ecoAmerica and @Climate4Health presentations, the Climate for Health Ambassadors Training and NEHA's 2017 American Climate Metrics Survey results. What a wonderful partnership! #climatechangeshealth #NEHAAEC

Private Well Class @help4wellowners
Steve gave a great presentation today about our Private Well Class program at the #NEHAAEC conference in the BIG room that seats 540 people! #EHMatters

Sultan Altaher @Sultan_BuZayed
"Spoke at the NEHA annual meeting- what an amazing gathering of food safety and environmental health professionals" @nehaorg #NEHAAEC #EHMatters #FoodSafety #HealthyHomes

Cambro Manufacturing @Cambro1
Government agencies are using social media to track foodborne illness outbreaks in the early stages. #NEHAAEC #EHMatters

Shelly Canada @shelly_canada
"It's amazing what you can accomplish if you don't care who gets the credit". New NEHA president. Closing session #NEHAAEC #EHMatters

Michael Crea @Crea34239
Found some great people in the vendor area last night from Ozark River sinks #NEHAAEC #EHMatters

Janie Cambron @Jne310
#NEHAAEC reception was wonderful! Thxs @nehaorg & @AnaheimMarriott for a great night!

Scott Becker @scottjbecker
The Beach Boys got nothing on us! Great "Good Vibrations" reception, thank you @nehaorg #NEHAAEC

2018 AEC Contest Winners

Thank you to everyone who participated in the contests and for being so active on social media. Congratulations to all the contest winners!

Social Media Photo Contest Winners

Below are the winners of the Social Media Photo Contest. The selected winners were awarded a \$25 Amazon gift card. You can view their posts at www.neha.org/news-events/latest-news/congratulations-neha-2018-aec-contest-winners.

- Kathleen Boyer (@KathyBoyer73) Tri-County Health Department, Colorado
- Naser Jouhari (@NaserJouhari) Kansas City Missouri Health Department, Missouri
- Melissa Hennis (@BethlehemHealth) City of Bethlehem Health Bureau, Pennsylvania

Connect4 App Game

The popular Connect4App Game was held again this year. Attendees earned points by scanning QR codes at events, sessions, and by participating in other various activities, as well as scanning exhibitor and attendee QR codes. The winner of the Connect4App Game was Maria Menjivar, Environmental Management, County of El Dorado, Environmental Management, California.

Exhibition Booth Drawing Winner

The NEHA Exhibition Booth Drawing winner was Peggy Sarcoma, Denver Public Health, Colorado. Peggy won a complimentary full conference registration to the 2019 AEC in Nashville, Tennessee.

SAVE THE DATE



83rd ANNUAL EDUCATIONAL CONFERENCE & EXHIBITION

Nashville, Tennessee • July 9 - July 12



UPCOMING REGISTRATION DATES

Exhibitor Registration: November 1
Attendee Registration: December 1

Watch for further details on our website.



NEHA.ORG/AEC

NEHA NEWS

New Resources From NEHA

The mission of the National Environmental Health Association (NEHA) is to “advance the environmental health professional for the purpose of providing a healthful environment for all.” NEHA endeavors to meet this mission through its many activities, programs, and resources. We wanted to share some of the new resources we’ve been working on to uphold our mission and support environmental health professionals.

Policy Statements

One of NEHA’s responsibilities is to speak up on issues of concern to our members, which it does through the adoption of policy statements. By publishing these statements, we strive to keep environmental health professionals informed about where NEHA stands as an association on issues critical to environmental health. All policies are approved by NEHA’s board of directors.

So far in 2018, NEHA has posted four new policy statements on ear piercing guns, microblading, food safety as related to the consumption of cannabis-infused food products, and comprehensive mosquito control. In 2017, policy statements were posted on the sale or distribution of raw milk, uniform and integrated food safety system adoption, the Model Aquatic Health Code, and climate change. We are currently working on policy statements related to cottage foods and renewable energy.

You can find NEHA’s policy statements at www.neha.org/publications/position-papers.

Cannabis Resources

The legalization of cannabis, be it medically or recreationally, is occurring in many states across the U.S. As of June 2018, 30 states and the District of Columbia have legalized the sale of medical cannabis and 9 states have legalized the sale of recreational cannabis. As such, there is a growing concern regarding the food safety of cannabis-infused products (edibles) and a need for resources for environmental health professionals to address this new issue. Many state and local food safety agencies currently need to quickly, effectively, and efficiently establish food safety programs around the legalized cannabis industry.

In the March 2018 *Journal of Environmental Health*, we highlighted several resources that were being created to address this need. We are happy to announce that these resources are now available.

- **Cannabis 101: Glossary of Terms**—This glossary details over 60 definitions and concepts that relate to cannabis-infused products. The resource helps food safety professionals and industry workers to understand and identify common terms and products when out in the field.
- **Food Safety Guidance for Cannabis-Infused Products**—This guidance document can be used as a reference to learn what other states have done in establishing food safety programs for the cannabis industry.

In addition to these resources, NEHA has also hosted several webinars on the topic. All these cannabis resources can be found at www.neha.org/node/60143.

Virtual Conferences

NEHA has hosted several different virtual conferences over the past few years. Virtual conferences are a unique way for environmental health professional to exchange information and discover new solutions to current issues without having to travel outside of the office. Our past virtual conferences have included:

- **Enhancing Environmental Health Knowledge (EEK): Vectors and Public Health Pests Virtual Conference** (www.neha.org/EEK-2018);
- **EH₂O Recreational Waters Virtual Conference** (www.neha.org/eh-topics/water-quality-0/eh2o-recreational-waters-virtual-conference); and
- **Integrating Data to Empower Advancement (IDEA EH) Virtual Conference** (www.neha.org/eh-topics/informatics/idea-eh-virtual-conference).

We are currently working on our next virtual conference—**EnSafe: Ensuring Safety in Private Drinking Water Systems**, October 16–17, 2018. The EnSafe Virtual Conference is designed to enhance the knowledge of environmental public health professionals and water safety specialists to help close the water quality gap in unregulated private drinking water. Registration is open and you can learn more at www.neha.org/node/60151.

New Food Manager and Handler Books

NEHA is pleased to offer new editions of its *Professional Food Manager* and *Professional Food Handler* books. Both books have been updated to the Food and Drug Administration’s 2017 *Food Code*. The books help food managers and handlers learn about the food safety principles needed to ensure the continued successful execution of food safety best practices in the workplace. The books can also help qualified candidates prepare for food manager and handler certification exams. You can find the books in NEHA’s online store at www.neha.org/store.

A Day in the Life Blog

Did you know that NEHA has a Day in the Life of an Environmental Health Professional blog? We have posted 13 different blogs in 2018 for people to read and comment on. These blogs cover a wide variety of environmental health topics—emergency preparedness and disaster response to hurricanes and wildfires, responding to the opioid epidemic, food trucks, rapid population growth and smart development, the use of technology to create a food recovery app, and achieving health and social equity through housing.

The blog also spotlights NEHA members. The latest blog is a member spotlight on Clint Pinion, Jr., MPH, DrPH, RS. Pinion shares his passion for environmental health, working with students, and the value of NEHA membership in this blog. You can find this blog and all the others at www.neha.org/membership-communities/get-involved/day-in-life.

As you can see, we’ve been busy at NEHA putting together these timely, relevant, and useful resources. Stay tuned as we continue to enhance and build upon the resources we offer! 🍷

DirectTalk

continued from page 62

affect our lives. Special efforts should be made to include youth and vulnerable communities in crafting solutions and setting policy.

You will be hearing more from me in the future about a roadmap to clean energy. I feel the need to lead by example through not only walking more and taking public transportation but also eating lower on the food chain (i.e., eating more locally grown and in season fruits and vegetables, as well as less meat and meat products). This endeavor is coming from a guy whose comfort foods are sausage and eggs, salami sandwiches made with white bread drowning in yellow mustard, and slow-cooked barbeque pork ribs.

It's now my time to personify black pepper. Irritating but essential to good health. Our nation and planet are increasingly under water, under a cloud of smoke, and generally under sustained stress. I recognize some of us do not believe that humans have an appreciable impact on climate. I acknowledge that



Golden milk. Photo courtesy of David Dyjack.

it is politically disadvantageous to talk about this subject or work in this space because of local politics. I ask that you lead in any way possible given your local set of conditions.

Over the next few years I plan to stay on message, possibly to the point of irritation. NEHA members should be perceived by our

communities as leaders in the national climate conversation. We should live our lives in a manner that demonstrates our individual commitment to reducing our carbon footprint. Collectively, all 7,000 of our members working in concert can make a difference in solving this crisis.

I end with a story. About one year ago, Georgetown, Texas, became the first city in Texas to operate solely on renewable energy. The city's mayor was quoted as saying, "We have a moral and ethical obligation to leave the earth better than we found it." Georgetown is a conservative town in a conservative state. I intend to learn more about Georgetown and its journey to renewable energy. Was it nature or nurture? Was it economics or ecology? I applaud Georgetown and those following in its footsteps.

It's getting late and there is ginger to grate in a few hours. 🐻

Dave

ddyjack@neha.org
Twitter: @DTDyjack

Integrating Data to Empower Advancement

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- REQUEST FOR PROPOSAL (RFP) PROCESS OUTLINE



- GLOSSARY OF RFP TERMS
- REPOSITORY OF RFP MATERIALS
- MORE RESOURCES TO COME



VISIT NEHA.ORG/EH-TOPICS/INFORMATICS FOR MORE DETAILS!

► **DirecTalk** MUSINGS FROM THE 10TH FLOOR

David Dyjack, DrPH, CIH

A Season of Discontent

Tumeric root, freshly grated ginger, full-fat coconut milk, and a dollop of Mānuka honey heated on the stovetop make for a glorious and healthy breakfast beverage. Golden milk is admired in many eastern cultures for its health promoting attributes, one I enjoy in my quiet time before the day begins in earnest. There is one, almost incongruent, ingredient I blend into the beverage: a grind or two of black pepper. Black pepper possesses its own antioxidant phytochemical piperine, which increases bio-availability of other nutrients. Piperine is also known for its ability to stimulate cells to absorb and retain nutrients from food. Clearly, black pepper can play an important role in an effective digestive system.

Black pepper is more commonly known as a mucous membrane irritant. Edge your nose close to freshly ground peppercorns and you'll immediately appreciate these qualities. As a metaphor for quality improvement, we are nudging NEHA into the black pepper phase of our evolution. Tonight, as I scan the news, there is massive flooding in Lynchburg, Virginia. The California Carr Fire has devoured 130,000 acres and taken several lives. Marshalltown, Iowa, is recovering from a massive tornado. A red tide in southwest Florida is in its ninth month and is harming fisheries and wildlife, as well as ruining family holidays. An alarming drought is lingering throughout the southwestern U.S. The earth is speaking to us, it's time for action.

NEHA is doing what it can within its means to minimize its impact on the environment. Our current office building is Energy Star

*Collective action,
new thinking,
and leadership
are in order.*

compliant, and when our lease ends, we are looking to relocate into new digs. We have already explored at least one potential new site. The promising prospect is a Leadership in Energy and Environmental Design (LEED)-certified building. LEED is an internationally recognized green building certification system providing third-party verification that a building was designed and built using strategies aimed at improving performance: less energy, greater water efficiency, reduced carbon dioxide emissions, improved indoor environmental quality, and stewardship of resources and sensitivity to their impacts.

We have taken other steps to reduce our carbon footprint. NEHA staff are encouraged to walk, bike, or take public transportation whenever possible. I walk. NEHA has also implemented a telework policy that further reduces our carbon footprint. We have taken steps to reduce unnecessary consumption of natural resources. We are actively planning to take the organization into the paperless era. Our incoming faxes are now digitized without the need to be printed. These faxes are securely forwarded to the intended recipi-

ent. Our credentialing department is working diligently to go paperless. Our Annual Educational Conference & Exhibition is largely paperless. I'm pleased to report that 77% of this year's attendees actively used the conference app, which reduces the need for paper programs. Furthermore, we are increasingly negotiating with our conference hotels to serve locally grown food at our meal functions and to provide vegetarian options.

This year we partnered with ecoAmerica to support climate initiatives in Franklin County, Ohio; Cambridge, Massachusetts; and Salt Lake County, Utah. We hope to expand that effort soon with support from federal and other sources.

The NEHA board of directors is also providing national leadership. We have divested ourselves of tobacco stocks and I will urge the board to support a climate for health declaration by committing us to work towards 100% clean energy by 2030, in part by purging our investment portfolio of fossil fuels. Why is that important? We need to lead collective action across the country, provide new thinking, and above all else, be leaders in this important effort. Let's do our part to promote clean energy, avoid costly carbon pollution from dirty fuels, and provide choices in affordable energy. These efforts should improve people's health and help to build a shared and sustainable prosperity. At the same time, we can assist our communities to be better prepared for the kinds of floods, fires, and droughts we are currently experiencing. Finally, our efforts should involve all Americans. All of us must have a say in decisions that

continued on page 61



Control of Communicable Diseases: Laboratory Practice

Edited by
Burton W. Wilcke, Jr, PhD
and **David Heymann, MD**

ISBN: 978-0-87553-285-1,
750 pages, Softbound, 2019

Laboratory Practice is a new complement to the *Control of Communicable Diseases Manual*, a book published by APHA Press for over 100 years and also the primary resource for disease control specialists. This new book addresses the laboratory aspect of disease control and prevention while presenting the material in an easy-to-use format.

Laboratory Practice gives an overview of the latest laboratory procedures for each disease, as well as information on laboratory safety practices, the critical role of quality assurance in all testing and the importance of laboratory informatics and rapid reporting processes. With in-depth detail for each disease, this is a must-have for all laboratory scientists, epidemiologists and others involved with communicable disease control. *Laboratory Practice* supports both planning and response for disease control.

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AN IMPRINT OF AMERICAN PUBLIC HEALTH ASSOCIATION

Last year Angie Clark did over **500** routine inspections, almost **100** complaint inspections, **5** Court dates, logged **3,000** travel miles and quite possibly prevented dozens of illnesses.

She doesn't take chances. The communities she serves depend on her to do more inspections under an increasingly difficult workload and conditions. In the office or on the road, she demands the most from her tools and equipment.

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Access to Free Home Test Kits for Radon and Secondhand Smoke to Reduce Environmental Risks for Lung Cancer

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Abstract This study examined the prevalence of home testing for radon and secondhand smoke (SHS) and associations between testing status and sociodemographic variables. It was a cross-sectional study of the baseline data from a randomized controlled trial to test the effects of a personalized environmental report-back intervention on exposure to radon and SHS in the home. Homeowners ($n = 515$) and renters ($n = 47$) were recruited in primary care or community settings using stratification by smoking in the home. Homeowners were randomly assigned to treatment or control; renters were assigned to treatment. Home testing status was determined by completion of short-term radon test kits and passive airborne nicotine samplers. Free test kits were provided to the treatment group. Controls received a coupon for free test kits. Of the 562 participants, 48% tested for radon and SHS. Higher education was associated with increased likelihood of testing. Homeowners and renters in the treatment group were more likely to test than homeowners in the control group. Participants were more likely to test their homes when provided free test kits in person.

Introduction

Lung cancer is the second most commonly diagnosed cancer and has the highest death rate of all cancers in the U.S. (Henley et al., 2014). These deaths are largely preventable by eliminating primary and secondhand exposure to tobacco smoke and exposure to radon (Centers for Disease Control and Prevention [CDC], 2016). Although most people are aware that smoking is the primary cause of lung cancer, many do not know that an estimated 25% of lung cancer cases globally occur in nonsmokers, resulting in approximately 300,000 deaths every year (Sun, Schiller, & Gazdar, 2007).

The second leading cause of lung cancer is exposure to radon (Neri, Stewart, & Angell, 2013), resulting in an estimated 15,000–22,000 lung cancer deaths every year in the U.S. (Kim, Hwang, Cho, & Kang, 2016). More radon-related lung cancers are diagnosed in individuals with a history of exposure to tobacco smoke. Synergistic risk, or exposure to both tobacco smoke and radon, increases lung cancer risk dramatically (National Research Council, 1999). Radon exposure, however, is a risk for both smokers and nonsmokers. Among never smokers, exposure to radon can be more harmful for those exposed to secondhand smoke (SHS)

(Lagarde et al., 2001). Despite the known synergistic risk, there is little public awareness of the combined risks of exposure to tobacco smoke and radon. There is a need to develop and test strategies to motivate individuals to create healthy homes, free of both radon and SHS.

The home is the major source of SHS. Most homeowners can control the quality of the air they breathe by adopting smoke-free home policies. Many adults and children are exposed to SHS, particularly those living in rental properties (Homa et al., 2015; Marano, Schober, Brody, & Zhang, 2009). These households are often composed of less educated parents or headed by a single parent, and they are more likely to report indoor smoking (Zhang, Martinez-Donate, Kuo, Jones, & Palmersheim, 2012). Multiunit housing, where smoking is often allowed, is especially problematic as tobacco smoke moves through air ducts, wall and floor cracks, elevator shafts, and along crawl spaces into other units (King, Cummings, Mahoney, Juster, & Hyland, 2010).

Efforts to separate smokers from their nonsmoker neighbors, to improve ventilation, and/or to increase air cleaning cannot control exposure to SHS in multiunit housing (American Cancer Society, 2018). Those who live in multiunit housing do not have as much control over decision making related to smoking as those who own a single-family residence. A recent study done with a group of renters who were provided with free home radon and airborne nicotine test kits, however, found that stage of action in home testing and adopting a smoke-free home policy increased from study

baseline to 3-months postenrollment, showing that this intervention might motivate renters to adopt behaviors for healthier homes (Hahn, Rademacher, Wiggins, & Rayens, 2018). Effective fall 2018, the U.S. Department of Housing and Urban Development announced a new rule to prohibit smoking in public housing (Office of the Assistant Secretary for Public and Indian Housing, 2016).

The home is also the major source of radon exposure. Radon, an odorless, colorless radioactive gas, results from the decay of uranium naturally found in soil and rock. Radon can enter a home by diffusion from the soil through concrete floors and walls, foundation cracks, floor drains, sump pumps, construction joints, and cracks or pores in hollow-block walls (Radon Testing Corporation of America, 2010). Despite the potential risk, many individuals might believe there is not a radon problem in their home (Kennedy, Probart, & Dorman, 1991), particularly because radon cannot be detected by human senses (Neri et al., 2013).

According to the U.S. Environmental Protection Agency (U.S. EPA), radon levels ≥ 4.0 pCi/L warrant mitigation (Sethi, El-Ghamry, & Kloecker, 2012). Mitigation is the process used to rid a building of detectable levels of harmful substances. The U.S. Surgeon General and the U.S. EPA estimate that 1 in 15 residences in the U.S. exceed 4.0 pCi/L and recommend that every residence be tested for radon (Neri et al., 2013).

Testing indoor air in homes is an underutilized area of prevention. Due to the serious health risks associated with home exposure to radon and tobacco smoke, it is important to examine what factors and characteristics can motivate people to test their homes and ultimately remediate the issue to create homes free of radon and SHS.

The purposes of this study were to 1) examine the prevalence of home testing for radon and SHS at baseline of a randomized controlled trial (RCT) to test the effects of a personalized environmental report-back intervention to reduce home exposure to radon and SHS and 2) look at the associations between testing status and sociodemographic variables.

Methods

Design and Sample

The design was a cross-sectional study of the baseline data from a RCT to test the effects

of a personalized environmental report-back intervention on exposure to radon and SHS in the home. Homeowners ($n = 515$) and renters ($n = 47$) were recruited at a university medical center's outpatient clinics and pharmacy, and at community events in the southeastern U.S. An institutional review board approved the study to assure protection of human subjects.

Procedure

Homeowners were randomly assigned to treatment (TRT) or control (CTL) groups, and stratified by whether or not there were any smokers living in the home. We continued recruitment and randomization until 515 homeowners were enrolled. Approximately half of the homeowners were in each home-smoking stratum and there was an equal likelihood of being assigned to TRT or CTL groups. Renters were also stratified (with approximately equal strata sizes) by whether or not there were any smokers living in the home, but all renter participants were assigned to the TRT group (renters formed a substudy of the larger RCT).

At enrollment, we provided free home test kits for radon and SHS to the TRT homeowners and renters groups; participants received \$20 to test their homes. CTL group homeowners received a coupon for free test kits, but no financial incentive to test. Radon and SHS test kits came with written instructions and were simple to use. Participants were instructed to deploy test kits per package instructions and leave the test kits out for 6 days prior to returning them in the mail using prepaid postage. Both groups were paid \$10 to complete a brief survey at baseline.

Measures

Home testing status: We assessed home testing status for radon and SHS by determining whether a participant returned a test kit they had deployed in their home. We used short-term radon test kits (Air Chek, Inc., www.radon.com) and passive airborne nicotine samplers to assess SHS exposure (Hammond & Leaderer, 1987; Ogdan & Maiolo, 1992). Participants were coded as positive for testing if they returned a kit, whether or not the kit was valid. The kit was determined to be valid if testing dates were recorded as consistent with the prescribed time frame and the kit was returned intact with all pertinent writ-

ten information. The main outcome for this study, testing for both radon and SHS, was determined by evaluating whether both tests were returned.

Smoker(s) living in the home: At recruitment, potential participants were asked, "Do you or any members of your household smoke cigarettes, cigars, or pipes?" This question was used to assign potential participants to one of the home-smoking strata during recruitment.

Demographic characteristics: The survey assessed age (in years) and sex (male, female). Race was measured using a 5-categorical nominal variable that included American Indian/Alaska Native, Asian, Native Hawaiian/Other Pacific Islander, Black or African American, White, and more than one race. Ethnicity was recorded as Hispanic or Latino, or not Hispanic or Latino. Consistent with the demographics of the population in this region, most participants were White and not Hispanic or Latino. We created a binary race/ethnicity variable with these as one subgroup and all minority racial/ethnic combinations in the other. Education was measured with an 8-item ordinal variable with response options ranging from never attended/only kindergarten to postgraduate education. This variable was dichotomized to "at most some college" versus those with college degrees or postgraduate education. We also asked, "How many people under the age of 18 live in your current residence?" We created a binary indicator for whether there were children living in the home.

Data Analysis

Group differences in demographics and personal characteristics were determined using one-way analysis of variance (ANOVA) or chi-square test of association, as appropriate. Logistic regression assessed predictors of the outcome (testing for both radon and SHS). The Hosmer-Lemeshow goodness-of-fit test assessed model fit, and variance inflation factors gauged the presence of multicollinearity. Analyses were conducted using SAS version 9.4, with $\alpha = .05$.

Results

Of the 562 participants in the study, 56% tested for radon, 49% tested for SHS, and 48% tested for both. The rate of testing for both radon and SHS varied by group ($\chi^2 =$

FIGURE 1

Percent Testing for Radon and Secondhand Smoke at Baseline by Group and Whether There Are Any Smokers Living in the Home

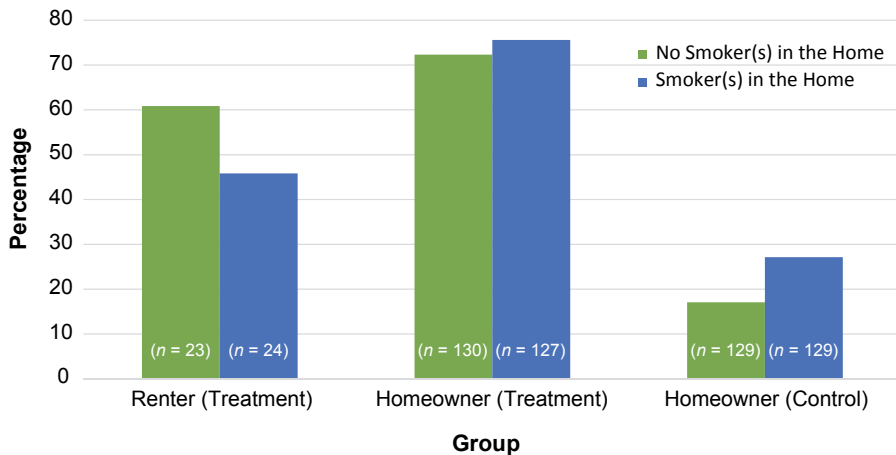


TABLE 1

Descriptive Summary of Sociodemographic Characteristics With Group Comparisons

Variable	Renter Treatment (n = 47) # (%)	Homeowner Treatment (n = 257) # (%)	Homeowner Control (n = 258) # (%)	p-Value
Age (years; mean, SD)	42.5, 14.7 ^a	51.6, 12.8 ^b	50.9, 12.6 ^b	<.001
Sex				.68
Male	18 (38.3)	84 (32.7)	82 (31.8)	
Female	29 (61.7)	173 (67.3)	176 (68.2)	
Race/ethnicity				.008
White/non-Hispanic	32 (68.1) ^a	222 (86.4) ^b	215 (84.0) ^b	
Other	15 (31.9)	35 (13.6)	41 (16.0)	
Education				.001
At most some college	31 (66.0) ^a	103 (40.2) ^b	96 (37.2) ^b	
College graduate	16 (34.0)	153 (59.8)	162 (62.8)	
Children in the home				.35
Yes	13 (27.7)	92 (35.9)	99 (38.5)	
No	64 (72.3)	164 (64.1)	158 (61.5)	
Smoker(s) in the home				.99
Yes	24 (51.1)	129 (50.0)	127 (49.4)	
No	23 (48.9)	129 (50.0)	130 (50.6)	

Note. Groups with the same letter are not significantly different in the pairwise comparisons.

139.0, $p < .001$), with renters (all in the TRT group) and homeowners who were randomly assigned to the TRT group having higher rates of home testing compared with home-

owners in the CTL group. More than half of renters (53%) tested, compared with 74% of homeowners in the TRT group and 22% of homeowners in the CTL group; each of these

groups was significantly different from each of the others in rate of testing ($p < .05$ for each pairwise comparison). There were no differences in rates of testing within each of these three groups when comparing those with and without any smokers living in the home (Figure 1; all within-group comparisons by home smoking were not significant at the α level).

As shown in Table 1, there was a significant difference among the groups in average age ($p < .001$); renters were significantly younger than either of the homeowner groups, but there was no difference in age between the homeowners in TRT and CTL groups. There was no group difference in sex of respondent: across the three groups, two thirds of participants were female (67%). There was an overall group difference in race/ethnicity ($p = .008$), with the renter group less likely to be White/non-Hispanic compared with either homeowner group.

As with age, there was no difference in race/ethnicity distribution between the homeowner TRT and CTL groups. Renters tended to have less education than the homeowner groups ($p = .001$), and the two homeowner groups did not differ significantly on educational attainment; the percent of those with a college degree was 34% in the renter group compared with 60% and 63% in the homeowner TRT and CTL groups, respectively. There was no difference in percent with children in the home among the three groups: 35% of all participants had at least one child in the home. Each of the three study groups had approximately half in each of the home-smoking strata, with no difference among the groups.

The overall model to assess predictors of testing for both radon and SHS was significant ($\chi^2 = 146.6, p < .001$). The significant predictors of the dual testing outcome were education and study group. Those with a college degree or higher were 2 times as likely to test for both radon and SHS ($p = .002$). Homeowners in the TRT group were nearly 10 times more likely to test for radon and SHS, compared with homeowners in the CTL group ($p < .001$). Renters were 5.5 times more likely to perform both tests, compared with homeowners in the CTL group ($p < .001$). Home testing for both radon and SHS was not related to age, sex, race/ethnicity, whether there were any children living in the home, or whether there were any smok-

TABLE 2

Logistic Regression Model to Evaluate Predictors of Testing for Both Radon and Secondhand Smoke (*n* = 556)

Variable	OR (95% CI)	<i>p</i> -Value
Age	1.01 (0.99, 1.03)	.23
Sex		
Male versus female	0.68 (0.45, 1.03)	.072
Race/ethnicity		
White/non-Hispanic versus other	0.91 (0.53, 1.54)	.72
Education		
College graduate versus other	2.00 (1.29, 3.10)	.002
Children in the home		
Yes versus no	0.85 (0.54, 1.33)	.47
Smoker(s) in the home		
Yes versus no	1.53 (1.00, 2.36)	.052
Group		
Renter (TRT) versus homeowner (CTL)	5.59 (2.75, 11.35)	<.001
Homeowner (TRT) versus homeowner (CTL)	9.63 (6.36, 14.61)	<.001

OR = odds ratio; CI = confidence interval; TRT = treatment group; CTL = control group.

ers living in the home. Though not meeting the strict cutoff for significance, the *p*-value of this last variable was close to the α level ($p = .052$).

This finding suggests a trend toward those with any smokers in the home being more likely to test for both radon and SHS, compared with those living with only nonsmokers; those living with one or more smokers were 1.5 times more likely to test for both, compared with those in nonsmoking homes. The Hosmer–Lemeshow test was not significant ($\chi^2 = 1.9$, $p = .98$), indicating the model fit the data well. Variance inflation factors were all less than 1.3, which suggests multicollinearity is unlikely to have caused any parameter distortion.

Discussion

Nearly half of participants tested their homes for both radon and SHS when offered free test kits, although testing for radon was slightly more prevalent than testing for SHS. This finding is similar to a previous pilot study describing the feasibility of engaging patients in home testing in a primary care setting; 76% tested for radon but less than half (49%) tested for SHS (Hahn et al., 2014). In the study reported here, providing a coupon for free test kits and requiring participants to call

to request that test kits be mailed to them did not have the same effect.

Those who received the free test kits on site and directions on how to deploy them in their homes were more likely to actually test their homes for radon and SHS compared with those who were given a coupon for free test kits. In many states, usual practice in home radon testing is to ask individuals to contact an agency to get free or low-cost radon test kits, or they must visit a home improvement store to purchase a radon test kit; SHS test kits are not commercially available. Our findings support efforts to increase access and affordability of radon and SHS test kits in primary care settings and other community locations to promote home testing.

It is critically important to eliminate barriers to home radon testing. Providing the test kits in person eliminates the time needed to identify and contact the relevant public health agency, and removes the waiting time to receive the test kit. This in-person approach might provide a stronger cue for follow-through with home testing. In addition to providing the test kits in person, we paid participants to test their homes for both radon and SHS, which might have been another incentive. Testing home indoor air is an essential step toward environmental

risk reduction to prevent lung cancer. New approaches are needed to engage the public in more integrated radon and tobacco control efforts. In particular, targeted strategies aimed at individuals and families living with smokers are greatly needed, as radon control efforts have stalled in the U.S. (Lantz, Mendez, & Philbert, 2013).

Understanding the predictors of home testing for radon and SHS can guide the development of targeted approaches to reduce exposure to these environmental pollutants. Those with a college education were 2 times as likely to test their homes for radon and SHS; yet, renters in our study were more likely than homeowners in the CTL group to test for radon and SHS despite the fact that renters had lower educational attainment than homeowners, consistent with a previous study of renters and radon risk reduction (Larsson, 2014). Over half of renters (53%) in our study completed home testing.

To improve lung cancer prevention efforts, renters are a special case to consider as environmental health disparities—including increased risk for radon and SHS exposure—are common among those who rent (Adamkiewicz et al., 2014; Larsson, Hill, Odom-Maryon, & Yu, 2009). Further, cigarette smoking, the primary cause of lung cancer, is higher among individuals with incomes below the federal poverty line (CDC, 2012). Renters, particularly those in multihousing units, share control of their indoor air environment with their landlord and individuals in neighboring rental units (Hahn et al., 2017). Due to the number of residents in rental properties, there is increased complexity in addressing exposure to radon and SHS. Despite these disparities and complexities, renters in our study were receptive to home testing.

Tailoring radon prevention efforts to the needs of low-socioeconomic communities is needed to reduce lung cancer risks from radon exposure coupled with higher rates of cigarette smoking and SHS exposure. Healthy indoor spaces in low-income communities that are free of environmental pollutants have become an important and necessary focus for environmental justice efforts (Adamkiewicz et al., 2011). More research is needed to understand access to home testing for radon and SHS among renters and property owners.

Another factor that can affect home testing is smokers living in the home. We doc-

umented a trend (albeit not a statistically significant trend) toward increased testing for radon and SHS among those with smokers in the home. Within each study group (i.e., homeowner TRT, homeowner CTL, and renter), however, those with smoking in the home were equally likely to test for both radon and SHS. The baseline survey asked about synergistic risks, which might have raised concern for those with smoking in the home. On the other hand, this question could have led nonsmokers to believe they did not need to test for radon and SHS. Public education on the synergistic effects of radon and SHS is needed, as well as further research on the perceived synergistic effects of radon and SHS and their impact on home testing.

Age, sex, and race/ethnicity were not associated with home testing status, implying that universal approaches to promoting home testing for radon and SHS might be equally effective with all ages, races/ethnicities, and with both males and females. Interestingly, the presence of children in the home was not associated with home testing status. This null finding is consistent with the fact that individuals living with children in this study were not more likely to worry about lung cancer, or to perceive risk or synergistic risk from radon and SHS compared with those not living with children in the home (Huntington-Moskos, Rayens, Wiggins, & Hahn, 2016).

Related to this finding, the research on the impact of having children in the home and smoke-free homes is mixed. One study reports that smoke-free homes are more likely to be reported by those with children living in the home (Borland et al., 2006). Another study by our group, however, did not find an association between having children in the

home and reporting a smoke-free home policy (Butler et al., 2014). Public education on the importance of smoke-free homes, synergistic risks of radon and SHS, and testing for radon and SHS—especially with individuals living with children—is warranted.

The primary study limitation is a relatively small sample of renters compared with the number of homeowners. Consistent with the demographics of the region, most participants were White/non-Hispanic. In addition, the socioeconomic status of most participants was relatively high given most owned their home. The high percentage of college-educated participants was due in part to recruiting at a university medical center, resulting in selection bias.

Study findings might not be generalizable to more diverse populations. We did not examine efforts to reduce risk in this study, as it was beyond the scope of this analysis. It should be noted that test kits for SHS are not commercially available at this time. The oversampling of those with smokers living in the home is a strength of the design, as this allowed for a more balanced assessment of access to home testing for radon and SHS.

Conclusion

Renters and homeowners are receptive to home testing for radon and SHS, especially when there is easy access to the test kits. Providing free test kits in person can engage homeowners and renters of all ages, both males and females, all race/ethnicity groups, and those with and without children in the home. Primary healthcare and community settings are promising locations for environmental risk reduction activities, especially for those at high risk of environmentally induced diseases, such as lung cancer.

Eliminating the barriers to access for home test kits will reduce the risk of exposure to environmental pollutants such as radon and SHS. Targeting renters and their respective property owners is of particular importance to address environmental justice, as renters tend to be younger, ethnically diverse, and less educated than homeowners. Lung cancer prevention efforts must also reach families with children to decrease the risk associated with environmental exposures; intervening early to eliminate environmental exposures will positively impact the cumulative risk over their lifetime.

More research is needed to examine the likelihood of home testing for radon and SHS among both homeowners and renters. Environmental and public health professionals are in a unique position to educate individuals and families about the importance of home testing and to promote ready access to home test kits. Testing home indoor air is an essential step toward environmental risk reduction to prevent lung cancer. 🐾

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