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Exploring the Benefits and Value of

Environmental Health Internships

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ABOUT THE COVER

Internships are an essential component of preparing prospective college graduates for entering the practice-based field of environmental health. Efforts are needed to ensure a supply of highly qualified and prepared graduates is available to sustain and strengthen the environmental health workforce. This month's cover article, "Exploring the Benefits and Value of Public Health Department Internships for Environmental Health Students," highlights the National Environmental Public Health Internship Program and an assessment conducted with former interns and mentors to explore experiences and perspectives. Overall, the internships appeared to provide environmental health students with a well-rounded professional and practice-based experience, while health departments benefited from hosting interns with a foundational knowledge and college education in environmental health.

See page 20.

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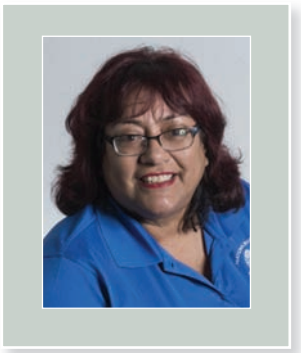

Sandra Long, REHS, RS

Self-Care: Focusing on You

While there is a variety of topics to select for this column, I would like to focus on you, the individual. This year has been a year of many changes, adjustments, and carrying out duties outside of the routine. With this type of activity comes stress. As we all know, some stress is good and some is, well, not so good or positive and is negative stress. Examples of positive stress are going on a holiday or vacation, learning something new, completing a goal, or buying a house. As we are approaching the holidays that can bring both positive and negative stress, I want to focus on good self-care and how you take care of yourself.

For months I have been on emergency management calls with Dallas County. At the end of each week, the Dallas County judge would thank us of taking care of the public and remind us that we needed to remember to take care of ourselves. He would insist that for the weekend we take a break from our emergency management duties because if we didn't, we wouldn't be able to carry on at our best. He would say, "Do some self-care this weekend."

Let's talk about self-care. The *Oxford Dictionary* defines self-care as the practice of taking an active role in protecting one's own well-being and happiness during periods of stress.

It sounds easy but is probably the one thing most of us are not really good at doing. Lack of energy and time are the two most common reasons self-care is not practiced. Feelings of selfishness, guilt, and finances also contribute to not practicing self-care. People tend to have misperceptions about self-care. It is not typically about treats or pampering oneself, it is not the negative stereotype of putting your needs ahead of others, it is not a list of behaviors, and it is not just about solitary activities.

> *Practicing self-care can have a remarkable difference in your well-being and overall health.*

So, now that you know what self-care is not, what is it? And is it really that important? Stress can affect the way we think, feel, and act toward each other. If we let stress rule our lives, we could become unhappy, have fatigue and poor physical health, and burn out. Self-care means knowing yourself, your limits, what makes you happy, identifying ways to enjoy yourself, finding ways to decompress, practicing gratitude, and eating and sleeping properly. Self-care does not have to be time consuming, exhausting, or expensive. Sometimes it is the quick, simple things that can keep us rejuvenated.

It is important to establish a self-care routine. Schedule some time for yourself. Then engage in an activity you find enjoyable or try something new. For example, I have two go-to activities, both of which I truly enjoy. One is photography. I enjoy going out walking with my camera and experimenting with settings, light, and composition. I may not be great at it yet but there is continuous improvement and thank goodness for digital where I can delete the blurry shots. My other favorite photo subjects are my granddaughters and I cannot get enough of those pictures. My other stress relief is creating in the kitchen or baking. I will find a recipe for something new or sometimes familiar, and bake cakes or cookies. This summer I made jams and jelly, a skill I learned growing up. It is time spent focusing on something different and time spent creating. The baking is generally portioned into snack size plastic bags and taken to work. I have not had any complaints and received a few compliments.

I challenge you to find your stress relief. That thing, hobby, or interest you have always thought about doing but never thought you had time to do. Let me give you a kick start with some ideas that might fit what you like to do: write, take a nap, do yoga, color, volunteer (a social and community benefit), play with pets or volunteer at a local animal shelter, read, meditate, walk in a park, observe a sunset or sunrise, commune with nature, listen to music or audiobooks, meet a neighbor, cook, learn to paint, learn to play an instrument, go for a drive, learn something new, take a bike ride, learn martial arts, learn to make movies, garden, or find a new hobby. Find something that

gives you energy, opens your mind, and releases stress.

Practicing self-care can have a remarkable difference in your well-being and overall health. It can enhance your self-awareness, promote rest and relaxation, and can potentially lead to new interests. If you are interested in learning more about self-care or want to do your own research, good starting points are *Psychology Today* and authors such as Dr. Shainna Ali, Dr. Tchiki Davis, and Elizabeth Scott. With the holiday season near, it could be a good time to invest in some self-care.

I appreciate and value your work in environmental health and want you to appreciate yourself.

President@neha.org

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A Multistage, Geocoding Approach for the Development of a Database of Private Wells in Gaston County, North Carolina

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Abstract **Many existing inventories of private wells in the U.S. lack digital geographic coordinates, and county-level permitting systems often store information in paper copies. We developed a GIS database of private wells from paper permits issued since 1989 in Gaston County, North Carolina (n = 8,721) using a multistage, geocoding approach. We then assessed the positional accuracy of the geocodes from the field-collected GPS location of these wells. In total, 98.9% of permits were successfully geocoded and 12.3% were secured with GPS devices. There were significant differences (p < .05) in positional accuracy for rooftop, parcel, and street geocodes of private wells in the GIS database, but positional accuracy was high for rooftop geocodes. Our approach is portable to other regions interested in the development of a digital inventory with GIS of private wells to aid in monitoring water quality and planning public health interventions.**

Introduction

Although most people in the U.S. drink water from public water systems, about 13 million households (45 million people) rely on unregulated private wells for drinking water (U.S. Environmental Protection Agency, 2020). Private wells use groundwater, which is prone to contamination. Sources of contamination to groundwater include leaks from coal ash ponds (Huggins, Senior, Chu, Ladwig, & Huffman, 2007), underground storage tanks (Fabro, Ávila, Alberich, Sansores, & Camargo-Valero, 2015), landfills, septic systems (Schaider, Ackerman, & Rudel, 2016), and excessive fertilizer application and animal waste (Messier, Kane, Bolich, & Serre, 2014). Groundwater contamination can also originate from native rocks. For example, the native rocks in the Piedmont region, including Gaston County, North Carolina, are associated with high levels of arsenic in groundwater (Harden, Chapman, & Harned, 2009; Pippin, 2005).

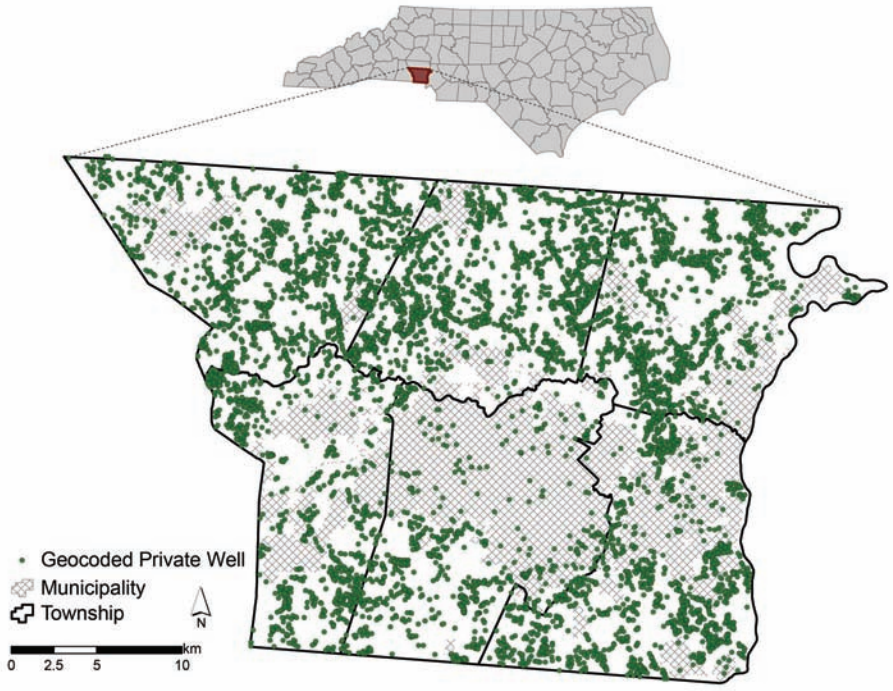
In North Carolina, local health departments issue permits for private wells and test for bacteria and inorganic chemical contaminants after construction of a new private well (MacDonald Gibson & Pieper, 2017). Most counties keep copies of the permits on file in paper format. For example, Mecklenburg County Health Department (2019) developed a digital GIS database showing the geographic locations of their private wells, but for many other counties this information is unavailable. The lack of geographic coordinates of private wells poses challenges to using GIS to model exposure to contaminants and then communicate risk to well users (Lan, Tang, Dye, & Delmelle, 2020).

To develop a GIS database of private wells, geocoding techniques can be used to convert location information in the form of addresses into geographic coordinates of longitude and latitude (Owusu, Lan, Zheng, Tang, & Delmelle, 2017). Geocoding an address requires spatially explicit road, parcel, or rooftop reference data sets to convert the address information to longitude and latitude of the reference data. These reference data sets also define the three geocoding techniques available in GIS.

Two measures of geocoding data quality that are recognized in the literature are match rate and positional accuracy (Goldberg, Wilson, & Knoblock, 2007; Zhan, Brender, de Lima, Suarez, & Langlois, 2006). Geocoding match rate is the number of successful matched results and is dependent on the availability of up-to-date reference data (Goldberg et al., 2013). An approach to improve geocoding match rates is to combine multiple reference data sets and use hierarchical rules in a multistage approach. For instance, multistage geocoding using street and parcel data sets improved geocoding match rate of sex offenders in Hamilton, Ohio, from 80% to 90% (Murray, Grubesic, Wei, & Mack, 2011). Sonderman and coauthors (2012) incorporated multiple base references from commercial vendors and U.S. Postal Service address point reference data to improve the geocoding match rate to 99%. The geocodes can also be placed manually when nearby features are known (Goldberg,

FIGURE **1**

Geocoded Private Wells in Gaston County, North Carolina



2011; McDonald, Schwind, Goldberg, Lampley, & Wheeler, 2017). This approach, however, is time consuming.

Most studies that employ geocoding suffer from incomplete or missing input data. A data-matching algorithm called probabilistic record linkage (PRL) can be used to reengineer addresses, as long as secondary information (e.g., name, parcel number) from the records is provided. PRL is used to match two data sets with similar attributes by assigning weights based on the degree of similarity (Randall, Ferrante, Boyd, & Semmens, 2013). High weights suggest a higher probability of a match (Schmidlin, Clough-Gorr, Spoerri, & SNC Study Group, 2015). PRL has been used in health services research of birth outcomes and hospitalization records (Bentley, Ford, Taylor, Irvine, & Roberts, 2012), but its utility to improve geocoding match rates by reengineering residential addresses has not yet been tested or evaluated. The application of PRL to improve match rates is essential because excluding nongeocoded records likely will reduce sample size and weaken the generalization of the analytical results due to selection bias (Ha et al., 2016; Zandbergen, 2009; Zimmerman, 2008).

Another metric for the quality of geocoding results is positional accuracy, referring to the distance between the position of the geocode and its true location (Bonner et al., 2003; Ward et al., 2005). The smaller the error distance, the higher the accuracy of the geocode. Differences in positional accuracy in environmental health assessments can lead to exposure mischaracterization and affect the reliability of spatial modeling estimates (Zandbergen, 2009). For instance, when geocoded data of contaminated private wells are analyzed, larger error distances can affect the estimate for contaminants characterized by small ranges beyond which spatial autocorrelation vanishes.

In this article, we describe a multistage, geocoding approach used to develop a GIS database of private wells. We then assess the positional accuracy of the geocodes in our GIS database using field-collected GPS locations of private wells. Our study provides a novel approach to increase geocoding match rates that goes beyond using multiple reference data sets to implement a PRL technique. The approach is portable to other counties in need of a digital database of private wells to aid in spatial modeling of exposure to contaminants, monitoring water quality, and planning public health interventions.

Methods

Study Area

Gaston County is a 942 km² (364 mi²) area in southwest North Carolina (Figure 1). The topography is gently rolling to hilly, ranging from elevations of 179 m (587 ft) above mean sea level in the southeast corner to 520 m (1,705 ft) with several pronounced ridges in the southwest part of the county. The county has 15 townships and a mixture of urban and rural environments. From 2010–2019, the population of Gaston County increased by 8.9% from 206,098 to 224,529 (U.S. Census Bureau, 2019). Almost 42% of the county's residents rely on private well water (Centers for Disease Control and Prevention, 2019). Owusu and coauthors (2020) found that private wells in the northwest part of Gaston County have more than a 50% probability of containing arsenic concentrations >5 µg/L stemming from the underlying geology.

Since 1989, the Gaston County Department of Health and Human Services has approved a total of 8,721 permits for the construction of new private wells. A typical permit contains a unique permit number, information on the well owner, type of well, size, depth, casing depth, residential address, parcel tax location codes, and site sketch of the well. Some of the historical paper permits were particularly challenging to digitize and geocode due to damaged paper, missing address information, directional addresses, and illegible handwriting. The locations of the private wells geocoded in this study are shown in Figure 1.

Reference Data

We retrieved spatially explicit reference data sets for rooftop centroid parcels and road networks from Gaston County from a variety of sources (Table 1). Other nonspatial reference data included deed records, property tax information, and paper copies of laboratory test results for total coliform and inorganic

chemicals. The paper copies of total coliform and inorganic chemical laboratory test results were limited to private wells since 2008 when North Carolina mandated laboratory testing when a new well is constructed (North Carolina Department of Health and Human Services, 2019).

Parsing and Address Cleaning

Incomplete address information and lack of address standardization can prohibit geocoding automation (Goldberg, 2011; Murray et al., 2011; Rosu & Chen, 2016; Rushton et al., 2006; Sonderman et al., 2012). We took initial steps to standardize and evaluate the raw addresses:

1. Raw addresses were parsed into usable components, including street number, prefix direction (e.g., S), street name, type, and suffix direction (e.g., SE) when available.
2. Common data entry errors (e.g., STRET, CIRCL) were corrected.
3. Other manual data cleaning strategies such as sorting and filtering by common street names helped correct typographical errors. More than one half of the input permit addresses, however, were postal box entries (e.g., P.O. Box 101), missing, or only directional descriptions.

Multistage Geocoding

Due to the inherent uncertainty of some input permit addresses, we developed a multistage, geocoding approach to increase the number of successfully geocoded private wells. The major components were the input permit and reference data, the geocoding procedure, and output geocoded private wells (Figure 2). The geocoding procedure consisted of two stages: automation and improvement.

Automation Stage

During the automation stage, rooftop, parcel, and road geocoding techniques were combined hierarchically based on their spatiotemporal accuracy, resulting in a composite address locator using ESRI ArcGIS 10.6. An address locator is a model used to create geometry for input addresses during geocoding. In the composite address locator, the first attempt to geocode the input permit address was made with rooftop geocoding. Unsuccessful input addresses were then considered at the parcel geocoding level. When the input addresses were not geocoded in parcel geocoding, then they were considered for street geocoding. The input permit addresses that were not geocoded after the first geocoding trial were then considered in the improvement stage (Figure 2).

TABLE **1**

Study Reference Data and Sources

Reference Data	Year	Source
Rooftop centroid data	2016	Gaston County IT-GIS Department
Parcel data	2012, 2014, 2015, 2016	Gaston County Department of Planning and Development Services
County roads	2002, 2016	Gaston County IT-GIS Department
TIGER/line roads	1992, 2000	U.S. Census Bureau
Copies of coliform and inorganic chemical test results	2008–2016	Gaston County Department of Health and Human Services
Deeds records	2012, 2014, 2015, 2016	Gaston County Department of Planning and Development Services
Property tax information		

Improvement Stage

The first approach in the improvement stage was to replace the missing or incomplete permit addresses with reengineered addresses from copies of total coliform or inorganic chemical tests that were linked using the unique permit numbers. The new reengineered addresses then were transferred to the automation stage to be geocoded using the composite address locator. Permits not geocoded were then considered for the PRL approach.

The PRL data-matching technique was implemented using LinkageWiz 2016 as a second approach in the improvement stage to link the permit data (source) with the parcel data (reference). Parcel attributes such as tax location codes, parcel owner information (first, middle, and last names), parcel street name, parcel size, lot number, and subdivision name were paired with corresponding attributes available on the private well permits. The PRL results were evaluated by the weight scores associated with a potential match based on the field agreements, disagreements, and missing values during the linkage (Bentley et al., 2012; Randall et al., 2013; Schmidlin et al., 2015). The weights are derived from the logarithm of the frequency ratio of the common attributes being examined and is expressed as:

$$\text{Weight} = \log_2\left(\frac{\text{Frequency of agreement in LINKED pairs in } s_1, r_1}{\text{Frequency of agreement in UNLINKED pairs in } s_1, r_1}\right)$$

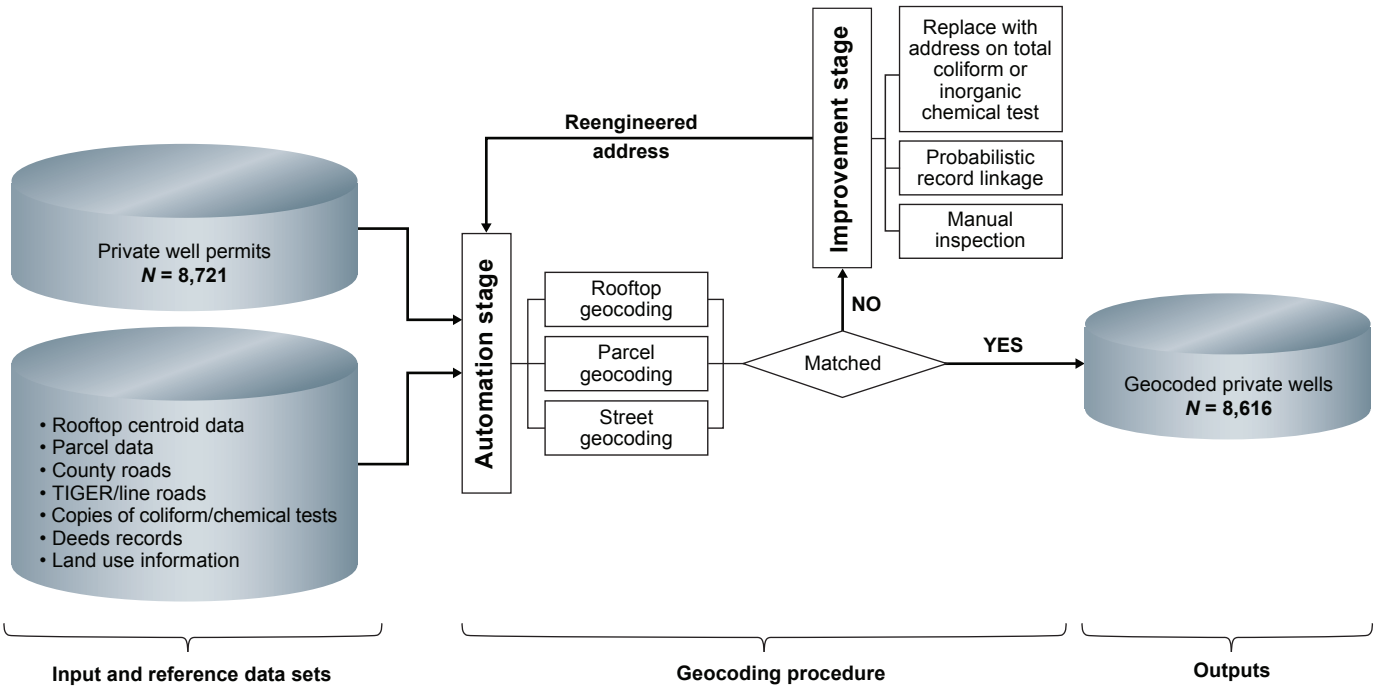
with s_1, r_1 as the common attributes in the permit and parcel data, respectively.

We evaluated the total weight scores for potential and false-positive linkages. A higher value corresponds to a good potential match, whereas a low value might signal a false match. We accepted linkage pairs with weight scores >30 because there was a natural break in the distribution of weights beyond the score, but manually reviewed those below this score before a potential linkage was accepted. We used the corresponding addresses associated with the parcels to replace the incomplete or directional addresses in the permit data. Reengineered addresses were transferred back to the automation stage. Permits not geocoded were transferred to the final approach in the improvement stage.

The final approach was to manually inspect only the permits that were not geocoded after PRL by comparing them with information in deeds and parcel data to trace any record of change in ownership that could help identify the addresses on these permits. Once we found a permit to have corresponding information in the deed or parcel data during the manual inspection, we replaced the incomplete or directional address on the permit accordingly with the address in the deed or parcel data. The new reengineered addresses were then transferred to the automation stage to be geo-

FIGURE **2**

Multistage, Geocoding Workflow for Private Well Permits in Gaston County, North Carolina



coded using the composite address locator. We excluded from the GIS database of private wells any permits not geocoded after this approach.

Field Data Collection of Private Well GPS Coordinates

We organized students from the University of North Carolina at Charlotte (UNC Charlotte) into two-member teams and sent them with Mesa handheld GPS units to obtain the coordinates at the actual well sites to compare with the geocoded locations. In order to minimize the drive time to the locations, we used the database and GIS network analysis to develop optimized route schedules for each team. The county's environmental health department provided the necessary training to the students and, in collaboration with UNC Charlotte, coordinated the field data collection of the private well locations and offered free well water sampling to test for total coliforms. By using the unique permit identification numbers assigned to each well, we merged the field-determined GPS coordinates data into the GIS database of private wells.

Assessing Positional Accuracy

As an indicator of positional accuracy, we calculated the error distance between the field-measured GPS coordinates and geocodes obtained from rooftop, parcel, and street geocoding of the private wells. As only 12.3% of well owners agreed to secure the GPS coordinates of their private well, we used kriging interpolation techniques to estimate the positional accuracy of the geocodes at unsampled locations for this study. Kriging is based on the geostatistical theory of regionalized variables, which states that variables in an area exhibit both random and spatially structured properties (Goovaerts, 2000; Pyrcz & Deutsch, 2014).

We mapped and visually compared the resulting interpolated surface obtained from kriging error distances to ascertain the geographic variation in position accuracy of rooftop, parcel, and street geocodes. The skewed error distances for rooftop, parcel, and street geocoded results were log-transformed before kriging so that the data were normally distributed, and the results were later back-transformed for interpretation purposes. We fitted the kriging semivariograms with an exponential model because it yielded the smaller sum of squared errors for rooftop and parcel error distances. Although the sum of squared errors for street error distances were small for Gaussian model fitting of the kriging semivariogram, we used an exponential model in order to compare the predictions for rooftop, parcel, and street geocoding.

Results

From October 2016–September 2019, a total of 8,721 permits were digitized. Only 3,207 (38.0%) of these permits were geocoded automatically on first attempt. The remaining permits had incomplete or missing address information. The improvement stage approaches to reengineer permit addresses yielded an additional 5,298 (60.7%) geocodes in the GIS database of private wells. Individually, PRL added more reengineered addresses (2,054, 23.6%) compared with substituting addresses on copies of laboratory reports of coliform or inorganic chemical tests (1,917, 22.0%) and man-

TABLE **2**

Summary of Results for Different Geocoding Stages

Stage	Rooftop Geocoding # (%)	Parcel Geocoding # (%)	Street Geocoding # (%)	Total # (%)
Original permit	3,115 (35.7)	46 (0.5)	157 (1.8)	3,318 (38.0)
Reengineered addresses				
From copies of coliform or inorganic chemical test	1,824 (20.9)	14 (0.2)	79 (0.9)	1,917 (22.0)
Probabilistic record linkage	1,875 (21.5)	179 (2.1)	–	2,054 (23.6)
Manual inspection	1,235 (14.2)	59 (0.7)	33 (0.4)	1,327 (15.3)
Total match				8,616 (98.9)

ual inspection interventions (1,327, 15.2%) (Table 2). A total of 105 (1.1%) of the private well permits were not geocoded because of paper damage, illegible handwriting, or directional descriptions in place of actual addresses. Geocoded permits were more likely to be at the rooftop level (92.3%) compared with parcel (3.5%) and street level (3.1%).

Positional Accuracy

From October 2017–September 2019, 1,075 households agreed to have their private well locations secured by GPS. The field teams reported the following reasons for not securing the GPS coordinates as:

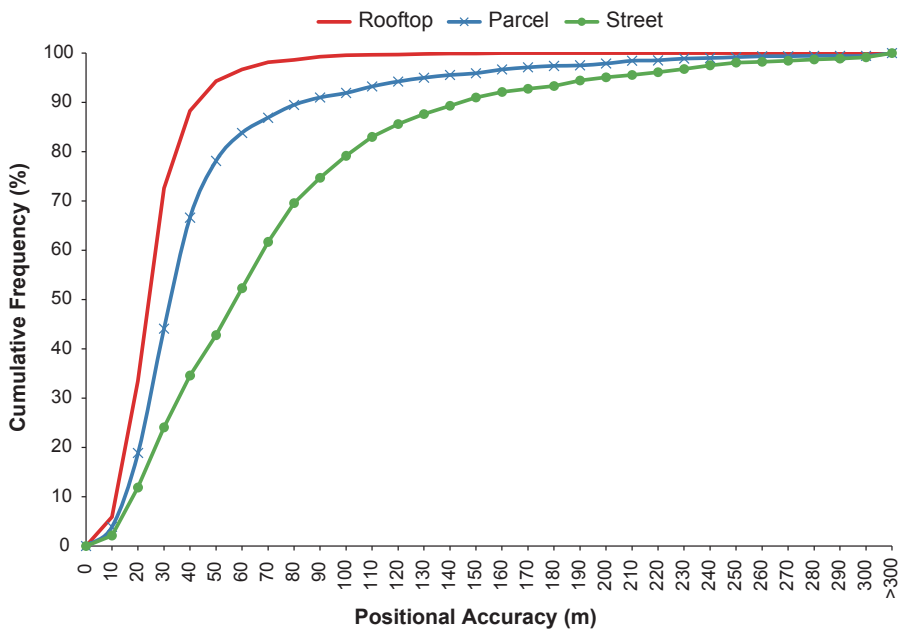
1. owners were not at home (n = 3,877);
2. property could not be entered because of notices such as no trespassing, beware of dogs, or private property (n = 2,039);
3. residents declined to participate (n =1,083);
4. residents were at home but unavailable/ residents asked to have their well locations taken later (n = 240);
5. house was serviced by city water (n = 107); or
6. house was serviced by a community well (n = 31).

Additionally, a total of 164 well owners requested not to have their well locations identified by GPS.

Positional accuracy results were statistically different (p < .05) for rooftop, parcel, and street geocodes. Rooftop was best, followed by parcel and then street geocodes. The mean positional accuracy for rooftop, parcel, and street geocoding were 26 m, 44 m, and 72 m, respectively. The cumulative frequency distribution (Figure 3) shows that 95% of the rooftop positional accuracy results were within 52 m, with 95% of parcel positional accuracy within 130 m, and 95% of the street positional accuracy within 190 m.

FIGURE **3**

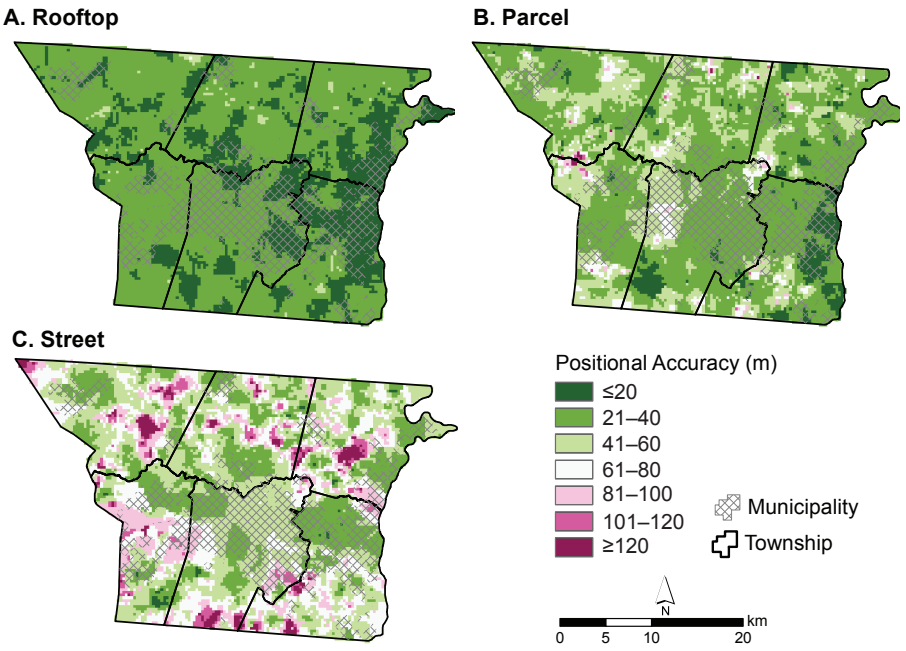
Cumulative Distribution of Positional Accuracy of Rooftop, Parcel, and Street Geocoded Locations of Private Wells to GPS-Measured Positions in Gaston County, North Carolina (n = 1,075)



The kriging maps for rooftop, parcel, and street geocodes show geographic variations, indicating differences in positional accuracy across the county (Figure 4). For example, whereas the map for rooftop geocodes shows that positional accuracy does not exceed 60 m, the parcel kriging map shows that some parts of the county have positional accuracy ≥120 m. Cross-examination of parcel sizes in these sections revealed that the area has larger parcel sizes (mean = 28,059 m^2) than in other parts of the county. Nonetheless, the kriging map for street positional accuracy shows more areas with values ≥120 m.

FIGURE **4**

Kriging-Based Prediction of Private Well Positional Accuracy From Geocodes Obtained From Rooftop, Parcel, and Street Geocoding Techniques in the GIS Database, Gaston County, North Carolina



Discussion

Developing a GIS database of private wells presented several challenges. One of the main challenges was dealing with paper permits and improving the geocoding match rate from permits with missing or incomplete address. This issue was resolved by identifying missing addresses from other data sources such as well water test results. Additionally, the PRL approach we used connected information such as tax location codes on private well permits with GIS parcel data to help identify missing addresses. These approaches improved our geocoding match rate from 38.0% to 98.9%. Our high match rate helps show the potential of this approach to other institutions interested in developing a GIS database of private wells.

Although we could not geocode 105 (1.1%) permits into the GIS database, the high geocoding match rate was enough to meet the health departments' need of showing the geographic locations of private wells within their jurisdiction. Information on coliform or inorganic chemical measurements at the well can be integrated into the GIS database to aid in monitoring water quality. For example, the developed digital database of private wells allows easy identification from an easily accessible data set of potentially contaminated wells.

Our positional accuracy assessment shows that rooftop geocoding outperforms parcel and street geocoding in spatial representation of a private well. This finding could be because rooftop geocoding outputs are the centroid of a building rooftop, and private wells usually are constructed near the residence. In environmental exposure assessment, GPS coordinates serve as the best spatial data in modeling exposure to the private well (Cromley & McLafferty, 2011). When the GPS coordinates are unavailable, however, rooftop geocodes can be used.

A major limitation of our study involves having the resources to digitize permits, technical expertise to convert the data into a GIS database, and available funds to send teams into the field to secure GPS locations of private wells. A limitation of the multistage, geocoding approach employed in this study might result from inputting inaccurate addresses from existing permits. For example, data entry errors from the paper permits could have a significant impact on the final geocoded data. The PRL approach also is limited by the availability of common attributes in the permit and parcel data. Even though PRL application is popular in health services research, privacy issues can arise from linking data with sensitive information (Schmidlin et al., 2015). In our study, we used only publicly available parcel data as a reference source during the linkage. The major strength of our approach was the use of multiple reference data sets and techniques to augment the geocoding rate, which enabled the incorporation of private well locations into the GIS database.

Conclusion

An accurate GIS database of private wells is critically important to evaluations of local environmental factors associated with groundwater contamination and threats to rural drinking water quality. We successfully created this type of database for Gaston County, North Carolina, using a multistage technique that could be practical for many health departments or other agencies currently limited to paper file records of domestic wells. We built our database first from paper files that often were damaged, had missing address information, used directional descriptions in place of addresses, or were illegible. We supplemented this initial information by obtaining addresses from well water testing done on a limited basis by the state laboratory. Lastly, for those locations for which reliable addresses were still unavailable, we employed PRL and used three distinct geocoding databases: rooftop, parcel, and street. An important finding was that rooftop geocoding was the most accurate technique, negating the need to use the other two databases for most foreseeable applications.

Potential applications of the database include a) the production of maps showing the locations of private wells and b) identification of relative risk of contamination on an areal basis. This information could be useful to support decision making, such as when to alert county residents of the risks posed by contaminated groundwater in their vicinity or where to conduct additional sampling in areas deemed at risk (Lan et al., 2020). A

variety of other public health interventions could be facilitated through the spatial identification of local wells and the accessibility of digitally available data.

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INTERNATIONAL PERSPECTIVES

Microbial Quality of a Middle Eastern, Raw, Ready-to-Eat Meat Dish

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Abstract **Numerous foodborne disease outbreaks have been associated with the consumption of raw beef dishes. The purpose of this study was to conduct a microbial examination of kibbeh nayyeh, a Middle Eastern, raw, ready-to-eat (RTE) meat dish. In 2017, 30 samples were purchased from three Middle Eastern butcher shops in Toronto, Ontario. We tested the samples for total coliforms and *E. coli*. Results showed that 93% of the samples were positive for total coliforms (*n* = 28) and 17% were positive for *E. coli* (*n* = 5). Furthermore, 30% of the samples had satisfactory levels of total coliforms based on provincial guidelines for RTE foods, while 87% of the samples had satisfactory levels of *E. coli*. Evidence indicates that additional procedures are needed to enhance the safety of this product.**

Introduction

Kibbeh nayyeh is a raw meat dish made from beef and/or lamb that is popular in countries such as Lebanon and Syria. The basic ingredients consist of fresh minced meat (usually beef), bulgur wheat, minced onions, spices, salt, pepper, and olive oil (University of Guelph, 2011). Kibbeh nayyeh is considered a ready-to-eat (RTE) product because there is typically no heat treatment prior to consumption (Peresi et al., 2016). Other raw meat dishes similar to kibbeh nayyeh include steak tartare, kitfo, and yukhoe (Greenland et al., 2009; Tegegne & Ashenafi, 1998; University of Guelph, 2011; Yahata et al., 2015). In addition to the lack of a cooking step prior to consumption, other food safety risks to consumers include the extensive handling of ingredients during preparation and the intrinsic characteristics of this dish (e.g., high water content, high levels of nutrients, and neutral pH) that favor microbial growth (Peresi et al., 2016).

Numerous foodborne disease outbreaks have occurred worldwide due to kibbeh nayyeh and other raw meat dishes. For example, a 1995 *Trichinella* outbreak associated with kibbeh nayyeh occurred in a southern Lebanese village due to a mixing of raw pork products with the kibbeh nayyeh. The outbreak resulted in 44 suspected or confirmed cases of trichinellosis, with 63 people seeking medical attention (Haim et al., 1997). More recently, a 2013 multistate outbreak of *Salmonella* Typhimurium occurred in the U.S., causing 22 infections across 6 states; out of the 22 infections, 7 were linked to consumption of kibbeh nayyeh at the same restaurant (Centers for Disease Control and Prevention, 2013).

Another reported outbreak associated with a raw meat product occurred in 2001 in Japan due to the consumption of yukhoe that was contaminated with *E. coli* O111. That outbreak led to 86 illnesses, 32 cases of hemolytic uremic syndrome, and 5 deaths, prompting Japan to implement stricter regulations for raw meat dishes (Yahata et al., 2015). Several foodborne outbreaks have also occurred in Europe due to the consumption of steak tartare (Braeye et al., 2014; Doorduyn et al., 2006; Greenland et al., 2009).

Some previous studies have been conducted on raw, RTE meat products to determine the levels of microbial contamination. For example, a study of raw kibbeh samples taken in 2010–2011 from Brazilian supermarkets and butcher shops found that 87% of the 70 samples were positive for *E. coli* and 2 of the 403 total isolated *E. coli* strains were positive for Shiga-toxin-producing genes (Peresi et al., 2016). Additionally, a 2014 study in Venezuela found that three out of seven samples of kibbeh nayyeh purchased from various locations were contaminated with *Salmonella* spp. (Rodríguez-Roque et al., 2018). A 1996–1997 study in Ethiopia found that *Salmonella* spp. was present in 21 of 50 samples of raw kitfo obtained from hotels, bars, and restaurants in Addis Ababa; in contrast, no *Salmonella* was isolated from cooked samples of the same product (Tegegne & Ashenafi, 1998). Another study in 1998–1999 of raw kitfo dishes prepared by street vendors in Ethiopia found that 9 out of 30 samples were contaminated with *Salmonella* (Muleta & Ashenafi, 2001).

In the U.S., the Food and Drug Administration (FDA) publishes the *Food Code* to assist all jurisdictions in developing food safety rules and policies. The FDA *2017 Food*

TABLE **1**

Microbial Levels in Samples of Kibbeh Nayyeh (*N* = 30)

Sampling Date (mm/dd/yyyy)	Microbial Analysis by Location					
	Location 1		Location 2		Location 3	
	Total Coliforms (CFU/g)	*E. coli* (CFU/g)	Total Coliforms (CFU/g)	*E. coli* (CFU/g)	Total Coliforms (CFU/g)	*E. coli* (CFU/g)
02/01/2017	4.80×10^3	1.60×10^2	5.10×10^3	3.10×10^3	–	–
02/02/2017	1.24×10^4	1.90×10^3	$<1.00 \times 10^1$	$<1.00 \times 10^1$	–	–
02/08/2017	3.70×10^3	$<1.00 \times 10^1$	6.00×10^1	$<1.00 \times 10^1$	–	–
02/09/2017	1.50×10^3	$<1.00 \times 10^1$	8.00×10^1	$<1.00 \times 10^1$	–	–
02/22/2017	1.70×10^3	$<1.00 \times 10^1$	5.00×10^1	$<1.00 \times 10^1$	3.00×10^4	$<1.00 \times 10^1$
02/23/2017	6.20×10^3	$<1.00 \times 10^1$	1.20×10^2	$<1.00 \times 10^1$	2.50×10^3	$<1.00 \times 10^1$
03/01/2017	5.20×10^3	$<1.00 \times 10^1$	1.60×10^2	4.00×10^1	1.60×10^6	$<1.00 \times 10^1$
03/02/2017	7.50×10^3	$<1.00 \times 10^1$	1.40×10^2	$<1.00 \times 10^1$	2.40×10^4	$<1.00 \times 10^1$
03/08/2017	2.50×10^4	$<1.00 \times 10^1$	–	–	2.40×10^4	$<1.00 \times 10^1$
03/09/2017	1.20×10^3	$<1.00 \times 10^1$	2.00×10^1	$<1.00 \times 10^1$	2.10×10^5	$<1.00 \times 10^1$
03/15/2017	$<1.00 \times 10^1$	$<1.00 \times 10^1$	1.10×10^4	$<1.00 \times 10^1$	7.90×10^4	$<1.00 \times 10^1$
03/16/2017	2.30×10^3	$<1.00 \times 10^1$	–	–	3.20×10^2	1.00×10^1

Code explicitly permits the sale of steak tartare or other rare meat in RTE form if

- the establishment does not serve a highly susceptible population,
- warnings are provided to consumers, or
- dishes are rendered safe to eat based on an approved hazard analysis critical control point (HACCP) plan with scientific data or information showing that a lesser time/temperature is safe (U.S. Department of Health and Human Services, 2017).

In Ontario, Canada, the Health Protection and Promotion Act provides the mandate to develop regulations, protocols, and programs that govern food safety at retail and food service premises. The Government of Ontario Food Premises Regulation 493 under this act legislates the preparation and sale of potentially hazardous food within food establishments (Government of Ontario, 2017). Under this regulation, RTE manufactured meat products such as kibbeh nayyeh are considered potentially hazardous foods and must be produced in a manner that makes the food safe to eat, including being processed in a manner sufficient to destroy foodborne pathogens (Government of Ontario, 2017). There are currently no data on the microbial safety of kibbeh nayyeh for retail consumption in Ontario. The objective of this study was to conduct a microbial analysis of kibbeh nayyeh in order to determine possible food safety risks.

Methods

Between February 1 and March 16, 2017, we collected 30 samples of kibbeh nayyeh from three Middle Eastern butcher shops in Toronto, Ontario, that were identified by the local health department as food establishments offering the dish for sale. On each sampling day, 1 kg of kibbeh nayyeh was purchased and a 200 g sample was aseptically obtained from the 1 kg dish using the inverted bag technique with approved sample bags provided by the local health department. We labeled each sample bag with the name of the item, location where it was collected, sample number, date and time it was collected, and time it was delivered to the laboratory. The samples were then placed in a refrigerated cooler and immediately taken to the laboratory to test for total coliforms and *E. coli*. A thermometer placed in the cooler was monitored to ensure maintenance of the cold chain at ≤4 °C or less.

The microbial analysis of the samples was conducted using Petrifilm to identify *E. coli* and total coliforms, and to differentiate between *E. coli* and other coliforms (Canada Department of National Health and Welfare, 2018). The laboratory results were interpreted using the Ontario microbiological guidelines for RTE foods; according to these guidelines, satisfactory total coliform levels for RTE food samples are values <103 CFU/g, while satisfactory levels for *E. coli* are <100 CFU/g (Ontario Agency for Health Protection and Promotion, 2019). We recorded and descriptively summarized the microbial sampling results in an Excel spreadsheet.

Results and Discussion

Of the 30 samples tested across all three locations, 93% were positive for total coliforms (n = 28) and 17% were positive for *E. coli* (n = 5). Among positive samples, the mean count of total coliforms was 3.44 log CFU/g (standard deviation [*SD*] = 1.18) and the mean count of *E. coli* was 2.32 log CFU/g (*SD* = 1.07). Based on the Ontario guidelines for RTE foods, 30% of the samples were satisfactory for total coliforms, while 70% were unsatisfactory. For *E. coli*, 87% of the results were satisfactory and 13% were unsatisfactory. When comparing across the three sample locations, location 2 tended to have lower levels of total coliform contamination, while positive *E. coli* samples were identified across all three locations (Table 1).

The results of our study are similar to those from a study in Ethiopia that sampled kitfo and found total coliform counts ranging from 10^4–10^6 CFU/g (Tegegne & Ashenafi, 1998). The presence of high levels of total coliforms in RTE foods suggests that good manufacturing and preparation practices have not been properly followed, which could be due to poor quality of raw ingredients, cross-contamination, poor cleaning and sanitation, food handler hygiene, or improper temperature control (Food Standards Australia New Zealand, 2016; Ontario Agency for Health Protection and Promotion, 2019). Although raw meat will contain a certain level of natural microflora, preparation methods in butcher shops—such as the sanitation of preparation areas, surfaces, and equipment; quality of the meat; and handling of the product—could have contributed to the levels of coliforms identified in this study (Food Standards Australia New Zealand, 2016). Meat grinders are a critical control point because cross-contamination can occur if a contaminated batch of meat passes through a grinder and the grinder is not properly cleaned and sanitized prior to processing the next batch of meat (Roels et al., 1997). Additionally, contamination of the seasoning used in the dish could contribute to the high coliform count if an employee exercised poor hand hygiene and added the seasonings with unwashed hands rather than using a utensil. Furthermore, spices and seasonings can be contaminated with various foodborne pathogens (Young et al., 2015), which could be introduced into the final product.

E. coli is found in all mammalian feces and serves as an indicator of fecal contamination (Baylis, Uyttendaele, Joosten, & Davies, 2011). The presence of *E. coli* in kibbeh nayyeh samples from all three butcher shops in this study indicates a pathway for foodborne pathogens to contaminate the product. Public health authorities should provide outreach and education to these establishments on the safest way to prepare the dish and to ensure that proper food safety procedures are followed. For example, the meat should be minced only by hand, proper sanitary tools should be used, the dish should be prepared to order (not in advance), only properly trained employees should prepare the dish, customers should be informed of the risk of consuming raw meat, and good manufacturing practices should be followed throughout the preparation process.

In the case of kibbeh nayyeh, as there is no cooking step, proper temperature control should be considered another critical control point. The product should be continuously maintained at or below 4 °C (40 °F) to prevent microbial growth (Regecová, Turek, Jevinová, Pipová, & Mačanga, 2017). In addition, premises should consider limiting or prohibiting sales of this product to consumers at high risk of foodborne illness, including pregnant women, immunocompromised people, and older adults (Lund & O'Brien, 2011).

In Ontario, Regulation 493 requires those who prepare raw meat dishes such as kibbeh nayyeh to possess and follow a written food safety procedure approved by the local public health inspector. In order for this type of food product to be permitted under these regulations in Ontario, the preparation process must include interventions to destroy or reduce pathogens (Government of Ontario, 2017). There are various possible ways that these controls can be achieved. For example, government guidance on the safe production of raw beef dishes (e.g., rare burgers) in the United Kingdom includes searing the whole cut of meat prior to grinding; this technique can achieve a 6-log pathogen reduction on the surface while the internal tissues remain raw (United Kingdom Food Standards Agency, 2016). The seared surface is then removed prior to grinding and preparing the raw meat dish.

Another approach recommended in New Zealand includes briefly blanching the whole cut of beef (e.g., unwrapped or in a vacuum-sealed bag) in boiling water prior to grinding, which achieves a similar pathogen reduction on the meat surface as searing (New Zealand Government, 2017). In addition, future research should examine whether the inclusion of acidic ingredients such as lemon juice to the dish can destroy or reduce the incidence of pathogens, as has been shown in the process of preparing the raw seafood dish ceviche (Mathur & Schaffner, 2013).

A limitation of this study was locating a sufficient number of butcher shops that sold kibbeh nayyeh. Only three locations were available to collect samples from because, at the time of sampling, it was technically illegal to sell the item in Ontario under the previous food premise regulations. Additionally, the study was limited to its small sample size in terms of the number of samples collected. Another limitation is that we tested for indicator organisms only and not for the presence of specific pathogens.

Conclusion

The results of this study indicate that it is essential that good manufacturing practices and food safety procedures are followed by premises that prepare and sell raw, RTE items such as kibbeh nayyeh. In addition, consumers should be adequately informed about the food safety risks of this raw, RTE product. We found that many samples had unacceptable levels of total coliforms, indicating that adequate good manufacturing and preparation processes were not followed, and some samples contained *E. coli*, which indicates fecal contamination. Little research exists on the safety and food safety risks of kibbeh nayyeh for retail consumption. Therefore, more research should be conducted to enhance our knowledge of this product, including the possible presence of specific foodborne pathogens such as *E. coli* O157 and *Salmonella*.

Local health departments need to be aware of establishments selling raw, RTE meat dishes such as kibbeh nayyheh in their jurisdiction and ensure good food safety production practices. Requiring establishments to implement consumer warnings and restrict sale to vulnerable populations should be considered in food safety policies and guidelines.

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Exploring the Benefits and Value of Public Health Department Internships for Environmental Health Students

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Abstract **Internships are an essential component of preparing prospective college graduates for entering the practice-based field of environmental health (EH). EH professionals continually encounter events or hazards of high complexity and impact, and many experienced EH professionals are expected to retire within the next several years. Efforts are needed to ensure a supply of highly qualified and prepared graduates is available to sustain and strengthen the EH workforce. The National Environmental Public Health Internship Program (NEPHIP) addresses this need by supporting health department internships for EH students of academic programs accredited by the National Environmental Health Science and Protection Accreditation Council. We conducted an assessment to examine former NEPHIP intern and mentor experiences and perspectives on 1) how well the internships prepared interns for careers in EH and 2) to what extent the internships provided value to the host health department. Overall, the internships appeared to provide EH students with a well-rounded professional and practice-based experience, while health departments benefited from hosting interns with a foundational knowledge and college education in EH. Promoting the value of public health department EH internships could encourage more students and graduates to seek internship or employment opportunities with health departments, ultimately strengthening the EH workforce.**

Introduction

Internships are a cornerstone of the academic journey. They are an integral experience for instilling prospective college graduates with a firsthand perspective on the realities of a practice-based field or profession. For environmental health (EH) students, this experiential opportunity allows the chance to ground the theory obtained in the classroom by applying it in real-life situations, which is identified as essential for preparing graduates to enter the workforce (Adams et al., 2001). Internships can be mutually beneficial to the student intern and host public health departments. While EH students gain valuable practical experience, host health departments can receive a motivated student eager to contribute to the department's important work and play an integral role in preparing future EH professionals to enter the workforce (Krinn, 1996).

The importance of the internship is underpinned by a continual need for ensuring the EH workforce is equipped and prepared to address emerging issues and challenges. Health department EH programs are tasked with responding to events or hazards of high complexity and impact, requiring professionals to have:

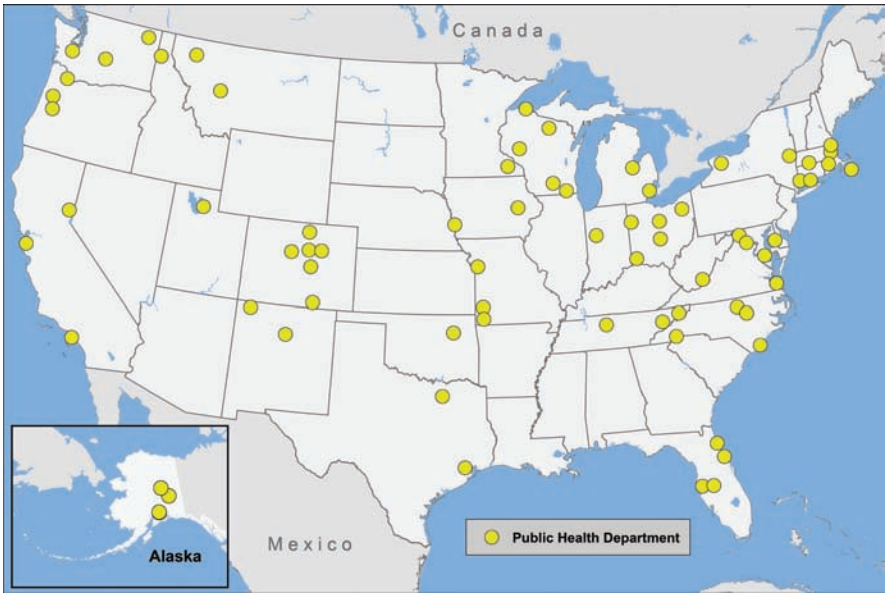
- science and practice-based academic preparation;
- increased capacity to generate, analyze, and use data;
- access to rapidly evolving technologies; and
- opportunities to develop leadership capabilities (Brooks et al., 2019; Gerding et al., 2020).

Compounding these needs, approximately one fourth of the local and state health department workforce, including EH professionals, is expected to retire in the next several years (Bogaert et al., 2019; Gerding et al., 2019; Robin, Castrucci, McGinty, Edmiston, & Bogaert, 2019). Preparing and encouraging the next generation of EH professionals to consider employment with public health departments is paramount to sustaining a sufficient and robust EH workforce and ensuring the nation's public health.

The Centers for Disease Control and Prevention (CDC) partnered with the National Environmental Health Association to offer the National Environmental Public Health

FIGURE **1**

Public Health Departments That Participated in the National Environmental Public Health Internship Program, 2015–2019



Internship Program (NEPHIP). NEPHIP supports state, tribal, and local health department internships for EH students of academic programs accredited by the National Environmental Health Science and Protection Accreditation Council (EHAC). The program connects EH students and health departments for internships to introduce interns to experiences common at public health departments. Host health departments receive an EH intern eager to contribute and gain field experience; host departments also develop familiarity with the academic preparation of students from EHAC-accredited academic programs.

In the 5 years since its inception in 2015, NEPHIP has supported 101 internships for EH students at 76 different health departments in 28 states (Figure 1). Host health departments provide an intern with a mentor who advises and interacts with the intern on a regular basis. We conducted an assessment to examine former NEPHIP intern and mentor experiences and ask about their perspectives on how well the internships prepared interns for careers in EH and to what extent the internships provided value to the host health department. In this article, we present the assessment results and describe the potential benefits and impact of health department internships for developing and strengthening the EH workforce.

Methods

In October 2019, we disseminated a web-based survey to former NEPHIP mentors (n = 51) and interns (n = 61) who participated in the program between 2016 and 2018. This range of years was considered ideal for gathering recent insight and outcomes resulting from participation in the program. We used the REDCap (Research Electronic Data Capture) web-based software platform hosted at CDC to administer the survey and collect the study data (Harris et al., 2009, 2019).

The survey collected common information from both mentors and interns (e.g., year of participation in the program and governmental level of the host health department) and was programmed with skip logic directing the respondent to mentor- and intern-specific items. Interns responded to survey items primarily about the internship experience and employment disposition, while the survey items for mentors pertained to the potential advantages of hosting the intern and post-internship recruitment and employment. Mentors who hosted more than one intern responded only once to the majority of survey items and then answered questions pertaining to each individual intern with regard to their post-internship employment at the host health department.

The survey design drew from instruments developed to assess the EH workforce and practice (Gerding et al., 2019) and fellowship programs supported by the CDC Division of Scientific Education and Professional Development (Centers for Disease Control and Prevention, 2017). To maximize survey response rates, respondents received up to five e-mail messages, including an introductory message, survey invitation, and three reminder messages (Dillman, 2007). We downloaded survey responses into an Excel spreadsheet and prepared the data for analysis using R statistical software. Qualitative analysis of various open-text survey items supplied further details and context on particular responses, including those regarding intern projects. In accordance with the Paperwork Reduction Act, the survey and collection of information received Office of Management and Budget approval (OMB# 0920-1163).

Results

The survey response rate was 39% (n = 20) for mentors and 54% (n = 33) for interns. Intern respondents were hosted by health departments at the local (n = 23), state (n = 8), and tribal (n = 2) levels. Overall, the health departments' population sizes served varied with more responses from interns hosted by departments serving populations <100,000 (58%, n = 19) than those serving populations ≥100,000 (42%, n = 14). At the time of participation in the program, the majority of the interns were juniors (40%, n = 13), followed by graduate students (30%, n = 10), seniors (27%, n = 9), and one sophomore (3%, n = 1).

The majority of interns participated in 2018 (42%, n = 14) and 2016 (33%, n = 11) with the fewest in 2017 (24%, n = 8). Approximately one half of the mentors participated in 2018 (52%, n = 13), followed by 2017 (36%, n = 9) and 2016 (12%, n = 3). Five mentors participated in two different years, which resulted in a total of 25 responses regarding the year of participation.

Interns reported working in approximately 40 different EH programs or services. We report the 10 most common programs in Table 1. Food safety and protection (85%), onsite wastewater (70%), and public swimming

pools (64%) were among the most common. On average, interns hosted by local health departments reported experience in 12 different programs or services, interns at the state level reported 5, and interns at a tribal health department reported 14. Interns engaged in various EH program functions and activities. The most common activities were performing inspections (85%) and educating the public (76%). One third (33%) of the interns reported involvement in developing and establishing policies and outbreak investigation or emergency response. Providing training (21%) was the least common function (Table 1).

In addition to day-to-day services and activities, interns completed complex projects that addressed challenging issues faced by host health departments. The scope of the projects and their topics appeared to span a range of EH programs areas and functions, illustrated by the selection of intern project descriptions shown in Table 2. Problem solving and critical thinking, data collection and analysis, and risk communication were the most common skills or competency areas where almost three fourths (70%) of the interns gained experience (Table 3).

Following participation in NEPHIP, 82% of the interns were more or somewhat more likely to pursue a position in the field of EH, whereas 67% indicated they were more or somewhat more likely to pursue a position with a public health department (Figure 2). Furthermore, 17 interns reported current employment in the field of EH; of these, 71% (n = 12) were employed at a public health department. Among those not currently employed in EH (n = 16), eight were either still finishing their college education or pursuing graduate degrees, and one was in the process of hiring into a position with a local health department (data not shown).

The majority of those currently in the field of EH were employed by state health departments (n = 8), followed by local health departments (n = 4). Almost one half of these interns stated that the internship played a large role in preparing them for their first job (47%, n = 8) or somewhat prepared them (47%, n = 8), and one stated that the internship had played only a small role. One intern was employed by the hosting NEPHIP health department and 10 interns (30%) reported that they received a job offer from their host health department. Nearly three fourths of the interns remained in contact with their mentor (73%, n = 24).

TABLE **1**

Percentage of Interns Working in Common Environmental Health Programs and Functions (n = 33)

	# (%)
Program	
Food safety and protection	28 (85)
Onsite wastewater	23 (70)
Public swimming pools	21 (64)
Rabies prevention	17 (52)
Private or onsite drinking water	16 (48)
Vector control	15 (45)
Emergency preparedness and response	13 (39)
Health-related facilities	12 (36)
Healthy homes	12 (36)
Hotels/motels	12 (36)
Function	
Perform inspections	28 (85)
Educate the public	25 (76)
Maintain databases or electronic information systems	20 (61)
Engage in partnerships with the community, stakeholders, or other agencies	19 (58)
Respond to complaints	18 (55)
Issue permits or licenses	17 (52)
Conduct disease or hazard surveillance	15 (45)
Conduct research or in-depth studies	12 (36)
Develop and establish policies	11 (33)
Investigate disease outbreaks or respond to emergencies	11 (33)
Provide training (e.g., food handler courses)	7 (21)

Table 4 presents mentor perspectives on some of the advantages and challenges to hiring NEPHIP interns after their participation in the program. Most mentors indicated that the advantages of hiring NEPHIP interns included their foundational EH knowledge (80%) and formal education in EH (65%). Aside from limited job vacancies, health department location and interns pursuing further education were reported as primary challenges to hiring former interns. A seemingly low percentage of mentors (25%) reported challenges related to competitiveness of salaries offered. Mentors also described benefits relating to the varied perspectives interns had and insights they provided on current EH practice and technology, contributions, and support of the department's work. Mentors appreciated having opportunities to mentor, develop, and prepare future EH professionals.

Discussion

Internships are a pivotal point in a prospective professional's academic career. Opportunities to experience the current realities of a field, along with applying theory and knowledge gained in the classroom, are essential to preparing EH professionals for the practice (Shalauta, Burke, Gordon, Stern, & Tran, 1999). Internships in public health departments can provide EH students this essential experience.

For example, interns participating in NEPHIP gained experience in a broad range of EH programs. While a high percentage of interns gained experience in the traditional EH program areas (e.g., food safety, onsite

TABLE **2**

Selection of Environmental Health Intern Project Descriptions

Project Description
Collected data from homes served by septic systems to determine if the homes could be integrated into the municipal sewer system.
Developed an educational curriculum to promote air quality awareness and provided necessary resources to public health employees, teachers, and volunteers.
Researched fertilizer laws and best land use practices to create community educational outreach materials on how homeowners can help decrease fertilizer runoff.
Used GIS to map the distribution of arsenic in drinking water, determined areas of high concentrations of naturally occurring arsenic, and investigated the relationship between arsenic concentration and private well depth.
Designed a web page for farmers markets that included all the procedures and policies on safe food preparation and selling food.
Organized and mapped multihousing violation data to identify locations to target for housing inspections and lead surveillance, and for focus by the asthma coalition

TABLE **3**

Percentage of Interns Gaining Experience in Various Professional Activities and Competency Areas (*n* = 33)

Professional Activity and Competency Area	# (%)
Problem solving and critical thinking	23 (70)
Collecting and analyzing data	23 (70)
Communicating risk to the public	23 (70)
Collaborating with other governmental agencies and staff	19 (58)
Participating in community-based initiatives or events	19 (58)
Evaluating the effectiveness of services and activities	14 (42)
Decision making that influences program planning	13 (39)

wastewater, and public swimming pools), opportunities were available in other program areas such as rabies prevention, emergency preparedness and response, as well as those within health-related facilities. The breadth of EH work highlights the importance of prospective EH professionals possessing knowledge and technical skills in various areas of EH.

Interns also engaged in various EH functions and competencies. Many performed inspections and educated the public, which are readily recognized responsibilities of EH professionals. Interns also had opportunities, however, to work with databases and electronic information, conduct research, and participate in outbreak investigations and emergency response. The breadth of experiences provided by host health departments could have contributed to the high percentage of interns indicating their internships prepared them for their first job in EH.

Strengthened professional attributes and competencies are an important outcome of an internship. Strong skills and abilities in areas such as data analysis and problem solving are important for the public health workforce, and EH workforce skill gaps in these areas reinforce the need for professional development opportunities and training (Heidari, Chapple-McGruder, Whitehead, Castrucci & Dyjack, 2019; National Consortium for Public Health Workforce Development, 2017). Almost two thirds of the NEPHIP interns had an opportunity to gain experience in these professional activities and competency areas.

Internships are a chance for both the intern and mentor or host site to "test the waters." NEPHIP interns get a glimpse of working at a public health department, potentially enticing them to seek employment at either their assigned department or another one. Host health departments have an opportunity to observe and develop familiarity with the intern and consider them for possible future employment, which could have been a factor in the host departments offering employment opportunities to almost one third (30%) of the interns. Following completion of their internships, most interns reported being more or somewhat more likely to pursue employment in the field of EH or at a public health department. This trend was reflected in similar numbers of interns who reported post-internship employment in EH or in public health departments. The internship experience likely played a role in the relatively high percentage of interns returning to EH and public health departments for post-internship employment.

Possessing a foundational EH knowledge and college education in EH were the most commonly identified advantages to hiring a NEPHIP intern. Students of EHAC-accredited academic programs complete college course work and preparation relevant to and matching current needs of the EH profession (Silverman & Silverman, 2003). Our study results suggest that mentors realized the value of this formal education and recruitment of EH graduates. Enhanced efforts to recruit graduates of EHAC-accredited programs could strengthen the public health department workforce and supply a cadre of professionals specifically educated in EH and well prepared to enter the practice.

Among the challenges to hiring NEPHIP interns, the ability to offer competitive salaries was somewhat surprisingly reported as the least common. Dissatisfaction with salary and limited opportunities for career progression, however, typically are cited as challenges for recruiting and retaining EH professionals (Marion, Murphy, & Zimeri, 2017; Silverman & Silverman, 2003; Zontek, DuVernois, & Ogle, 2009). As Marion and coauthors (2017) explained, "until there are more significant investments in state and local EH agencies and their workforces, graduating EHAC students examining compensation and career advancement

will seek opportunities in the private sector." Aside from job vacancies, mentors indicated hiring challenges because of lack of interest in relocating, potentially to areas with a higher cost of living.

A few 2019 studies indicate that roughly one half of the EH workforce reported opportunities for career progression, while about three quarters of the EH and public health workforce reported having opportunities to apply their expertise and demonstrate leadership skills (Bogaert et al., 2019; Gerding et al., 2019; Robin et al., 2019). This finding could represent an evolving work setting that could increasingly support career advancement and provide leadership opportunities. Related to these topics, most interns reported engaging in activities such as problem solving and critical thinking, collecting and analyzing data, and risk communication. Competencies such as these are present in the scientific and technical curriculum of EHAC-accredited programs (Marion & Murphy, 2016). Highlighting the potential ability to apply and strengthen professional competencies acquired in the academic setting might encourage more EH students to seek internships or employment with public health departments.

Our study included a small sample of interns and mentors selected through a competitive process to participate in a formal internship program with specific eligibility criteria and requirements. Additionally, NEPHIP interns receive a stipend to cover relocation and living expenses, a financial support that might not be offered through other health department internships. Therefore, the criteria and aspects of the NEPHIP internship experience are likely not uniformly applicable and might not be indicative of other health department internships. Furthermore, EHAC-accredited academic programs are not available in every state and many public health departments might not have opportunities to recruit students and graduates from these programs. Although the study results are not generalizable, they give insight into the potential value and benefits of health department internships for EH students.

FIGURE **2**

Percentage of Interns Reporting Likeliness to Pursue a Position in Environmental Health or With a Public Health Department (*n* = 33)

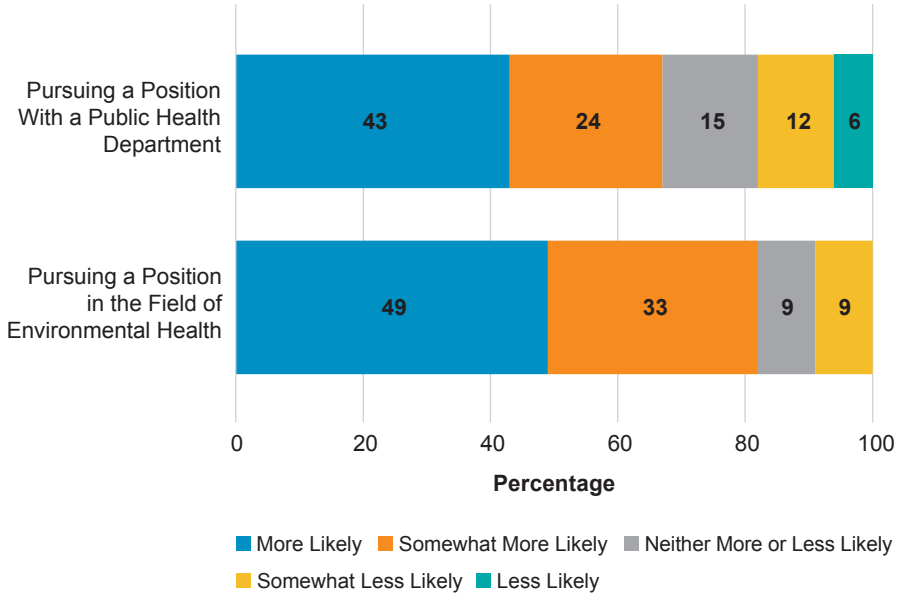


TABLE **4**

Percentage of Mentors Indicating Advantages and Challenges of Hiring Interns (*n* = 20)

	# (%)
Advantage	
Possess a foundation of environmental health knowledge	16 (80)
Have received college education in environmental health	13 (65)
Possess public health experience within federal, state, or local government, nonprofit organizations, or academic institutions	12 (60)
Familiarity with their contributions, skills, and/or work style	11 (55)
Would require less (or no) time to train	10 (50)
No advantages to hiring NEPHIP interns over other comparable candidates who did not participate in NEPHIP	0 (0)
Challenge	
No vacancies for their skill and experience level	12 (60)
Not interested in living in the location	12 (60)
Intern pursuing further education	9 (45)
Cannot match the higher salaries of other agencies or organizations	5 (25)

NEPHIP = National Environmental Public Health Internship Program.

Conclusion

Overall, participation in NEPHIP provided EH students with a wide range of opportunities for a well-rounded professional and practice-based experience. Health departments benefited from hosting interns who possess a foundational knowledge and college education in the contemporary scientific and technical aspects of the EH practice. Health

department internship experiences could increase student interests in pursuing positions in the field of EH and post-internship employment with public health departments. A need remains, however, to further analyze and understand salaries and aspects of career progression. In-depth analysis and comparative studies of salaries and further research to examine critical factors for recruitment and retention are necessary to strengthen the EH profession and workforce. Regardless, public health department internships have the potential for providing EH students exposure and experience in many facets of the EH practice. Promoting the value of public health department EH internships could encourage more students and graduates to seek internship or employment opportunities with health departments, ultimately strengthening the EH workforce.

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AEHAP
ASSOCIATION OF ENVIRONMENTAL HEALTH ACADEMIC PROGRAMS
announces

THE 2021 AEHAP STUDENT RESEARCH COMPETITION

for undergraduate and graduate students enrolled in a National Environmental Health Science and Protection Accreditation Council (EHAC)-accredited program or an environmental health program that is an institutional member of AEHAP.

Win a $1,000 Award

and up to $1,000 in travel expenses

Students will be selected to present a 20-minute platform presentation and poster at the National Environmental Health Association's Annual Educational Conference & Exhibition in Spokane, Washington, July 12–15, 2021.

Entries must be submitted by Friday, February 26, 2021, to
Dr. Clint Pinion
Eastern Kentucky University
E-mail: clint.pinion@eku.edu
Phone: (859) 622-6330

For additional information and research submission guidelines, please visit www.aehap.org/srcandnsf.html.

AEHAP gratefully acknowledges the volunteer efforts of AEHAP members who serve on the advisory committee for this competition.

Opportunity for Students

From EHAC-Accredited Environmental Health Degree Programs to Win a $3,500 PAID INTERNSHIP

The Association of Environmental Health Academic Programs (AEHAP), in partnership with NSF International, is offering a paid internship project to students from National Environmental Health Science and Protection Accreditation Council (EHAC)-accredited programs. The NSF International Scholarship Program is a great opportunity for an undergraduate student to gain valuable experience in the environmental health field. The NSF Scholar will be selected by AEHAP and will spend 8–10 weeks (February–June 2021) working on a research project identified by NSF International.

Project Description
The applicant shall work with a professor from their degree program who will serve as a mentor/supervisor. The project will focus on examining certain measures that are utilized in the prevention of and response to legionellosis outbreaks.

Application deadline: December 11, 2020

For additional information and research submission guidelines, please visit www.aehap.org/srcandnsf.html.

For more information, contact Dr. Clint Pinion at clint.pinion@eku.edu or (859) 622-6330.

NSF

AEHAP
ASSOCIATION OF ENVIRONMENTAL HEALTH ACADEMIC PROGRAMS

BUILDING CAPACITY

Darryl Booth, MBA

Building Capacity by Guarding Against Cyber Attacks

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

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

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

Phishing, distributed denial-of-service, and ransomware. These are three modes of criminal attack that can devastate an organization. Girding your health department for these and related attacks is as important as preparing for any other disaster—it is an element of emergency preparedness.

Phishing

Phishing is a deceitful attempt to obtain information (e.g., account details) by e-mail, text, or the Internet designed to impersonate a legitimate request. So, what appears to be an e-mail from the county help desk, for example, asking to confirm your contact information is, in fact, an enticement to give up your username and password to a third party.

The oddly spelled word phishing comes from the hacker propensity to replace the letter "f" with "ph" in deference to 1970s telephone system hacking, a practice known as phreaking. The reference to fishing is easily understood if you think of an ocean of potential victims (fish) attracted to fancy colorful lures. Fishing.

The Threat

With stolen credentials, perpetrators could gain unauthorized access. With that access, they might retrieve protected information, change data, or wait silently. That is, the credentials might be sold (yes, there's a market for stolen credentials) or used to gain access to increasingly sensitive systems (the true target).

For environmental health, the attack is a threat to privacy and ongoing operations.

The Defense

Like most emerging threats, educating users is the best defense. For example, if your bank seemingly invites you to access your account with a convenient hyperlink, close the e-mail and navigate to your bank's website directly.

Other clues include misspelled words, off-brand language and/or images, and URLs (i.e., web addresses) that don't match the expected website.

Using security configuration to allow privileges to those needed by each user also reduces risk. Gaining access to a limited account isn't as catastrophic.

Top-tier security experts, such as those employed by major cloud-based providers, will also defend against and monitor for intruders.

Distributed Denial-of-Service

Distributed denial-of-service (DDoS) is a coordinated attack on your network from the outside world. Inconceivably, the attack can involve hundreds of thousands of attackers, computers previously compromised and instructed remotely to generate constant network traffic all bound for your network.

So, while your health department's website or e-mail servers respond to normal requests (e.g., to send a web page or receive an e-mail) at a certain level, they are not equipped to handle millions of requests each hour. The illegitimate traffic floods out the legitimate

requests, denying the service it is intended to provide. Think about trying to talk to your date during a loud Rolling Stones concert. Your communications can't get through!

The Threat

Thankfully, this type of attack is not the fault of any single user within the department. This type of attack might arise from a political or revenge motivated incident. It's external.

During an attack that can go on for hours or days until blocked or abandoned, certain network services could be unavailable or intermittent. Those services can include the agency's website, e-mail server, and virtual private network (VPN).

The Defense

Responsibility for monitoring and responding to this type of attack lies solely with your agency's information technology organization/department and its tools and vendors. Any threat of this nature should be taken seriously and the health department, an essential service, should receive full attention after emergency response services. Get those assurances.

Having a distributed environment (i.e., critical applications are hosted in the cloud and noncritical applications are maintained in the county's data center) will preserve critical services during an attack.

Ransomware

Often injected into an organization by a phishing scam, ransom malware or ransomware takes compromised computer systems and methodically encrypts the organization's files, both local and on network file servers.

When the encrypted files are no longer accessible and the organization is crippled, an e-mail—a ransom note—is sent that demands a fee (often to be paid in Bitcoin, an anonymous payment method on the Internet) to unencrypt (unscramble) your files.

Search no further than today's headlines to see the impact on networks the like of Cooke County, Texas; the City of Knoxville; and the Texas Department of Transportation. Government agencies are very often the victims with some paying the ransom and others rebuilding from backups. In the most devastated cases, the attack becomes a matter of public debate and requires the Federal Bureau of Investigation to investigate. Many more cases are never reported.

Image courtesy of iStockphoto, AKodisinghe.

The Threat

Encrypted files are simply inaccessible, garbled by an essentially unbreakable code. Without the files, the critical systems on your network will be inaccessible. No posting financial transactions. No dispatching inspectors. No running state reports. No payroll!

Also, while the encrypted files are "under the control" of the hacker, they can be read or copied. So, beyond the inaccessibility that can last days or weeks, there is a high risk that sensitive data are compromised.

The Defense

Since most ransomware is delivered through phishing, protection starts with anti-phishing systems and education.

Keep operating systems up-to-date and restrict the ability to install software to administrators. Antivirus software can prevent attacks in some cases. Also, the data systems hosted in the cloud are almost always protected. While ransomware runs rampant in local networks, it cannot access the cloud-based systems in other networks. The bottom line is to be confident in your backups and your vendors. Make it automatic and frequent for the best protection.

Building and Protecting Your Capacity

Building capacity is the topic of this column. Like environmental health programs that surveil and intervene, the most successful outcomes are the absence of an event. That is, avoiding a security breach is similar to preventing a foodborne illness in many ways. Intent, consistency, and education are key.

As environmental health leaders, you might not perceive that cyber security is among your responsibilities. Consider, however, that circumstances that threaten to disrupt your essential mission are relevant and worthy of your attention.

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Did You Know?

You can view NEHA's Digital Defense: Education for a Safer World Virtual Conference & Exhibition on-demand until February 28, 2021. The free, on-demand offering includes access to the recorded Food Safety and Water educational sessions and the Exhibition and Poster Halls. Learn more at www.neha.org/digital-defense.

DIRECT FROM CDC ENVIRONMENTAL HEALTH SERVICES

Erik W. Coleman, MPH

Aja-Fatou Jagne, MPH

Advancing Environmental Health Practice Through Environmental Health Informatics Activities

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

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

Aja-Fatou Jagne is an Oak Ridge Institute for Science and Education (ORISE) fellow in CDC's Division of Environmental Health Science and Practice (DEHSP). Jagne provides support to DEHSP by contributing to environmental health informatics resource development and providing technical assistance through research, scientific reasoning, and effective communication. Erik W. Coleman is a health scientist (informatics) in CDC's DEHSP. Coleman assists in building capacity to use data to address environmental hazards and improve services.

Environmental health (EH) programs collect data (e.g., inspection results) that might not be routinely analyzed for trends or used to inform timely public health decision-making. State, tribal, local, and territorial (STLT) health departments and EH programs, however, can lack resources, time, or the experience to collect, analyze, and visualize EH data. Leveraging the use of informatics by standardizing data collection, sharing, and utilization can support innovative approaches to improving EH practice.

The Centers for Disease Control and Prevention (CDC) Water, Food, and Environmental Health Services Branch supports the work of EH informatics through collaborative activities that

- promote timely public data and information sharing to detect and address existing or potential exposures to EH hazards,
- support best practices for the innovative use of existing data and electronic information to design interventions to protect public health, and
- identify environmental and health outcome indicators to assess the need for and impact of EH services.

Designing an Open Data Standard to Improve Health and Safety in Aquatic Facilities

Open data is defined as data that are freely available to everyone to use and republish, without restrictions or mechanisms of control (Auer et al., 2007). Open data in EH provides accessibility to diverse data that, in turn, can improve analysis and evaluation, inform program and policy development, increase capacity for public participation, enable transparency, and improve accountability (Huston, Edge, & Bernier, 2019). Designing a standardized way to report open data will increase consistency in collecting and reporting that will make it more useful.

Illnesses from recreational water are a prominent EH concern. The capacity of EH programs to conduct effective inspections and use the data collected is critical to addressing aquatic facility safety issues. To help build this capacity, CDC partnered with the National Environmental Health Association (NEHA) to improve how STLT health departments and EH programs use aquatic facility inspection data.

To develop the data standard, NEHA started by contracting with Smarter Civic to design and execute an aquatic facility inspection data ecosystem scan. This scan helped to better understand how EH programs manage and publicly share their data. The ecosystem scan identified

- jurisdictions with published aquatic facility inspection data in open data,

- jurisdictions that post aquatic facility inspection information online, and
- trends in how aquatic facility inspection data are presented when available online.

The information gathered from this ecosystem scan assisted in developing NEHA's open data standard for reporting aquatic facility inspection data. Currently, NEHA is supporting several EH programs in health department to implement the open data standard in their jurisdictions. These EH programs play a crucial role in documenting and reporting on the standard development process and best practices because this work might inform future EH data reporting efforts.

Leveraging Informatics to Improve Environmental Health Practice and Innovation

CDC partnered with the Public Health Informatics Institute (PHII) and NEHA to evaluate EH data, processes, and information systems of food service establishment and aquatic facility inspections. This evaluation will lead to recommendations for an informatics solution to improve data use and information technology infrastructure of EH programs. To get there, PHII will conduct a business process analysis and business process redesign, and then determine requirements for a data standard or framework to support STLT health departments and EH programs. These processes are expected to support evidence-based practices and policies and strengthen informatics capabilities of EH programs to use electronic data for informed and timely decision-making.

PHII will work with a diverse and representative sample of STLT health departments and EH programs that vary in governance relationships between the state and local EH programs (e.g., centralized, decentralized, shared, or mixed programs), rural and urban EH programs, and across geographic regions throughout the U.S. Specifically, PHII will

- conduct key informant interviews with STLT health department and EH program professionals;
- develop business process matrices and task flow diagrams of the current state of food service establishment and aquatic facility processes;
- develop functional requirements for future state and local EH restaurant and aquatic facility processes;

Environmental health professionals conduct an aquatic facility inspection. Photo courtesy of the Centers for Disease Control and Prevention, Environmental Health Services.

- conduct an interactive workshop with EH program professionals in STLT health departments to map out and validate key EH processes, identify areas for improvement in informatics capabilities for EH programs, and develop a standardized informatics methodology or framework for EH programs; and
- report findings and recommendations for next steps.

Informatics, a transformational tool in our robust and rapidly evolving technology system, has the potential to improve real-time surveillance systems, communication, and sharing of information among various agencies (Williams, Oke, & Zachary, 2019). EH is no exception to the various public health sectors that have embraced this tool to improve the health of populations across the nation. EH programs and professionals are encouraged to take advantage of the tools and resources produced through CDC's EH informatics activities. Leveraging informatics can help enhance the EH practice to inform policy decisions that impact the air we breathe, water we drink and use, and food we eat.

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Quick Links

- Centers for Disease Control and Prevention's Environmental Health Practice Resources: www.cdc.gov/nceh/ehs/activities/eh-practice-resources.html
- Public Health Informatics Institute: https://www.phii.org
- National Environmental Health Association's Informatics Resources: www.neha.org/eh-topics/informatics/informatics-resources

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EH CALENDAR

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

UPCOMING NATIONAL ENVIRONMENTAL HEALTH ASSOCIATION (NEHA) CONFERENCES

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

NEHA AFFILIATE AND REGIONAL LISTINGS

Kentucky
February 8–10, 2021: Annual Conference, Kentucky Environmental Health Association, Lexington, KY, http://kyeha.org/events

Michigan
March 2021: Annual Educational Conference, Michigan Environmental Health Association, Port Huron, MI, www.meha.net/AEC

TOPICAL LISTINGS

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

Did You Know?

You can stay in the loop every day with NEHA's social media. Find NEHA on
- Facebook: www.facebook.com/NEHA.org
- Twitter: https://twitter.com/nehaorg
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Did You Know?

You can stay up-to-date on environmental health issues within the various levels of government through NEHA's Government Affairs page at www.neha.org/government-affairs. Check out the Your Insider in Government Affairs blog, view one of the Government Affairs webinars, or read a recent position paper or sign-on letter.

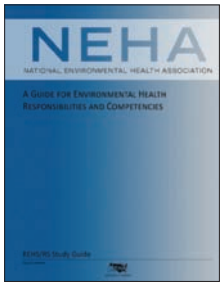
RESOURCE CORNER

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

NEHA BOOKSTORE
www.neha.org/store

REHS/RS Study Guide (4th Edition)

National Environmental Health Association (2014)

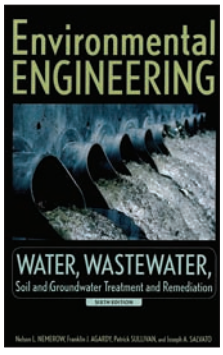


The Registered Environmental Health Specialist/Registered Sanitarian (REHS/RS) credential is the National Environmental Health Association's (NEHA) premier credential. This study guide provides a tool for individuals to prepare for the REHS/RS exam and has been revised and updated to reflect changes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

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

Environmental Engineering: Water, Wastewater, Soil and Groundwater Treatment and Remediation (6th Edition)

Edited by Nelson L. Nemerow, PhD; Franklin J. Agardy, PhD; Patrick Sullivan, PhD; and Joseph A. Salvato (2009)



First published in 1958, Salvato's *Environmental Engineering* has long been the definitive reference for generations of sanitation and environmental engineers. The most recent edition was completely rewritten by leading experts in the field and offers succinct case studies, process and plant design examples, and added coverage of such subjects as urban and rural systems. This volume covers water and wastewater treatment, water supply, soil and groundwater remediation and protection, and industrial waste management. Study reference for NEHA's Registered Environmental Health Specialist/Registered Sanitarian credential exam.

384 pages / Hardback
Member: $140 / Nonmember: $155

Certified Professional–Food Safety Manual (3rd Edition)

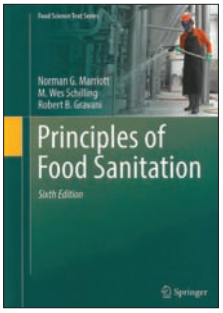
National Environmental Health Association (2014)

The Certified Professional–Food Safety (CP-FS) credential is well respected throughout the environmental health and food safety field. This manual has been developed by experts from across the various food safety disciplines to help candidates prepare for NEHA's CP-FS exam. This book contains science-based, in-depth information about causes and prevention of foodborne illness, HACCP plans and active managerial control, cleaning and sanitizing, conducting facility plan reviews, pest control, risk-based inspections, sampling food for laboratory analysis, food defense, responding to food emergencies and foodborne illness outbreaks, and legal aspects of food safety.

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

Principles of Food Sanitation (6th Edition)

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



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

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

Did You Know?

If you missed any of the webinars offered by NEHA during National Food Safety Education Month in September, you can view the recordings posted at www.neha.org/neha-celebrates-national-food-safety-education-month. Four webinars focused on different foodborne pathogens. Also, a roundtable cosponsored by the NEHA Business and Industry Affiliate explored the current challenges faced by food safety programs. You can also view our Food Safety Heroes blog at www.neha.org/membership-communities/get-involved/day-in-life/food-safety-heroes.

DAVIS CALVIN WAGNER SANITARIAN AWARD

The American Academy of Sanitarians (AAS) announces the annual Davis Calvin Wagner Sanitarian Award. The award will be presented by AAS during the National Environmental Health Association's (NEHA) 2021 Annual Educational Conference & Exhibition. The award consists of an individual plaque and a perpetual plaque that is displayed in NEHA's office lobby.

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

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

NOMINATIONS MUST BE RECEIVED BY APRIL 15, 2021.

Nomination packages should be e-mailed to Dr. Robert W. Powitz at powitz@sanitarian.com

Files should be in Word or PDF format.

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

SPECIAL **LISTING**

The board of directors includes NEHA's nationally elected officers and regional vice-presidents. Affiliate presidents (or appointed representatives) comprise the Affiliate Presidents Council. Technical advisors, the executive director, and all past presidents of the association are ex-officio council members. This list is current as of press time.

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"Now more than ever, I believe it is important to have a professional organization such as NEHA representing the field of environmental health. Communities across the country benefit from the passion, education, skills, and focus from my fellow environmental health specialists and NEHA helps uplift our profession. I am humbled by the knowledge that environmental health professionals save lives through the protection of food, water, air, land, and vectors of disease. Bravo to us all!"

Jannette Whitcomb, REHS, Colorado

U.S. Postal Service Statement of Ownership

UNITED STATES POSTAL SERVICE® — Statement of Ownership, Management, and Circulation (All Periodicals Publications Except Requester Publications)

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f. Total Distribution (Sum of 15c and 15e)			1,007	935
g. Copies not Distributed (See Instructions to Publishers #4 (page #3))			188	165
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NATIONAL ENVIRONMENTAL HEALTH ASSOCIATION

NEHA **NEWS**

Call for Nominations

By Angelica Ledezma (aledezma@neha.org)

The National Environmental Health Association (NEHA) is governed by a board of directors who oversee the affairs of the association. There will be four board positions up for election in 2021:

- Region 2 vice-president (represents Arizona, California, Hawaii, and Nevada; 3-year term);
- Region 3 vice-president (represents Colorado, Montana, Utah, Wyoming, and all NEHA members residing outside of the U.S. [except members of the U.S. armed forces]; 3-year term);
- Region 8 vice-president (represents Delaware, Maryland, Pennsylvania, Virginia, Washington, DC, West Virginia, and all NEHA members of the U.S. armed forces residing outside of the U.S.; 3-year term); and
- second vice-president (national officer; 5-year term that progresses through the national offices and will serve as NEHA president in 2024–2025).

We seek diversity on the board in terms of gender, ethnicity, and a balance between regulatory officials, academia, and industry. Most importantly, we want people who will help us develop a new strategic vision, have experience managing diverse organizations, and can open doors for NEHA in building relationships with industry, academia, federal and state agencies, foundations, and other associations.

Requirements to serve on the board include

- membership with NEHA (individual or life) for 3 consecutive years prior to assuming office on July 15, 2021;
- not simultaneously holding a voting position on the board of a NEHA affiliate;
- endorsement by at least five voting NEHA members (from members residing in the region for regional vice-president candidates and from members residing in at least three different regions for second vice-president candidates); and
- willingness to commit the time necessary to actively serve on the board.

If you are interested in serving on our board of directors, please visit www.neha.org/elections for information on the nomination and election process. You can also contact NEHA Immediate Past-President Dr. Priscilla Oliver, chairman of NEHA's Nominations Committee, at immediatepastpresident@neha.org. The deadline to submit a nomination is **December 1, 2020**.

NEHA Staff Profile

As part of tradition, NEHA features new staff members in the *Journal* around the time of their 1-year anniversary. These profiles give you an opportunity to get to know the NEHA staff better and to learn more about the great programs and activities going on in your association. This month we are pleased to introduce you to one NEHA staff member. Contact information for all NEHA staff can be found on page 36.

Jesse Bliss

It was with great pleasure that I joined NEHA as director of Program and Partnership Development (PPD) starting in October 2019. This new chapter in my professional career takes the many individual threads of my experience and expertise from nearly two decades of academic, research, teaching, community engagement, and public health practice and weaves them together to form a multifaceted fabric of innovative, visionary, needs-based, and targeted resources that I use to guide and support the growth of PPD. My background and experience that comprise this fabric include workforce engagement and higher education administration, teaching and research; public health practice and environmental health workforce development; emergency preparedness, community resilience, disaster response, and recovery program development; environmental health strike team creation and deployment; and global health engagement, to name a few.

While this background has helped to prepare me for this leadership role at NEHA, I am honored to work with a vibrant, dedicated, passionate, and knowledgeable staff who work in PPD who help make our programs successful. I count myself blessed to work with a fantastic team who love the work they get to do, bring great energy and ideas on how to implement new programs, and pursue growth opportunities. PPD staff actively engage our members, both to learn from subject matter experts and to provide resources and support for the workforce.

My wife and I and our two boys ages 8 and 5 relocated from Salt Lake City, Utah, to the Washington, DC, metro area in December 2019 to establish stronger leadership support for NEHA's Washington, DC, staff and to support further growth of our presence in the eastern part of the U.S. We embraced this opportunity wholeheartedly and have since planted roots in a great community just outside of Frederick, Maryland. We are enjoying getting to know the East Coast as it is the first time we have lived on this side of our nation.

As I write this staff profile, our global community is in the throes of battling a pandemic that has challenged everyone, has highlighted ongoing issues with health disparities, and has pressed the public health workforce harder than ever before as we contend with this novel infectious disease. If there was ever a time to be involved in public health and more specifically, environmental health workforce development, it is right now. I am honored to work for an organization committed to the health, well-being, educational, and occupational needs of the nation's environmental health workforce.

To environmental health professionals, I want to share that I am inspired by your work, commitment, and by the numerous ways you are helping to make an essential difference in this unprecedented pandemic response. I share my heartfelt thanks to each and

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every one of you and offer my commitment to pursue excellence in all we endeavor to accomplish for our membership and for the environmental health workforce across the nation.

NEPHIP Goes Remote During the COVID-19 Pandemic: Part 2

How do you successfully turn an in-person, multistate travel internship into a robust virtual program in 1 month? The secret is simple: establish strong partnerships and retain strong staff who are passionate and innovative. In the September 2020 *Journal*, former NEHA project coordinator Christine Ortiz Gumina wrote about the National Environmental Public Health Internship Program (NEPHIP) that is funded through a cooperative agreement with the Centers for Disease Control and Prevention (CDC). Due to the COVID-19 pandemic, the traditional in-person travel program was innovated into a remote/virtual platform, constructing what public health internships could potentially look like in the future.

In any project, success is determined by the strength of its partnerships. Having a solid foundation and strong communication can move mountains and in the case of NEPHIP, transform an in-person internship with challenging travel logistics into a robust virtual program within 1 month. NEHA managed NEPHIP through the lens of partnerships and built strong communication channels between Environmental Health Science and Protection Accreditation Council (EHAC) academic program directors and Leslie Mitchell, EHAC director. When news of the COVID-19 pandemic began to fill the media and cities and states were closing down in March, it became apparent that the NEPHIP internships were in jeopardy.

Mitchell helped connect NEHA with many of the academic directors at EHAC-accredited schools by creating an opportunity for NEHA to speak with the directors about their concerns, the foreseeable challenges, and the needs of the selected NEPHIP students. What ultimately came of these multiple meetings was that an in-person internship would not be a safe option. To continue the program, it would have to be transformed to a virtual program. Simultaneously, meetings with the selected host health departments were also occurring to access their capabilities of hosting a student remotely and what potential projects the student could contribute to in this remote manner.

In order to innovate you must have passion. Understanding the connection between environmental health education and the field of practice is what makes NEPHIP such a vital internship for environmental health. NEPHIP's goal is to be the pipeline for graduating environmental health students to the public sector. Coming from a health department background, Ortiz Gumina understood this connection and the need to establish this pipeline. Canceling the program due to COVID-19 was not an option.

NEPHIP's first change was recognizing host health departments that could support and mentor students remotely. Many previously selected health departments could not understandably support the new logistics while others were able to host multiple students. Once the new host health departments were established, projects were worked through based on the needs of the health departments. Students participating in the NEPHIP 2020 summer program contributed to improving preparedness plans, air quality programs through asthma community outreach, harmful algal bloom programs, veterinary programs, hazardous waste, and issues associated with per- and polyfluoroalkyl substances (PFAS) and perfluorooctanoic acid (PFOA), just to name a few.

In addition to working on a project remotely, a National Environmental Public Health Network web page was created through the Higher Logic platform. The web page housed a continuously updated list of environmental health and public health trainings. The curated list of trainings consisted of trainings from CDC, NEHA, the Federal Emergency Management Agency, Tulane Public Health Learning Management System, and many other reputable learning platforms. In addition to the training resources, the network page housed a calendar that shared webinars ranging in topics from race and health inequality to COVID-19 and disinfectants. The platform creation was initially established for the use of students selected for the NEPHIP internships. Many EHAC-accredited program students had lost their summer internships, however, due to the pandemic. Academic directors at these universities and colleges expressed the great need to expand the National Environmental Public Health Network page to all EHAC-accredited program students who had lost their internships. This expansion allowed for more students to network with each other from multiple schools across the country.

The final transformation for NEPHIP was sharing on-site food establishment inspections, hazardous waste site assessments, and vector control field inspections virtually. To address this issue, NEHA purchased GoPro cameras and sent them to health departments that were willing to use the cameras to record inspections to share with the students through the network page. These videos allowed not only NEPHIP students to observe field work but also EHAC-accredited program students who had access to the network page.

The success of this transformation was confirmed by check-in calls between NEPHIP students, academic advisors, and the NEPHIP project coordinator. While a remote internship by no means can fully replicate the priceless experience of an in-person field work program, many of the students during the check-in calls expressed that it came close. The program still provided foundational skills, knowledge, and experience within the environmental health practice.

The pandemic has drastically changed our lives and our futures. Innovations can come from earth shaking events. Moments like these are occasions to reflect, change, and grow. NEHA would like to thank all those who helped in supporting the NEPHIP program this summer. Check out part 1 of this story published in the September 2020 *Journal* at www.neha.org/publications/journal-environmental-health/jeh-issue-september-2020.

Did You Know?

NEHA continues to expand the offerings of the COVID-19: Essential Functions of the Environmental Health Workforce Live Chat Series. Recordings from past live chats can be viewed at https://emergency-neha.org/covid19/live-chat-series. Previous live chats include building water safety, virtual inspections, and more.

2021

ACCEPTING NOMINATIONS NOW

Walter S. Mangold Award

The Walter S. Mangold Award recognizes an individual for extraordinary achievement in environmental health. Since 1956, this award acknowledges the brightest and best in the profession. NEHA is currently accepting nominations for this award by an affiliate in good standing or by any five NEHA members, regardless of their affiliation.

The Mangold is NEHA's most prestigious award and while it recognizes an individual, it also honors an entire profession for its skill, knowledge, and commitment to public health.

Nomination deadline is March 15, 2021.

For application instructions, visit www.neha.org/about-neha/awards/walter-s-mangold-award.

2021 Joe Beck Educational Contribution Award

This award was established to recognize NEHA members, teams, or organizations for an outstanding educational contribution within the field of environmental health.

Named in honor of the late Professor Joe Beck, this award provides a pathway for the sharing of creative methods and tools to educate one another and the public about environmental health principles and practices. Don't miss this opportunity to submit a nomination to highlight the great work of your colleagues!

Nomination deadline is March 15, 2021.

To access the online application, visit www.neha.org/about-neha/awards/joe-beck-educational-contribution-award.

DirecTalk
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What core governmental environmental health services should each program be prepared to deliver? What menu of additional services should we provide reflecting local conditions? If we do not answer these questions, then someone outside the profession will fill the void on our behalf.

Third, lets rally around our strengths. We maintain good relationships with the American Academy of Sanitarians, National Environmental Health Science and Protection Accreditation Council, Association of Environmental Health Academic Programs, and International Federation of Environmental Health. We also enjoy solid working relationships with our counterpart environmental health associations throughout the planet, as many of you observed during our recent Digital Defense virtual conference in August. What can we achieve together that we cannot achieve alone? This question is not intended to be a koan.

Last week we convened a hotwash after the Digital Defense virtual conference. The aim was to aggregate and summarize lessons learned from our first major virtual conference that attracted over 2,100 registrants. The conference suffered from warts, blemishes, and internal staff conflict, but hey, we pulled it off, door-to-door in under six weeks. We learned we could operate in a high-tech, high-touch environment. We learned that staff who considered themselves technically incompetent could acquire skills to use new software systems. Perhaps most importantly, we learned that when we work together and share credit, there is no end to what we can accomplish. I am struck how stress has the innate ability to provide illumination.

I commit to repurpose the dickery of 2020 into an opportunity in 2021 to disrupt our cognitive processes to chart a new navigational course. In fact, we may have entered a once in a career year to reestablish our professional identity as an essential public health service. We will not bask in the glow of our colleagues in the clinical professions. We cannot compete with the human drama and the emotions associated with the healthcare setting, no matter how many lives we protect and life expectancies we extend. At the same time, our profession is at the intersection of the things our communities hold sacred—our family's health, safety, and financial security.

Lee County shoreline in Florida. Photo courtesy of David Dyjack.

The Florida Lee County shoreline and the sailor's leeward shore represent more than a double entendre. Tropical gales and prevailing wind can nurture us or pummel us onto the rocky shorelines of our minds. We must dispense with our familiar grooves and create our future because history demonstrates that someone who does not understand or appreciate our profession may do it for us. Our profession possesses the grit, the ability to work together, and willingness to share credit. We can do this.

As we departed Blind Pass Beach, Sanibel traffic came to halt in both directions. My cortisol level rose, the worst of my churlish tendencies on full display as I lamented the inept drivers around me. My partner dutifully called out my poor attitude and inability to relax and enjoy the scenery. I took a deep breath and looked to identify the source of the delay. A baby alligator trundled across the road while more thoughtful and appreciative motorists regaled in the photo opportunity.

Dave

ddyjack@neha.org
Twitter: @DTDyjack

Did You Know?

You can access NEHA's policy and position statements at www.neha.org/publications/position-papers. NEHA's latest position statement focuses on racism and environmental health. Other recent statements cover COVID-19, adoption and implementation of the current Food and Drug Administration *Food Code*, cottage foods, clean energy, ear piercing guns and microblading, and mosquito control. You can also view the declarations of support NEHA recently posted for World Environmental Health Day, National Food Safety Education Month, and National Preparedness Month.

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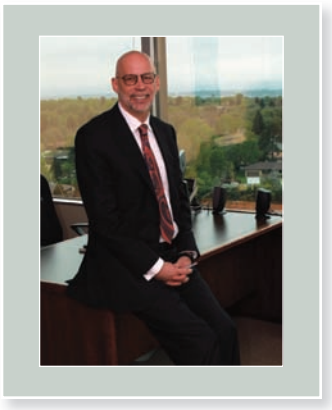

David Dyjack, DrPH, CIH

Along the Lee Shore

Blind Pass Beach lies between the Sanibel and Captiva Islands, nestled in coastal Lee County, Florida. This gem is serviced by a diminutive parking lot that extorts a $5/hour fee from motoring visitors. I reluctantly forfeited $10 from my checking account and endured the scorching hot sand to secure a spot where the Gulf of Mexico unites with the Wulfert Channel.

Within minutes of arrival I was captivated by the beach's charm as my wife and I waded into the Gulf and onto a sandbar some 100 m from shore. Shells, loose coral, and sand dollars were abundant. Reluctantly we left these potential souvenirs in the ocean where they belonged. The customary summertime tropical afternoon rain shower threatened to ruin the romantic moment, but then again, thunderstorms and torrential rain give rise to the vegetation and verdant colors that punctuate the location's charm. They are inseparable.

The maritime industry takes an entirely different view of the lee shore. Lee shores are known as coastal areas where the wind blows towards the beach. History is replete with stories of foundering ships that ran aground in part by the wind that drove their vessels onto the rocks. Proximity to the lee shore provides a glimpse of coastal ecological splendor and is at the same time to be avoided by all but the most skilled sailors. Beauty and danger are siblings, and they too, are inseparable.

I see a parallel of the gales that pummel the lee shore with two major risks that I have increasingly observed across the public health landscape. The first is the human tendency to regress to the mean or take the path of least resistance down the neural pathways of the familiar. These neural pathways are real. They reside in the brain and are like the repeated route we take when commuting to work. When a vehicle accident occurs during our morning commute, cortisol is released into our bloodstream as we manage our emotions and attendant stress. We enter a moment when our journey to work is disrupted and we ponder an alternate path for our vehicle. Make no mistake, the brain's plasticity can accommodate change but the immediate impact of an unwelcome confounder to our morning commute can be profound. Consider road rage if you doubt my hypothesis.

> *Let us exploit this state of mental activation.*

The second and more disturbing characteristic I detect is the Dunning–Kruger effect. The researchers who first observed and reported the phenomena summarized that people who are incompetent at a task will almost always overestimate their abilities. Ironically, these people are literally unable to recognize their own incompetence. Discretion and my continued employment as executive director temper my impulse to provide environmental public health illustrations. Privately, I am comfortable with the notion you can spot this attribute in people you know and love.

The neural pathways of the familiar and the Dunning–Kruger effect are cognitive fraternal twins. While most of us desire to closeout calendar year 2020 as quickly as possible, I am impressed that we should use this disruptive time to grow and escort the profession to a brighter future. A future characterized by recognition, sustained support, and professional self-actualization. If our neural pathways and ego are disrupted by COVID-19, then let us exploit this state of mental activation.

First, we should build on the Understanding the Needs, Challenges, Opportunities, Vision, and Emerging Roles in Environmental Health (UNCOVER EH) articles published last year in the *Journal of Environmental Health*, *American Journal of Public Health*, and *Environmental Health Perspectives* through a partnership between the Centers for Disease Control and Prevention, National Environmental Health Association, and Baylor University. These workforce articles dispense with dated notions and provide clarity on who we are and our expressed needs. I recommend these articles be considered required reading in academic programs as they provide important markers of the state of this profession as it was in 2019.

Second, the National Academies of Sciences, Engineering, and Medicine in 2012 identified environmental health as a foundational public health service. They provided us a beachhead to disrupt cliché perceptions of who we are and what we do. Here is our opportunity to answer questions: What does foundational public health service mean?

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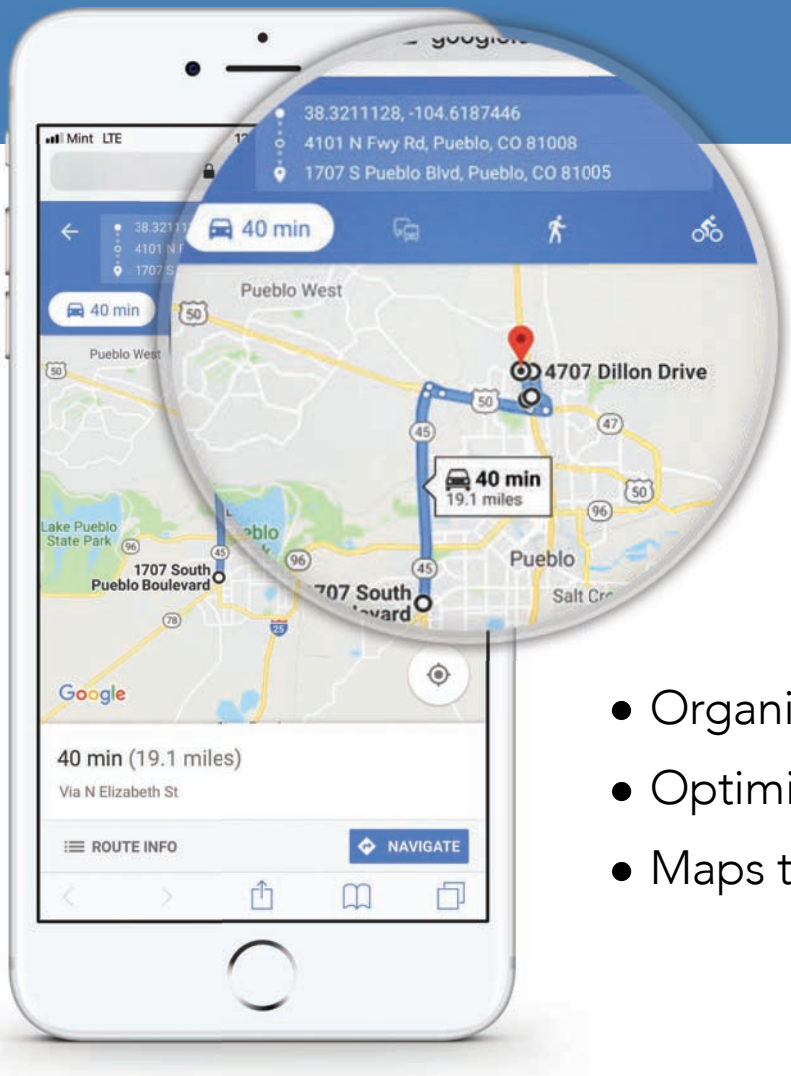

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