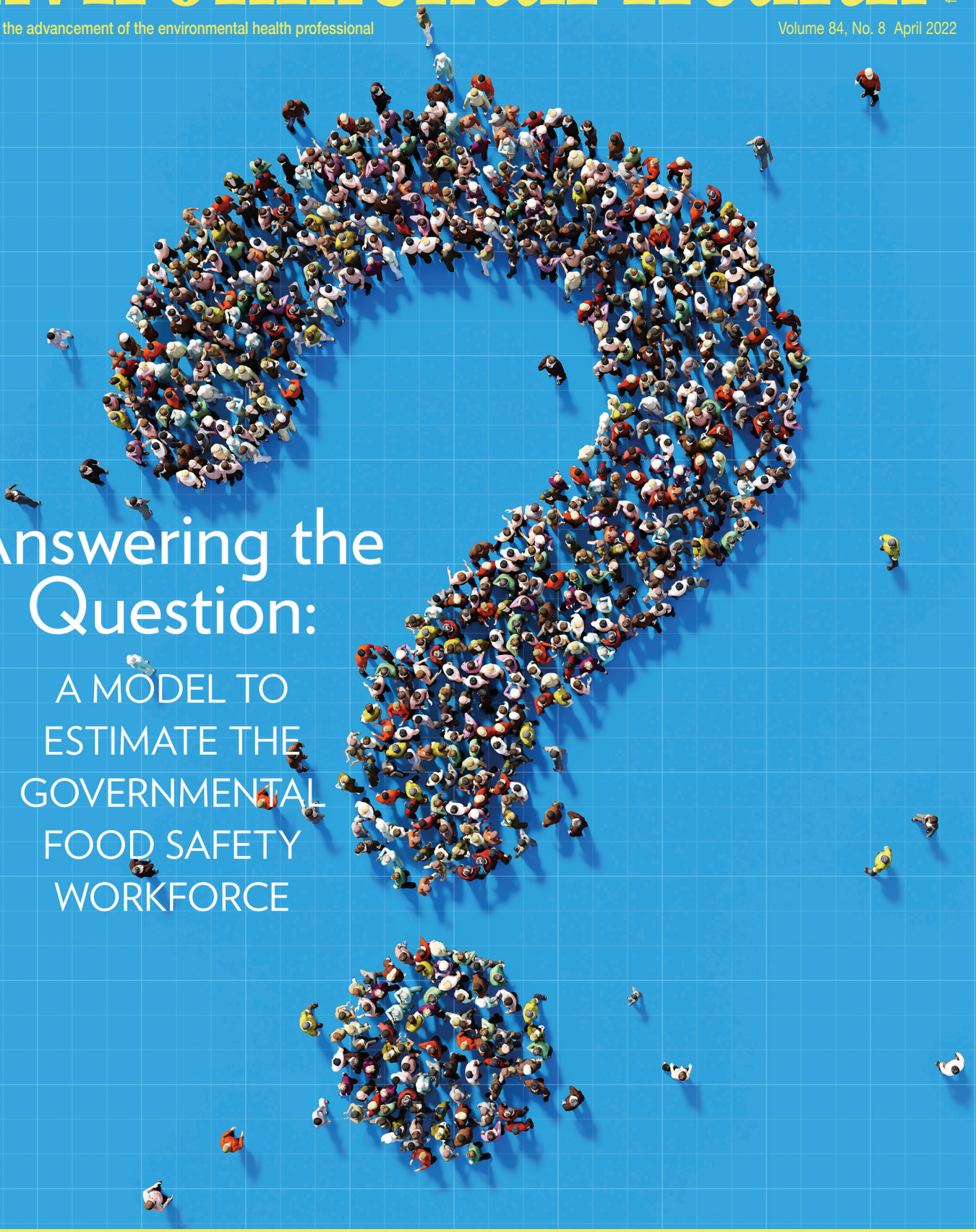
JOURNAL OF

Environmental Health

fifteen dollars

Dedicated to the advancement of the environmental health professional

Volume 84, No. 8 April 2022

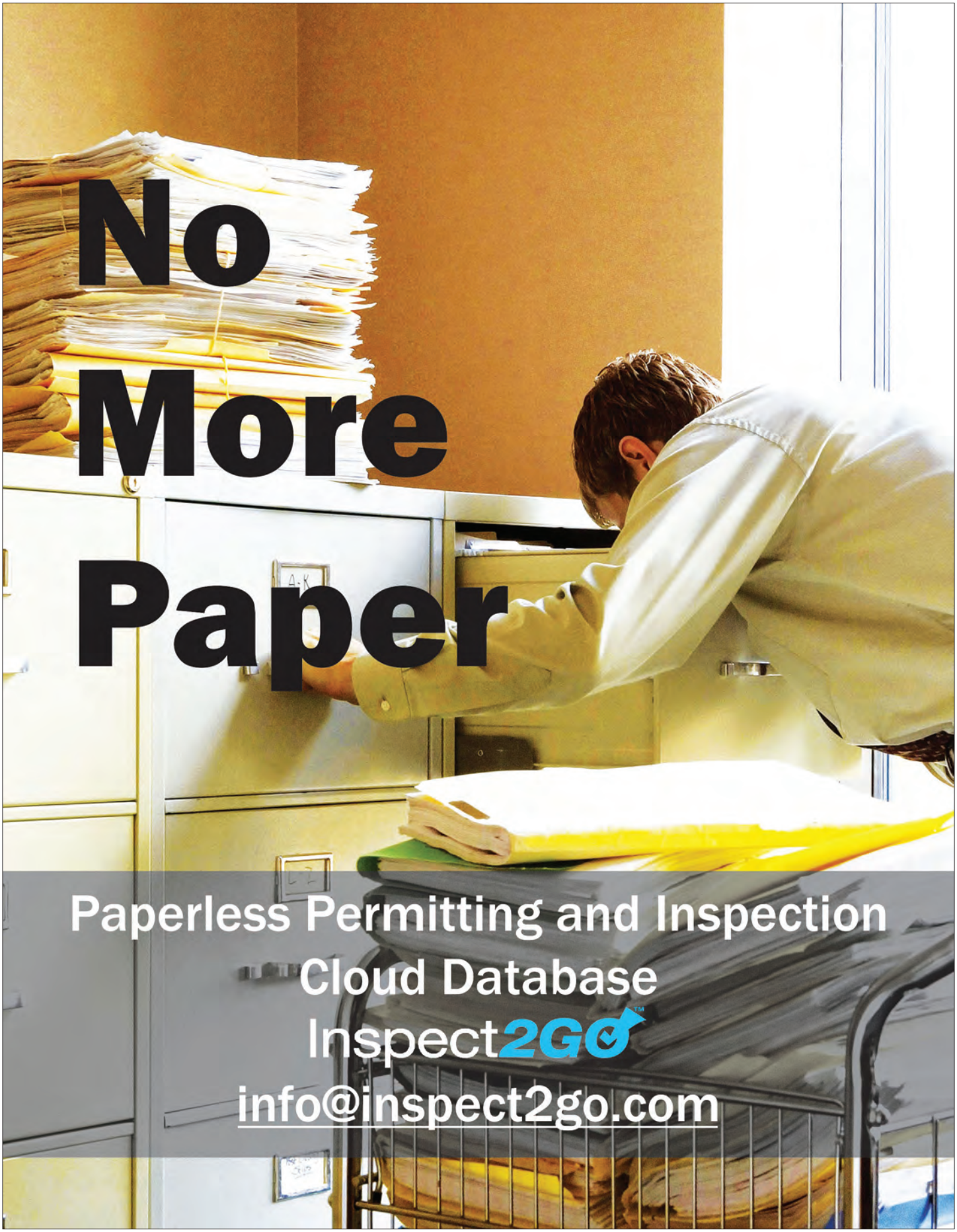


Answering the Question:

A MODEL TO ESTIMATE THE GOVERNMENTAL FOOD SAFETY WORKFORCE

Published by the National Environmental Health Association

www.neha.org


No
More
Paper
Paperless Permitting and Inspection
Cloud Database
Inspect2GO
info@inspect2go.com

JOURNAL OF

Environmental Health

Dedicated to the advancement of the environmental health professional

Volume 84, No. 8 April 2022

ABOUT THE COVER

Governmental food safety professionals (FSPs) play a critical role in verifying that the food industry is fulfilling its responsibilities. Without the ability to accurately estimate the FSP workforce, potential concerns arise regarding the effectiveness of the U.S. food safety system. In this month's feature article, "Governmental Food Safety Professional Workforce Estimation Model," a new model is introduced that provides a better understanding of the estimated number of FSPs within various nonfederal government agencies. The model can aid in the allocation of federal resources to fill gaps in staffing and competency-based training, as well as increase awareness of the need for and access to standardized training for FSPs.

See page 26.

Cover image © iStockphoto: MicroStockHub

ADVERTISERS INDEX

ADVANCEMENT OF THE SCIENCE

ADVANCEMENT OF THE PRACTICE

ADVANCEMENT OF THE PRACTITIONER

YOUR ASSOCIATION

don't miss

in the next *Journal of Environmental Health*

- An Overview of Brownfields Redevelopment in the United States
- Association Between Equipment Maintenance Violations in Food Service Establishments and Their Risk Levels
- Spatial Analysis of the Impact of "Do Not Spray" Areas on Mosquito Adulticiding

Official Publication

Journal of Environmental Health
(ISSN 0022-0892)

Kristen Ruby-Cisneros, Managing Editor

Ellen Kuwana, MS, Copy Editor

Hughes design|communications, Design/Production

Cognition Studio, Cover Artwork

Soni Fink, Advertising
For advertising call (303) 802-2139

Published monthly (except bimonthly in January/February and July/August) by the National Environmental Health Association, 720 S. Colorado Blvd., Suite 105A, Denver, CO 80246-1910. Phone: (303) 756-9090; Fax: (303) 691-9490; Internet: www.neha.org. E-mail: kruby@neha.org. Volume 84, Number 8. Yearly subscription rates in U.S.: $150 (electronic), $160 (print), and $185 (electronic and print). Yearly international subscription rates: $150 (electronic), $200 (print), and $225 (electronic and print). Single copies: $15, if available. Reprint and advertising rates available at www.neha.org/JEH. CPM Sales Agreement Number 40045946.

Full text of this journal is available from ProQuest Information and Learning, (800) 521-0600, ext. 3781; (734) 973-7007; or www.proquest.com. The *Journal of Environmental Health* is indexed by Current Awareness in Biological Sciences, EBSCO, and Applied Science & Technology Index. It is abstracted by Wilson Applied Science & Technology Abstracts and EMBASE/Excerpta Medica.

All technical manuscripts submitted for publication are subject to peer review. Contact the managing editor for Instructions for Authors, or visit www.neha.org/JEH.

To submit a manuscript, visit http://jeh.msubmit.net. Direct all questions to Kristen Ruby-Cisneros, managing editor, kruby@neha.org.

Periodicals postage paid at Denver, Colorado, and additional mailing offices. POSTMASTER: Send address changes to *Journal of Environmental Health*, 720 S. Colorado Blvd., Suite 105A, Denver, CO 80246-1910.

Printed on recycled paper.

PRINTED WITH SOY INK

2022 Walter F. Snyder Award

Call for Nominations

Nomination deadline is May 14, 2022

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

❖ ❖ ❖

Nominations for the 2022 Walter F. Snyder Award are being accepted for environmental health professionals achieving peer recognition for:

- Outstanding accomplishments in environmental and public health protection.
- Notable contributions to protection of environment and quality of life.
- Demonstrated capacity to work with all interests in solving environmental health challenges.
- Participation in development and use of voluntary consensus standards for public health and safety.
- Leadership in securing action on behalf of environmental and public health goals.

❖ ❖ ❖

Past recipients of the Walter F. Snyder Award include:

2021: Kevin Smith	2011: Gary P. Noonan	2000: Friedrich K. Kaeferstein	1990: Harvey F. Collins	1980: Ray B. Watts
2020: Joseph Cotruvo	2010: James Balsamo, Jr.	1999: Khalil H. Mancy	1989: Boyd T. Marsh	1979: John G. Todd
2019: LCDR Katie Bante	2009: Terrance B. Gratton	1998: Chris J. Wiant	1988: Mark D. Hollis	1978: Larry J. Gordon
2018: Brian Zamora	2008: CAPT Craig A. Shepherd	1997: J. Roy Hickman	1987: George A. Kupfer	1977: Charles C. Johnson, Jr.
2017: CAPT Wendy Fanaselle	2007: Wilfried Kreisel	1996: Robert M. Brown	1986: Albert H. Brunwasser	1975: Charles L. Senn
2016: Steve Tackitt	2006: Arthur L. Banks	1995: Leonard F. Rice	1985: William G. Walter	1974: James J. Jump
2015: Ron Grimes	2005: John B. Conway	1994: Nelson E. Fabian	1984: William Nix Anderson	1973: William A. Broadway
2014: Priscilla Oliver	2004: Peter D. Thornton	1993: Amer El-Ahraf	1983: John R. Bagby, Jr.	1972: Ralph C. Pickard
2013: Vincent J. Radke	2002: Gayle J. Smith	1992: Robert Galvan	1982: Emil T. Chanlett	1971: Callis A. Atkins
2012: Harry E. Grenawitzke	2001: Robert W. Powitz	1991: Trenton G. Davis	1981: Charles H. Gillham	

The 2022 Walter F. Snyder Award will be presented during the NEHA 2022 Annual Educational Conference & Exhibition being held in Spokane, Washington, June 28–July 1, 2022.

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

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 (NEHA) 2022 Annual Educational Conference & Exhibition. The award consists of an individual plaque and a perpetual plaque that is displayed in the NEHA office.

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

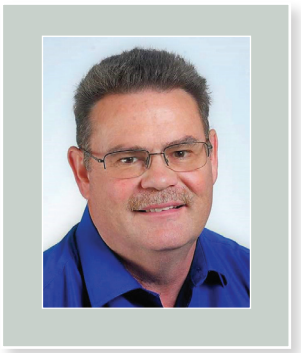
1. Exhibit resourcefulness and dedication in promoting the improvement of the public's health through the application of environmental and public health practices.
2. Demonstrate professionalism, administrative and technical skills, and competence in applying such skills to raise the level of environmental 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, 2022.

Nomination packages should be emailed to Eric Bradley, AAS Executive Secretary/Treasurer, at ericbradley30252@gmail.com. Files should be in Word or PDF format.

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

PRESIDENT'S MESSAGE



Roy Kroeger, REHS

Data, Data, Data

Each month as the deadline approaches for writing this column, I find it more difficult to find a topic to write on. What is relevant? What is essential to our profession? Over the past several weeks I have reviewed grant applications for the National Environmental Health Association (NEHA)-Food and Drug Administration (FDA) Retail Flexible Funding Model Grant Program. In many of these applications, I saw projects that dealt with data: the collection of data, the analysis of data, the sharing of data, and how agencies plan to use the information to improve food safety. The same topic flooded my email inbox this week as the Centers for Disease Control and Prevention (CDC) Foundation hosted a summit on the future of public health.

As environmental health professionals, think about how much data your office has stored. How much information you have collected over decades of service to the community. Data on food safety, water quality, air quality, and so much more. We keep these data to refer back to when it is needed. How much sewage is this subdivision adding to the groundwater supply? Which risk factor violations are found most often? This information helps us make more informed decisions to improve public health in our communities.

Now that we have thousands of state and local environmental health programs collecting data, where do we go next? Does this information have a higher purpose than residing on our local servers? Collectively, can all these data be used to improve public health around the country? I believe it can be used to improve our health outcomes on a larger scale.

To combat what ails us, we need to know more.

Currently, most environmental health data are siloed in local departments. Some of it might get shared with our state programs in some instances. We store information in Access, HealthSpace, Accela, Custom Data Processing, Inspect2GO, RedCap, and our alphabet soup of databases. I would like you to see these databases as cell phone towers. The more towers in a network, the better the coverage. These databases can have the same impact if they are all networked together. As new data are added to our network of environmental health data, the gaps become smaller. As a disease or pollutant crosses the country, our data would be there to help us more quickly recognize and fix a problem. Currently, it is difficult to find data and slower to retrieve it if it is kept on a different network in a different county or state. If only we had a way to build an information network that connects with adjoining counties, states, and even the federal government.

Public health has proven over the last couple of years that the technology is available to make this type of network happen. For example, consider the >500 million COVID-19 vaccines administered and the millions of COVID-19 test results recorded in a little over 1.5 years. All these data have been captured locally and shared with state agencies and CDC. From there, the information is transferred to universities such as Johns Hopkins and reported in *The New York Times* overnight. If we can achieve this sharing with COVID-19 data, we can do it with other data. Another example of a public health network is the Community Well-Being Index, a website that reports on nearly 600 data points broken down by almost every county in the U.S. (https://wellbeingindex.sharecare.com). The information is then shared openly around the country to improve health. Environmental health can and should learn from these examples to build a vast network of data that will help create a more informed workforce for our communities.

I am not suggesting that everyone use the same database or put all their data on an open-facing database. In many cases, we are not able to do that for legal reasons. We must, however, start looking at the obstacles standing in the way of quick and easy data sharing capabilities. The first thing that needs to change is our mindset that data are ours and we must protect it at all costs. That is crazy and violates our social philosophy to do the most good for the most significant number of people. There are many lines on a map and we see that our world is getting smaller each day. Lines on a map do not stop the progression of disease and illness, but it has built barriers in our minds and policies for decades. Foodborne illnesses spread rapidly across the country. West Nile virus spread from coast to coast in only a couple of years. To combat what ails us, we need to know more.

I am not an information technology specialist but having worked with the Partnership for Food Protection to create an integrated food safety system, I have learned that to share data, creating a data dictionary

is crucial. The data dictionary builds a foundation so that different databases speak the same language. FDA has started doing some of this work in the manufactured foods arena.

Once information is given a common name, it must be stored so that others can access the data. Access to data needs to be down two-ways or in a push–pull manner. Users must provide and retrieve the information, or they will not feel that it is of any use to participate in sharing. Formal agreements and metadata can be created to communicate what participants or data users are getting and why the information was created. Policies, rules, and regulations can prevent the misuse of these data.

While we learn to share data, we also need to teach our workforce how to use the power of this information. Many environmental health professionals are great at collecting information, yet most do not analyze and interpret what they have. Collaboration with research facilities and academia can teach us how to use data to make better predictions on water and air contamination, where we are most likely to have a foodborne illness, and when and where the next disease outbreak will occur. Information can even be used to determine workforce shortages or how to best use existing resources to prevent an outbreak.

Having good data will also help environmental health professionals gain a seat at the policy making table. Healthcare professionals, community planners, elected officials, and many others need data when making decisions. If we have data they seek, we will be invited to share it. Many of us already experience this inclusion in the process of public health department accreditation as environmental health data are used to help meet several accreditation requirements.

As I write this column, many of us in the NEHA leadership and staff have discussed creating some type of data lake. What information can we capture? How and where can we store it? Who will benefit from the information? How will the data improve our profession and the health of the public? Can those professions and individuals outside of public health benefit? The possibilities are endless. I say that if you build the network, the users will come.

Let me know what you think. Is this too futuristic? Is the thought of data collection, storage, and use essential, or is it a waste of time and money?

President@neha.org

SUPPORT THE NEHA ENDOWMENT FOUNDATION

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

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

Thank you.

DELEGATE CLUB

($1–$99)

Name in the Journal for 1 year.

Tunde M. Akinmoladun
Steven K. Ault
Michael E. Bish
Logan Blank
Marnie Boardman
Glenn W. Bryant
Kimberley Carlton
Deborah Carpenter
James G. Cortelyou
Lawrence Cyran
Kristen Day
Thomas P. Devlin
James M. Dodd
Samantha Donahue
Wendy L. Fanaselle
Shelby Foerg
Christopher J. Foster
Mary K. Franks
Debra Freeman
Abdelrahim Gador
Dolores Gough
Catherine Hefferin
Scott E. Holmes
Jamison S. Honeycutt
Douglas J. Irving
Lamin Jadama
Leila Judd
Bonnie Koenig
Robert W. Landry
Richard Lavin
Allan R. Levesque
Ann M. Loree
Stephanie Mach
James C. Mack
Patricia Mahoney
Patrick J. Maloney
Alan Masters
Kaiser Milo
Peter J. Mitchell
Derek Monthei
Naing Myint
John A. Nakashima
Brion A. Ockenfels
Daniel B. Oerther
Christopher B. Olson
Joe Otterbein
Kathryn Pink
Frank Powell
Jeffrey A. Priebe
Mike K. Pyle
Jeremiah Ramos
Evangeline Reaves
Roger T. Reid
Catherine Rockwell
Dora Rodriguez
Luis O. Rodriguez
Anthony Sawyer
Philip H. Scharenbrock
Marilou O. Scroggs
Frank Semeraro
Karla Shoup
Christopher J. Smith
Robert A. Stauffer
Tamika Thompson
James M. White
Dawn Whiting
Christian Witkovskie

HONORARY MEMBERS CLUB

($100–$499)

Letter from the NEHA president and name in the Journal for 1 year.

Freda W. Bredy
Kenneth C. Danielson
Michele DiMaggio
Annette Eshelby
Michael G. Halko
Donna K. Heran
T. Stephen Jones
Ayaka Kubo Lau
Philip Leger
Sandra M. Long
Robert A. Maglievaz
John A. Marcello
Wendell A. Moore
Victoria A. Murray
Susan V. Parris
James E. Pierce
Larry A. Ramdin
Jonathan P. Rubingh
Joseph W. Russell
Michéle Samarya-Timm
Vickie Schleuning
Mario Seminara
John H. Shrader
Joshua R. Skeggs
Jacqueline Taylor
Linda Van Houten
Tom A. Vyles
Sandra Whitehead
Lisa Whitlock

21st CENTURY CLUB

($500–$999)

Name submitted in drawing for a free 1-year NEHA membership and name in the Journal for 1 year.

Thomas J. Butts
Ned Therien

SUSTAINING MEMBERS CLUB

($1,000–$2,499)

Name submitted in drawing for a free 2-year NEHA membership and name in the Journal for 1 year.

James J. Balsamo, Jr.
Brian K. Collins
George A. Morris
Peter H. Sansone
Peter M. Schmitt
James M. Speckhart

AFFILIATES CLUB

($2,500–$4,999)

Name submitted in drawing for a free AEC registration and name in the Journal for 1 year.

Robert W. Custard
Timothy N. Hatch
Welford C. Roberts

EXECUTIVE CLUB AND ABOVE

(>$5,000)

Special invitation to the AEC President's Reception and name in the Journal for 1 year.

Vincent J. Radke

Application of Haddon's Matrix in the Exploration of Factors Related to Exertional Heat Illness in Disaster Responders in the U.S. National Guard

Denise A. Smart, MPH, DrPH, RN
Washington State University, College of Nursing

Gail Oneal, PhD, RN
Washington State University, College of Nursing

Mary Lee Roberts, PhD, RN
Washington State University, College of Nursing

Janessa M. Graves, MPH, PhD
Washington State University, College of Nursing

Lindsey Eberman, MS, PhD
Indiana State University, College of Health & Human Services

Tamara Odom-Maryon, PhD
Washington State University, College of Nursing

Stephanie Rowan, MSN, RN
University of Texas Health Science Center

Cory Edwards, MHPA
Washington State University, College of Nursing

Dawn DePriest, MSHS, DNP, FNP-C, ARNP, RN-BC
Washington State University, College of Nursing

Abstract

Exertional heat illness (EHI) presents significant risks for National Guard (NG) disaster response teams, especially when they are performing operations in impermeable personal protective equipment (PPE). Impermeable PPE does not allow passage of air or fluids either from the outside or inside of the equipment. While EHI prevention and management strategies are well documented, these strategies do not account for the additional heat-related risks NG teams confront when responding to disasters requiring PPE that protects against any hazards. NG personnel who wear the full gamut of impermeable PPE (including Tyvek coveralls and respirators) experience core body temperature increase as a result of built-up body heat or accumulated perspiration.

We conducted a qualitative descriptive study using thematic analysis with three focus groups to identify EHI-related factors during disaster response operations that require PPE. We organized focus group data into phases of disaster response operation: pre-event, event, and post-event to reflect four conceptual groups: human (host), agent (energy transfer), environmental, and workplace/social conditions. Participants identified 12 themes covering the 3 phases and situated in the 4 conceptual groups. Results of this study serve as an evidence-based foundation for enhancing pre-event, event, and post-event assessments administered by NG medical personnel and can be applied to other professionals who are required to wear PPE.

Introduction and Background

Heat injuries affect >2,500 U.S. Armed Forces personnel annually (Armed Forces Health Surveillance Bureau, 2017). Incidence of military heat injuries, in general, and heat stroke, specifically, have steadily increased in recent years (Kodack, 2019). In 2018, 578 cases of heat stroke and 2,214 cases of heat exhaustion were reported across all four branches of the military, which equals an incidence rate of 0.45–1.71 per 1,000 person-years (Armed Forces Health Surveillance Branch, 2019). If each of these cases resulted in hospitalization in the civilian sector, it would equate to nearly $9,000/case, $25,128,000/year, or $250 million over 10 years (Schmeltz et al., 2016). These numbers do not reflect additional personnel replacement costs should the hospitalized personnel no longer be able to fulfill their military positions. From 2008–2018, military costs were estimated at nearly $1 billion for heat injuries resulting in life-threatening conditions and included lost duty time, medical treatment, and medical evacuations, which all have negative implications for mission readiness (Army Public Health Center, 2021; DeGroot et al., 2015). Heat injuries, including exertional heat illness (EHI), account for a significant portion of nonbattle injuries (Armed Forces Health Surveillance Branch, 2019; Lilley, 2017).

EHI is defined as a group of heat-related illnesses caused by bodily responses to physiological reactions and environmental conditions during activity (Casa et al., 2015; Kazman et al., 2018). Although an EHI often occurs in hot and humid environments, one can occur in normal conditions depending on a person's physical condition and the type of activity. EHIs include heat syncope, heat exhaustion, heat stress, and heat stroke, with each type of heat injury carrying a set of signs and symptoms that fit their respective case definitions (O'Connor & Casa, 2021).

Across occupations, heat stress and heavy physical activity are associated with physical

fatigue, impaired cognition, and improper use of personal protective equipment (PPE), which put workers at risk for on-the-job injuries, illness, and death (Jacklitsch et al., 2016; Varghese et al., 2019). Because military personnel often train or work in hot environments, heat illness is a serious injury risk. Experts have expressed growing concern that EHI is a high priority for injury prevention within the military (Goforth & Kazman, 2015; Hosokawa et al., 2019; Office of the Under Secretary of Defense for Acquisition & Sustainment, 2019). Understanding the predictors of EHI is important to the safety of military service members and the overall mission. Despite knowledge of risk factors for heat illness and prevention strategies, annual rates of heat-related illness and injury continue to increase in the U.S. military (Armed Forces Health Surveillance Branch, 2019).

The National Guard (NG) is the U.S. military organization responsible for national defense and disaster response. Specialized NG teams (e.g., Homeland Response Force [HRF] and Chemical, Biological, Radiological, Nuclear, and Explosive [CBRNE] Enhanced Response Force Package [CERF-P]) are responsible for the emergency response to disasters, often in field situations and in stressful, hot, and/or humid environments (Matthews, 2016; Washington National Guard, 2018). In addition, most NG personnel are reservists who serve only on a part-time basis with training once a month and a longer 2-week period during the year; as such, reservists might not be acclimated to a training site or physically fit for some tasks. Therefore, service personnel are often at risk for EHI, especially when wearing full-body PPE that is designed for hazardous situations (Potter et al., 2019).

Full-body PPE is impermeable, trapping heat and perspiration. It requires the use of Tyvek suits, respiratory breathing masks, rubber gloves, and boots. Recommendations and tools have been developed to assess health risks, including EHI, during military or athletic performance (Army Public Health Center, 2016; Hosokawa et al., 2019; Miller et al., 2021). Tools described in the literature, however, are population-specific, may not evaluate EHI specifically, and many have not been validated. Moreover, an easy-to-use EHI assessment tool with corresponding medical management applications is not available or used by CERF-P/HRF teams. A set of guidelines specific to EHI, in addition to this easy-to-use assessment tool, is needed to facilitate use of best practices by CERF-P/HRF medics who care for NG personnel, especially those using full-body PPE.

Despite what is known about EHI and its underlying pathophysiology (Navarro et al., 2017; O'Connor & Casa, 2021), we do not understand how all the associated factors affect an individual's susceptibility (Stacey et al., 2014). Intrinsic predisposing factors for EHI include participant health status and age, which contribute to EHI risk regardless of gender. Those individuals with sickle cell trait or a prior history of EHI are at higher risk for subsequent EHI based on uniquely different physiological processes. In addition, high motivation of military personnel to continue the mission despite physiological warning signs can lead NG personnel to ignore the early signs of EHI or delay seeking treatment (Goforth & Kazman, 2015; Hosokawa et al., 2019).

Extrinsic factors such as ambient air temperature, wet-bulb temperature, medication use, or clothing type worn also generate risks for EHI in military personnel (Kazman et al., 2018). Usual hierarchy of controls is used when considering EHI: acclimatization, engineering controls, administrative controls, and PPE (Department of the Air Force, 2020; Department of the Army, 2016). General safety controls include training, heat stress hygiene practices, and medical surveillance (Centers for Disease Control and Prevention, 2020; Dehghan et al., 2013; Department of the Air Force, 2020; Department of the Army, 2016; Jacklitsch et al., 2016; Moore et al., 2016). It is unclear, however, how general controls and fitness affect overall risks for EHI in NG personnel while they are wearing PPE during training and actual events. Identification of inherent factors that put an individual at higher risk is needed. In addition, identification of general controls used for treatment and management of EHI, in relation to those factors, could assist in developing a tool that could mitigate EHI injury.

Presently, a standard medical screening and assessment form (SF-600) is used during CERF-P/HRF exercises and live disaster deployments to identify current physical fitness and potential health risks. Using the SF-600, NG personnel are screened and assessed by medics before and after any CERF-P/HRF exercise or deployment. The form does not, however, capture all of the factors associated with EHI; moreover, health personnel using the form to do assessments might not be familiar with EHI symptoms.

A project is underway to enhance the SF-600 by including the addition of key EHI risk factors and referencing best practices in field and clinical management guidelines. The project aims to expand the SF-600 into an evidence-based tool for military health professionals to use in the field for immediate assessment of service personnel in an effort to reduce and prevent EHI events. Two major aims, each with multiple steps, were developed for the project: 1) revise the current SF-600 form to add missing heat risk data required to identify EHI severity and to incorporate current best practices related to managing EHI risk and 2) conduct a pilot study to inform content validity of the revised SF-600 and the relevance of guidelines for field and clinical management of heat injury and illness. Additions to the SF-600 based on this project will provide an EHI severity score and a deployable risk score as part of in-field assessments.

As a final step, the revised SF-600 will serve as an EHI risk assessment tool with corresponding field and clinical management guidelines and will be pilot tested in two NG disaster training exercises. The first step of aim 1, which is the focus for this article, was to identify and prioritize factors related to EHI severity via expert focus groups of medical personnel, CERF-P/HRF medics, and other military and community experts. For these focus groups, the guiding research question was: What are the unique NG military factors that potentiate EHI risk? Haddon's Matrix, a conceptual framework for injury prevention, was followed to identify the factors related to EHI during NG disaster training. In this article, we describe how the framework of Haddon's Matrix was used in conjunction with focus groups to identify EHI factors related to recognition of EHI symptoms, and the risks of returning to duty.

Methods

This study used a qualitative descriptive focus group design and deductive thematic analysis reflecting the Haddon's Matrix conceptual framework to identify and prioritize factors related to EHI symptoms.

TABLE **1**

Haddon's Matrix for Risk Factors of Exertional Heat Illness (EHI) During Military Disaster Exercises

	Human (Military Service Personnel)	Agent (Energy Transfer Providers and Equipment, Behaviors, Actions)	Environment	
			Physical Environment (Terrain, Heat and Weather Conditions)	Workplace/Social Environment (Military Norms, Culture, Policies, Regulations)
Pre-event	• Personal characteristics (age, gender, high-risk group, BMI) • Fitness and acclimation • Behaviors/actions prior to exercise (sleep, diet, stress, hydration, use of alcohol and medications), withholding information • Knowledge of prevention and own signs and symptoms of EHI	• Pre-exercise health assessments • Setup and organization of military health assessment areas (e.g., screening, flow of traffic)	• Hot weather conditions • Type of geography (e.g., hilly, flat) • Time of year • Wet-bulb temperature	• Attitudes about risks • Support structures • Officer examples or orders • Enforcement of regulations and policies • Evaluation and treatment plan in place • Multiple assessment team members and appropriate staff
Event	• Participation in exercise (role) • Quality of personal protective equipment • Heat stress response • Prior heat injury	• Tyvek suits • Activities they are required to do (intensity and duration) • Assessment team member knowledge	• Heat • Humidity • Amount of time in suit • Amount of sunlight	• Good communication sources and plan • Ability of unit to complete exercise • Good observation of early symptoms while in suits • Personnel reports signs/ symptoms during exercise
Post-event	• Ability for recovery/return to duty	• Post-exercise health risk assessment, recognition of EHI • Referral/first aid station • Monitoring • Rapid cooling and/or immediate transport	• Area for immediate assessment or treatment • Rest and recovery areas • Distance to hospital	• Debrief team • Review assessment and triage protocols and regulations

Application of Haddon's Matrix to Exertional Heat Illness Factors

Haddon's Matrix guided the extrapolation of risk factors related to EHI during NG training exercises from the shared experiences of military healthcare personnel and athletic trainers who have knowledge of and experience with managing EHI. This theoretical model has been applied to injury, violence prevention, and trauma care and is appropriate for EHI (Bell et al., 1999). Haddon's Matrix utilizes the epidemiological triad model (i.e., human, agent, and environment) to examine factors related to the stages of an event when injury occurs, three levels of prevention, and the development of interventions (Bell et al., 1999). After identifying risk factors, the matrix can be adapted and used to evaluate options for preventing and reducing harm as well as to identify primary, secondary, and tertiary prevention strategies for stages of an event.

Prior to conducting the focus groups, we developed a Haddon's Matrix for EHI risk factors for NG personnel who were wearing Tyvek suits during training exercises (Table 1). The current SF-600 assessment form, military and sports literature, and existing military and health guidelines informed the main factors for the matrix cells (Armed Forces Health Surveillance Branch, 2019; Casa et al., 2015; Department of the Air Force, 2020; Department of the Army, 2016; Jacklitsch et al., 2016; Webber et al., 2016). The matrix was used to develop interview questions for the focus groups and then used to guide the analysis.

Population and Setting

Focus group participants included enlisted and officer NG personnel, retired NG personnel, civilian health professionals, and athletic trainers who were experienced in managing or identifying EHI and its sequelae in a military or athletic context. Using purposive sampling, research personnel identified participants who had CERF-P/HRF experience and local athletic trainers who were familiar with EHI. Focus groups were held over two months in 2018. Military healthcare personnel completed focus groups at one of two geographically distinct military bases; community-based participants completed their focus groups in a university classroom setting.

Data Collection

A summary table of existing military and nonmilitary EHI risk assessment guidelines and the SF-600 form were distributed to participants prior to their focus group so that they could familiarize themselves with concepts and current recommendations related to EHI. After consent was obtained, the purpose of the focus groups was explained and demographic information was collected.

TABLE **2**

Demographics of Focus Group Participants

Demographic/Training Experience	Participant Response (*N* = 27) # (%)
Age (years)	*M* = 46.22, *SD* = 8.69
Sex	
Male	20 (74)
Female	7 (26)
Racial background	
White	19 (70)
Black or African American	1 (4)
Asian	3 (11)
Hawaiian Native or Pacific Islander	0
Other: Mexican American	1 (4)
Multiracial [a]	3 (11)
Ethnic background	
Hispanic	3 (11)
Non-Hispanic	24 (89)
Highest level of education	
Associate or vocational degree	2 (7)
Bachelor's degree	10 (37)
Master's degree	5 (19)
Doctoral degree [b]	10 (37)
Professional licensure	
Medical doctor	7 (26)
Physician assistant	3 (11)
Registered nurse	5 (19)
Certified athletic trainer, certified registered nurse anesthetist, doctor of pharmacy	4 (15)
Current military involvement	
Civilian	5 (19)
Enlisted	6 (22)
Officer	16 (59)
Experience with disaster or mass casualty trainings or events	
No [c]	3 (11)
Yes	23 (85)
Role in a disaster or mass casualty training or event [d]	
Participant	8 (30)
Medical triage	21 (78)
Administrative	5 (19)
Other	2 (7)

Note: The sample population included participants from three sites: base 1 (*n* = 13), base 2 (*n* = 9), and the community (*n* = 5). Columns might not sum to total of 100% due to rounding and/or missing data. Some categories are not mutually exclusive.

[a] Identified as both Asian and Native American.

[b] Includes doctor of medicine (MD).

[c] Experience with extreme heat illness at the individual level and not at the mass casualty level.

[d] Categories are not mutually exclusive.

Focus groups took 45–60 min and were led by a qualitative expert as a moderator.

Semistructured questions derived from our Haddon's Matrix of risk factors for EHI during military exercises were posed to the focus groups and discussions were digitally recorded. During the focus groups, conceptual notes were recorded on display boards that were prepopulated with headings from the columns and rows of the Haddon's Matrix, but without the preidentified factors. Much of what was discussed during the focus group sessions centered on exploring and identifying possible factors that put NG personnel at risk for EHI when responding to a disaster while wearing Tyvek suits.

Institutional review board approval was obtained from Washington State University and secondary review was conducted by the Human Research Protection Office of the U.S. Department of Defense for final approval.

Data Analysis

A nurse researcher with qualitative methods expertise led the analysis team. Following the steps outlined in Braun and Clarke's (2006) method for thematic analysis, researchers began the analytical process by reading each transcript and the notes from each display board multiple times while writing down initial ideas. Next, focused, line-by-line coding was completed to identify ideas and themes relevant to EHI health risks. Codes that were agreed upon were then aligned to the predetermined cells within the Haddon's Matrix for EHI. Themes with subthemes were developed from the codes to reflect the most general elements and ideas important to a matrix column and row. Finally, themes were reviewed in relation to the coded extracts and the total data set was defined and named.

Results

Demographics

Across the three focus groups, 27 NG personnel, civilian health professionals, and athletic trainers participated (Table 2). Most participants identified as male (*n* = 20). The mean age of participants was 46.2 years. Participants reported a range of professional licensures, with over one half (*n* = 15, 56%) holding graduate degrees. Of the participants, 81% (*n* = 22) were currently in the military at the time of the focus groups. Over 80% (*n*

TABLE **3**

Themes Characterizing the Haddon's Matrix Cells for Prevention Strategies of Exertional Heat Illness (EHI) and Death in Military Personnel

	Human	Agent	Environmental	
			Physical Environment	Workplace/Social Environment
Pre-event	Influences on military personnel: controlled (risk taking, fitness, substance use, withholding information, medications) and uncontrolled (health conditions, genetics, age)	Dynamic properties with potential to influence EHI risk: substances, assessment/screening, preparation activities	Meteorological conditions affecting risk: weather, season, ecoclimates (jungle, arctic), water availability	Cultural practices and traditions: readiness and culture-driven policies and procedures
Event	Effects on human function: personal (hydration, motivation, fitness, BMI) and inherent conditions (capacity to regulate heat) experienced due to behaviors and genetics	Actively affecting EHI outcomes: protections/equipment, team knowledge, organizational barriers, workloads	Conditions conducive for EHI: hot and humid, temperature, radiant heat/no shade, work location (outdoors, cockpit)	"Ways of being in the work:" ways of doing that put people at risk, sociocultural conditions in the workplace, hierarchy
Post-event	Human response to heat illness: symptomatic (passed out, seizures, poor vital signs, truthfulness) and recovery response (trajectory and needs)	Treatment-related agents for symptoms of EHI: referral procedures, monitoring expertise, treatment/transport abilities and knowledge	Complications: limitations (shade/radiant heat), local geography	The-buck-stops-here versus passing-the-buck attitudes: degree of responsibilities, decreasing EHI risks, knowledge claims

= 23) had some disaster training and over 75% (n = 20) had worked in medical triage at some type of disaster training event.

Preventing Exertional Heat Illness and Death in Military Personnel

The overarching concept of preventing EHI and death in military personnel explained the participants' experiences and perceptions of EHI and prevention strategies. Throughout all focus groups, participants acknowledged the importance of being able to accurately assess EHI so that the occurrences of heat stroke and death are reduced and prevented. Analysis of the interviews and notes revealed that the three main risk factor areas—human elements, agents, and environment (environment was further divided into two sections, physical and workplace/social)—had themes that described the various concepts important to each phase of a potential EHI event. These themes were then aligned to cells in the matrix as areas to explore for prevention strategies for NG personnel who are at risk for EHI (Table 3).

Defining Exertional Heat Illness

Each focus group defined EHI similarly. Participants understood the ramifications of an EHI event and most, including the athletic trainers, had seen at least one heat stroke incident. EHI was explained by the participants in simple terms, "When your body experiences some adverse reaction to too much heat," and in very detailed medical terms, "Unintentional exogenous hyperthermic exposure resulting in alterations in homeostatic dysregulation." Each participant knew, however, that EHI was the cause of injury and possible death if not treated immediately, which is especially true for NG personnel during training and active disaster events.

Human Elements Themes

Human elements included attributes, attitudes, health behaviors, and other elements that make the individual (e.g., NG military personnel) vulnerable to an EHI incident. Important concepts in the pre-event phase included factors that could be controlled (e.g., ingesting substances or medications, sleeping, hydrating, keeping fit, not disclosing health information, and risk-taking behaviors such as drinking alcohol) and factors that could not be controlled (e.g., specific health conditions and genetics). Fitness included physical ability and acclimation to the training site. As one of the focus group participants commented: "As summer approached, many of them aren't acclimated…we see a big uptick in incidents. The cadets will come in ill-prepared, not physically ready for the exertional burden."

Many participants discussed the use of prescribed and over-the-counter medications and supplements that affect performance. Others noted use of illegal drugs and alcohol prior to training as problematic. One important finding, however, was the nondisclosure of information. One participant noted, "I'll see people the day before using alcohol. And then when I see their questionnaire, it's checked no." There were many examples of personnel who withheld health information that later affected performance or caused an EHI incident. Additionally, several participants suggested that women should get additional attention when pregnant as one way to reduce risks because hormonal responses change and risks increase with heat.

Uncontrolled factors were also discussed, including sickle cell anemia, undiagnosed psychological issues, and that one incidence of heat-related illness predisposes an individual to a future EHI.

Concepts pertaining to the event phase were those that related to human function and included personal characteristics (e.g., being hydrated, motivation), and physiologic reactions during the event (e.g., capacity to

regulate). Several participants noted that some personnel have an exceptional drive to continue work under duress, putting themselves at risk: "They will minimize any symptoms they're having because they don't want to miss out."

NG personnel are evaluated post-event immediately after taking off the Tyvek suits and are monitored for EHI. Early treatment can be initiated in this field setting and includes rapid cooling, hydration with or without electrolytes, and repeated vital sign measurements before determination of the need to transport to a medical facility. Transport is not delayed in the event of heat stroke, with rapid cooling initiated and intravenous access established prior to transport. Concepts important to the post-event phase dealt with the human response to heat illness. Participants noted, "A couple of guys just completely collapsed and went unconscious," "We get hyponatremia and seizures," "They survived and did fine, but their core temperature was up in the hospital a lot longer than we wanted."

Agent Themes

Agents are factors that have some effect on energy transfer or factors that increase risk for or cause injury. These agents can include the actual instructions, instruments, or treatments rather than the actions of doing, which are considered human elements. Many agents are dynamic, meaning they have varied effects pre-event. Many participants talked about agents that caused problems such as specific medications or substances: "Antihistamines, decongestants, nonsteroidals. It's over-the-counter. No one thinks about it—they all either dehydrate you or make it so you can't sweat." Others, however, pointed out that equipment, education, or assessment procedures can help prevent severe illness. Participants noted, "We have to have cold tubs ready," "If instead of prescreening the morning of, we prescreened the evening before… then we could talk to them…[about] what you need to do tonight in the next 12 hours."

During the event there are different agents, such as procedural orders or policies, that actively affect outcomes. Participants stated, "Standing at attention with 100-degree weather," "We don't have rectal temps." Additionally, one finding was about "who" was assessing personnel as they came from the field and the assessor's knowledge of EHI: "We had a…psych PA [physician assistant] and he gave pushback, asking, 'Why are those two getting IVs?' It was like, I mean—they need it."

Other agents designed to protect personnel, such as full PPE, can also be the cause of EHI during an exercise. One participant noted that what is worn under the PPE can make a difference: "…usually it's their PT [physical training] uniform, because it's far more comfortable to wear…than ABU [camouflage combat uniform] pants and a shirt. There were some that did not have their PT uniforms, so they wore ABU pants and sand-colored t-shirts. That was a major identifier as far as who was very high risk…I don't believe they have in writing a standardized uniform to wear underneath full PPE."

Post-event, agents can include equipment, personnel, procedures, or policies that dictate treatment and possible transfers to healthcare facilities: "Some of the common characteristics of [incidences leading to] death were those who called the ambulance first and continued to assess versus [the life-saving approach of] cool first and transport second," "If you're not measuring core temperature, you really can't use anything else to substitute for that," "Ice buckets…stick their hands in ice buckets and put an ice towel on their heads."

Many comments focused on decisions based on assessment data: "It's a go/no-go. They get to the no-go stage [can't go back into the field] when they need fluids." Several stated that some field exercises are in areas where there are no nearby healthcare facilities or no ability to get ice for cooling, which affect human outcomes. One way a number of participants tried to prevent further problems post-event, however, was through education to those who exit the suits and need extra assessments before being cleared.

Environment Themes

There are two subdomains within the environment theme: physical and social. While many factors in the physical environment are associated with EHI, it is also necessary to explore social environment factors. The social settings and support that define the culture of the workplace, policies, and personal interactions are important to how EHI is understood and prioritized. One important finding for this area is that there was little discussion about the relation to the physical domain and much more attention given to the workplace/social domain.

Physical Environment

Concepts related to the physical environment were those aligned with meteorological conditions or geography, and the place where training or the disaster event happened. Pre-event concepts related to the environment that were discussed as increasing risk included weather, seasons, water availability, and ecoclimates. Conditions during the event that affected EHI included humidity, lack of shade, radiant heat in work or rest zones, working in areas that increased risk such as outside or in a cockpit, and temperature spikes. The only EHI post-event concepts in the physical environment discussed were complications of geography (e.g., road conditions to access healthcare facilities) or field conditions (e.g., lack of availability to provide shade or reduce radiant heat as personnel recover from an event).

Workplace/Social Environment

Much of the discussion in all the focus groups centered on the workplace/social environment. Themes included pre-event military and other cultural practices and traditions, event "ways of being in the work" (e.g., the socioculture conditions and hierarchies of ways of doing work that put people at risk), and post-event the-buck-stops-here attitude versus a passing-the-buck attitude (e.g., different military branch practices affecting personal responsibilities, attempts to decrease EHI risks, and knowledge claims). The workplace/social environment was important to the participants, who saw this area as where underlying factors of EHI are—and therefore where change could take place.

Pre-event concepts involved readiness or being prepared for an EHI occurrence and the policies or cultural practices that are driven by different military branches or other agencies. Participants noted that EHI preparation was key, education was necessary for prevention, and that appropriate staff and policies needed to be in place; without these elements, personnel were at risk. Some discussions centered around getting the team ready, with participants noting, "You know with education and that team mentality, you can

get the team to minimize their human factors and other factors [for EHI];" "Unless you can build not only their mission set [but also] their mettle, they're not going to focus on it [preparation for exercises and decreasing EHI risks]. It's the culture. Our token theory was that safety was third. You can capitalize on that team mentality, though;" "It's a different philosophy. Like when you're infantry and you're in there and your squad is your team, like that's your family."

Having the proper medical team that used best practices was noted, yet many of the medical staff are not always qualified or ready. Participants noted, "Some of our medics are not medics full time;" "We never practice medicine. All it is is pushing people through. So, when you talk about medicine, this [focus group] is probably the most we've ever talked about medicine in these exercises. And I think, someone comes in with an extreme heat stroke—what is our treatment plan for that? It's basically based off of what our ER provider does on the job."

Also discussed was a lack of assessing for cultural practices such as fasting or taking specific days off: "I think in some people, you may see it [fasting]. In Muslim cultures if it's Ramadan, they're not taking anything from sunrise to sunset. In bodybuilding, they [do] intermittent fasting." In addition, participants explained that different military branches play a big role in how they see the "person" (as a valuable investment or as a means to an end) and this mindset affects how much effort is put in to developing EHI readiness policies that protect and support personnel during events.

Event concepts included looking at the ways that work puts people at risk. Issues involved the work culture, the nature of work, actual procedures, and a lack of experience and knowledge of EHI by midlevel commanders. A participant in the medical field shared, "There's been situations where the medical personnel had to act as advocates for the patient because their supervisor was like, 'Okay we need to get you back out there.' And we're saying, 'No, they are not okay.'"

One participant shared how bad instructions before transport to the field led to a number of personnel being dehydrated before arriving: "We leave here in this big old caravan…and we're not stopping for 3 hours, so 'you all better not drink and hold it (urinating).'" Another revealed a view about one military branch that was shared by a number of participants: "Their mentality is, 'Put this suit on. I don't care how sick you are. You're gonna suit up again.' Some individuals have had like two or three heat exposure illnesses and they're right back in the suit." Focus group participants believed that the attitude of the branch was just "next guy up." Other issues discussed included the pressure to not pull personnel out of teams when they had EHI symptoms, going up the hierarchy chain of command to protect personnel, monitoring work–rest cycles that might or might not be followed, lack of protocols, and disregard versus acute attention about EHI in different military branches. Participants commented, "We did not have experience with multiple people with heat exhaustion at one time. And it would be good to have a protocol so that you are prepared for that;" "We do not have enough teams for the work–rest cycle."

Post-event concepts had to do with whether the workplace culture increased or decreased the degree of responsibility for EHI occurrences, if there was an environment that welcomed suggestions and change, and if the workplace promoted expert knowledge and by whom. Many participants who were in the military noted throughout this theme that military branches have different practices in all phases of EHI. In the post-event stage, it was noted in one particular branch that there is a lot of policing, oversight, and education, with a resulting reduction of EHI cases as compared with other branches. One participant noted, "We're all very good about policing that [pretraining assessments] up. That's probably why we have a lot fewer heat stress injuries than maybe the other services do."

The athletic trainers in the focus groups agreed with these actions and noted that by implementing evidence-based standards, they have had only 2 collapses with full recoveries in 26 sports seasons. Some noted that there was still the problem of a nonmedical officer in the field deciding personnel actions, although recommendations are given by medical officers, due to the hierarchy of command and lack of policies that would change procedures in all branches. One main discussion point many athletic trainers noted was that rectal temperatures (considered the gold standard) should be used in assessments when EHI symptoms are present. Rectal temperatures, however, are not part of military policies or procedures, and therefore are not done due to an aversion of having a rectal temperature taken.

One participant, however, noted that reflection has been a way to change things through prevention via officer education: "The hard part is we injured a number of cadets in the training process. There were a lot of different factors. No one was trying to do it, but it ended up happening. So, we started doing more education up front early in the academy…before they train each day, they gotta weigh in…urine and its color in correlation to hydration status…there's cutpoints where…they are pulled out of activities and have to rehydrate before there's an injury."

Another participant shared, "I've seen people who have had previous heat illness injuries. We marked them with tape to say this person was injured." Participants agreed that NG personnel needed more education to learn to police themselves, and policies and procedural changes need to be made and should come from experts in the field of EHI and not necessarily from those in a higher level of command. Also, several participants suggested that those policies may need to be made uniformly outside of the military branches.

Discussion

Haddon's Matrix has been used in studies to uncover the actual risks and causes of injuries as well as to develop prevention strategies (Deljavan-Anvari et al., 2012; Espitia-Hardeman & Paulozzi, 2005; Haddon, 1980). We used Haddon's Matrix as a conceptual framework to conduct a literature search to classify EHI risk factors in a military population, to develop interview questions, and to guide data analysis. While areas of EHI risk were found across all cells of the matrix, one significant finding was the overwhelming focus by all participants on workplace/social factors. Although it is known that each military branch has mission-specific protocols and procedures, military medical literature recommends standardized assessment and treatment for EHI events. Without the use of the matrix to develop interview questions, this area of concern could well have been missed.

NG personnel can have an increased risk for nonbattle injuries of all types due to dif-

ferences in training and baseline levels of health and fitness (Riddle et al., 2008). Barriers in the workplace/social environment put military personnel at risk for an EHI, which can in turn increase morbidity and mortality rates, necessitating the promotion of prevention and risk reduction. Suggestions include policy changes to in-field treatment, such as adding core body rectal temperatures as part of post-event assessment for individuals with any level of EHI symptoms.

Overall, we found and identified new risk factors in combination with items currently on the SF-600. One area of concern is the nondisclosure or misunderstanding of health information in the pre-assessment tool by NG personnel coming for training. Another concern is the rare use of rectal temperature, which is the best tool to determine core temperature. Some rationales given as barriers were that personnel would consider rectal temperatures invasive, medics might not have the proper equipment to perform a rectal temperature, and privacy concerns. As athletic trainers in the focus groups noted, they have been able to implement rectal temperature assessments on the sports fields without difficulty.

Other EHI risks involve cultural practices such as fasting, medical personnel who lack EHI training, and lack of ongoing training about EHI for medical personnel and those participating in training exercises. These risks should be addressed prior to events. As a first step toward our study goal of development of an EHI risk assessment tool for the military, we are integrating our findings from this study with current science. Next steps to complete the tool development process will include the use of a panel of content experts and a Delphi procedure.

After development of the risk assessment tool and guidelines for this study, the intent based on the information from the matrix, will be to field test them. Targeted information from themes regarding pre-event human elements and agents that put people at risk for EHI will guide the addition of an educational component about EHI prevention for military personnel. This educational component will be offered prior to disaster exercises. Rigor for our aim 1 involved triangulating (or cross-referencing) the following: subject matter experts from the focus groups corroborating our findings, use of coding protocols, and comparison of the tool and guidelines to the themes identified from the qualitative phase of the study (focus groups).

Limitations

Limitations for this study include the use of both officers and enlisted personnel in the focus groups, as well as the exclusive use of registered nurses, medical doctors, nurse practitioners, and physician assistants at the point of care. The use of a homogeneous environment is suggested as best practice for focus groups. Although the focus groups represented medical personnel from the military, civilian health professionals, and athletic trainers who were all experienced with EHI conditions and treatment, the difference in rank among the military personnel could have influenced participation of enlisted participants. That said, all participants volunteered information during the focus groups.

Additionally, the use of medical personnel could pose a limitation. Several issues presented by the participants conflict with the current evidence, which indicates that practice standards might not be current. For instance, the use of rectal thermometry is the most valid and reliable assessment tool for core body temperature and is readily accepted among researchers, yet not implemented fully into practice within military procedures. As such, a representative sample of participants might indicate other behaviors that need to be elevated to the standard of practice in military medical care. In the next steps of our study, we will address these limitations, incorporating the available evidence and representing broader stakeholder perspectives.

Conclusion

The Haddon's Matrix proved to be a useful and robust framework to list known EHI injury risks as noted in the literature. We used this information for the purpose of developing interview questions and data analysis. Furthermore, the information allowed for coding guidelines and the development of themes. The main themes that emerged include modifiable behaviors such as poor sleep hygiene, behaviors that can contribute to dehydration such as energy drinks, awareness of the effects of certain medications and supplements on EHI risks, acclimatization protocols, emphasis on how hypermotivation impacts the mission and individual safety, and the need for cooling and rest stations with cooling protocols for individuals presenting with an EHI.

From findings that emerged related to the matrix, the development of a risk assessment tool for the military may provide an easy-to-use field tool to identify those most at risk early on, with the goal of preventing or lessening EHI during heat and exertional work conditions. Overall, the Haddon's Matrix and use of focus groups allowed for the operationalization of EHI risk factor themes into EHI screening questions.

Findings from this study can be used to address EHI safety and health concerns for other professionals who respond to emergency and disaster situations under heat extremes and while wearing PPE and gear. In addition, many of this study's findings are applicable to agricultural workers who work in extreme weather conditions without additional PPE and lack shade, cold water, rest breaks, and education about the warning signs of EHI. As many of the risk factors are modifiable (e.g., insufficient sleep, consumption of energy drinks), pre-deployment education and screening of personnel with potential risk factors are low-cost interventions that both military and civilian supervisors and leadership can implement.

Acknowledgements: This study was funded through a TriService Nursing Research Program Grant number: HU000011-18-10043 (N18-A03). The work reported here was performed under U.S. Air Force Surgeon General (HRPO)-approved Protocol Study No. FSG20180024H. The 59 MDW Public Affairs Office has cleared this manuscript for publication.

Disclaimer: The information of content and conclusions do not necessarily represent the official position or policy of, nor should any official endorsement be inferred by, the TriService Nursing Research Program, Uniformed Services University of the Health Sciences, U.S. Department of Defense, or U.S. government.

Corresponding Author: Denise A. Smart, Professor, Washington State University, College of Nursing, 412 East Spokane Falls Boulevard, Spokane, WA 99202.
Email: dsmart@wsu.edu.

References on page 16

References *continued from page 15*

Armed Forces Health Surveillance Branch. (2019, April 1). Update: Heat illness, active component, U.S. Armed Forces, 2018. *Medical Surveillance Monthly Report*, *26*(4), 15–20. https://health.mil/News/Articles/2019/04/01/Update-Heat-Illness

Armed Forces Health Surveillance Bureau. (2017). Update: Heat illness, active component, U.S. Armed Forces, 2016. *Medical Surveillance Monthly Report, 24*(3), 9–13.

Army Public Health Center. (2016). *Injury prevention: Just the facts. Heat illness* (Fact Sheet 12-005-0316). https://home.army.mil/ansbach/application/files/2115/6042/6955/HeatIllness_FS_12-005-0316.pdf

Army Public Health Center. (2021). *Army injuries, causes, risk factors, and prevention overview*. https://phc.amedd.army.mil/topics/discond/ptsaip/Pages/Army-Injuries-Causes-Risk-Factors-and-Prevention-Overview.aspx

Bell, N.S., Amoroso, P.J., Baker, S.P., & Senier, L. (1999). *Injury control part II: Strategies for prevention* (Technical Note TN 00-4). Military Performance Division, U.S. Army Research Institute of Environmental Medicine. https://apps.dtic.mil/sti/pdfs/ADA372985.pdf

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Casa, D.J., DeMartini, J.K., Bergeron, M.F., Csillan, D., Eichner, E.R., Lopez, R.M., Ferrara, M.S., Miller, K.C., O'Connor, F., Sawka, M.N., & Yeargin, S.W. (2015). National Athletic Trainers' Association position statement: Exertional heat illness. *Journal of Athletic Training*, *50*(9), 986–1000. https://doi.org/10.4085/1062-6050-50.9.07

Centers for Disease Control and Prevention. (2020). *Heat stress*. National Institute for Occupational Safety and Health. http://www.cdc.gov/niosh/topics/heatstress

DeGroot, D.W., Kenefick, R.W., & Sawka, M.N. (2015). Impact of arm immersion cooling during ranger training on exertional heat illness & treatment costs. *Military Medicine*, *180*(11), 1178–1183. https://doi.org/10.7205/MILMED-D-14-00727

Dehghan, H., Mortazavi, S.B., Jafari, M.J., & Maracy, M.R. (2013). Cardiac strain between normal weight and overweight workers in hot/humid weather in the Persian Gulf. *International Journal of Preventive Medicine*, *4*(10), 1147–1153.

Deljavan-Anvari, R., Sadeghi Bazargani, H., Fouladi, N., Arshi, S., & Mohammadi, R. (2012). Application of Haddon's matrix in qualitative research methodology: An experience in burns epidemiology. *International Journal of General Medicine*, *5*, 621–627. https://doi.org/10.2147/IJGM.S34394

Department of the Air Force. (2020). Thermal injury prevention program. *Air Force Instruction* (AFI48–151). http://static.e-publishing.af.mil/production/1/af_sg/publication/afi48-151/afi48-151.pdf

Department of the Army. (2016). *Prevention of heat and cold casualties* (TRADOC Regulation 350–29). https://adminpubs.tradoc.army.mil/regulations/TR350-29.pdf

Espitia-Hardeman, V., & Paulozzi, L. (2005). *Injury surveillance training manual*. Centers for Disease Control and Prevention, National Center for Injury Prevention and Control. https://www.cdc.gov/violenceprevention/pdf/instructor-guide.pdf

Goforth, C.W., & Kazman, J.B. (2015). Exertional heat stroke in Navy & Marine personnel: A hot topic. *Critical Care Nurse*, *35*(1), 52–59. https://doi.org/10.4037/ccn2015257

Haddon, W., Jr. (1980). Advances in the epidemiology of injuries as a basis for public policy. *Public Health Reports*, *95*(5), 411–421.

Hosokawa, Y., Casa, D.J., Trtanj, J.M., Belval, L.N., Deuster, P.A., Giltz, S.M., Grundstein, A.J., Hawkins, M.D., Huggins, R.A., Jacklitsch, B., Jardine, J.F., Jones, H., Kazman, J.B., Reynolds, M.E., Stearns, R.L., Vanos, J.K., Williams, A.L., & Williams, W.J. (2019). Activity modification in heat: Critical assessment of guidelines across athletic, occupational, and military settings in the USA. *International Journal of Biometeorology*, *63*, 405–427. https://doi.org/10.1007/s00484-019-01673-6

Jacklitsch, B., Williams, W.J., Musolin, K., Coca, A., Kim, J.-H., & Turner, N. (2016). *Criteria for a recommended standard: Occupational exposure to heat and hot environments, revised criteria 2016* (Publication No. 2016-106). U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health. https://www.cdc.gov/niosh/docs/2016-106/pdfs/2016-106.pdf

Kazman, J.B., O'Connor, F.G., Alan Nelson, D., & Deuster, P.A. (2018). Exertional heat illness in the military: Risk mitigation. In Y. Hosokawa (Ed.), *Human health and physical activity during heat exposure* (pp. 59–71). Switzerland: Springer Briefs in Medical Earth Sciences. https://doi.org/10.1007/978-3-319-75889-3_5

Kodack, M. (2019). Heat-related illness increasing among U.S. military personnel. *The Center for Climate & Security*. https://climateandsecurity.org/2019/08/30/heat-related-illness-increasing-among-u-s-military-personnel/

Lilley, K. (2017). Heat illness remains 'significant threat' to troops, despite warnings and guidance. *Military Times*. https://www.militarytimes.com/off-duty/military-fitness/2017/07/19/heat-illness-remains-significant-threat-to-troops-despite-warnings-and-guidance/

Matthews, W. (2016, January). Specially suited. *National Guard*, 24–29. http://www.nationalguardmagazine.com/publication/index.php?m=12619&i=287212&p=26&ver=html5

Miller, K.C., Casa, D.J., Adams, W.M., Hosokawa, Y., Cates, J., Emrich, C., Fitzpatrick, T., Hopper, M., Jardine, J.F., LaBotz, M., Lopez, R.M., O'Connor, F., & Smith, M.S. (2021). Roundtable on preseason heat safety in secondary school athletics: Prehospital care of patients with exertional heat stroke. *Journal of Athletic Training*, *56*(4), 372–382. https://doi.org/10.4085/1062-6050-0173.20

Moore, A.C., Stacey, M.J., Bailey, K.G.H., Bunn, R. J., Woods, D.R., Haworth, K.J., Brett, S.J., & Folkes, S.E.F. (2016). Risk factors for heat illness among British soldiers in the Hot Collective Training Environment. *Journal of the Royal Army Medical Corps*, *162*, 434–439. https://doi.org/10.1136/jramc-2015-000427

Navarro, C.S., Casa, D.J., Belval, L.N., & Nye, N.S. (2017). Exertional heat stroke. *Current Sports Medicine Reports*, *16*(5), 304–305. https://doi.org/10.1249/jsr.0000000000000403

References

O'Connor, F.G., & Casa, D.J. (2021). Exertional heat illness in adolescents and adults: Epidemiology, thermoregulation, risk factors, and diagnosis. *UpToDate*. https://www.uptodate.com/contents/exertional-heat-illness-in-adolescents-and-adults-epidemiology-thermoregulation-risk-factors-and-diagnosis/print

Office of the Under Secretary of Defense for Acquisition and Sustainment. (2019). *Report on effects of a changing climate to the Department of Defense*. https://media.defense.gov/2019/Jan/29/2002084200/-1/-1/1/CLIMATE-CHANGE-REPORT-2019.PDF

Potter, A.W., Hunt, A.P., Cadarette, B.S., Fogarty, A., Srinivasan, S., Santee, W.R., Blanchard, L.A., & Looney, D.P. (2019). Heat Strain Decision Aid (HSDA) accurately predicts individual-based core body temperature rise while wearing chemical protective clothing. *Computers in Biology and Medicine*, *107*, 131–136. https://doi.org/10.1016/j.compbiomed.2019.02.004

Riddle, M.S., Tribble, D.R., Putnam, S.D., Mostafa, M., Brown, T.R., Letizia, A., & Armstrong, A.W. (2008). Past trends and current status of self-reported incidence and impact of disease and non-battle injury in military operations in Southwest Asia and the Middle East. *American Journal of Public Health*, *98*, 2199–2206. https://doi.org/10.2105/AJPH.2007.131680

Schmeltz, M.T., Petkova, E.P., & Gamble, J.L. (2016). Economic burden of hospitalizations for heat-related illnesses in the United States, 2001–2010. *International Journal of Environmental Research Public Health*, *13*(9), 894–905. https://doi.org/10.3390/ijerph13090894

Stacey, M., Woods, D., Ross, D., & Wilson, D. (2014). Heat illness in military populations: Asking the right questions for research. *BMJ Military Health*, *160*, 121–124. https://doi.org/10.1136/jramc-2013-000204

Varghese, B.M., Hansen, A., Nitschke, M., Nairn, J., Hanson-Easey, S., Bi, P., & Pisaniello, D. (2019). Heatwave and work-related injuries and illnesses in Adelaide, Australia: A case-crossover analysis using the Excess Heat Factor (EHF) as a universal heatwave index. *International Archives of Occupational and Environmental Health*, *92*, 263–272. https://doi.org/10.1007/s00420-018-1376-6

Washington National Guard. (2018). *Homeland response force*. https://mil.wa.gov/homeland-response-force

Webber, B.J., Casa, D.J., Beutler, A.I., Nye, N.S., Trueblood, W.E., & O'Connor, F.G. (2016). Preventing exertional death in military trainees: Recommendations and treatment algorithms from a multidisciplinary working group. *Military Medicine*, *181*(4), 311–318. https://doi.org/10.7205/MILMED-D-15-00299

INTERNATIONAL PERSPECTIVES

Consumer Perception of Novel Restaurant Hygiene Certificates and Evaluation Criteria for Food Safety

Jinkyung Choi, PhD, RD
Department of Food Science and Nutrition, Pukyong National University

Abstract **As more people consume food away from home, there is growing interest in hygienic conditions at restaurants. To respond to public concerns, the Korean Health Department has developed and implemented a new restaurant hygiene certificate system. This study investigated how the new restaurant hygiene certificate has been accepted by the public by measuring the perception of message quality and evaluation criteria for restaurant food safety practices. This study used an online survey to collect data and analyzed the data with an independent *t*-test, exploratory factor analysis, Mann–Whitney U test, and Kruskal–Wallis H test. Questionnaires determined restaurant hygiene certificate awareness, message quality, and evaluation criteria regarding restaurant food safety practices, general eating out behaviors, and demographic characteristics. Significant differences in message quality were found among respondents who were aware of the certificates and those who were not. There were significant demographic differences in the four factors respondents used to evaluate food safety practices at restaurants: restaurant hygiene certificates, cleanliness, sensory perception, and restaurant image. The results of this study suggest that the restaurant hygiene certificate system has been well received by the public but requires greater restaurant participation for enhanced public awareness.**

Introduction

The popularity of food-away-from-home (FAFH) has been steadily increasing and is now a part of daily life in Korea. The sales volume of the restaurant business in Korea has gradually increased from 593,690 billion won in 2007 to 1,282,990 billion won (approximately 12 million U.S. dollars) in 2017 (Korea Agro-Fisheries & Food Trade Corporation [KAFTC], 2019). The number of food service outlets increased by 19% between 2007 and 2017, and 47.8% of total food expenditure was for FAFH in 2018 (KAFTC, 2019). The consumption of FAFH has increased due to its convenience, both in terms of location and time (Barkley et al., 2016).

As the food service industry is growing, however, FAFH has become a critical source of foodborne disease (Griffith, 2013; Knight et al., 2007; Min, 2016). While restaurant health inspection reports are used worldwide, their style can vary, including color, narrative, quantitative data, symbol, and letter grade. Message formatting—such as language strength (i.e., how powerfully the message is delivered to the recipient) and style—impacts how a consumer understands the information (Bettman & Zins, 1979). It has been shown that the narrative format influences consumers to adopt recommended health messages (Dunlop et al., 2010), whereas a letter grade might not provide enough detailed information, leading to incorrect interpretations (Choi et al., 2010).

Quantitative information has more impact to persuade individuals because individuals reported that they thought the message demonstrates more expertise (Yalch & Elmore-Yalch, 1984). Quantitative information, however, might decrease a reader's motivation to read and process the material (Witt, 1976). A health inspection report with a narrative format had the highest message quality and influence on consumer response (Choi et al., 2013). A newly developed three-tier inspection grading system has been implemented for the inspection certificate.

Safety attributes are difficult to discern before consuming food (Kim, 2012) and are considered quality attributes (Yiridoe et al., 2005). Consumers use other cues to predict food quality, such as government certificates (Henson et al., 2006). One study found that sensory perception of food was an indicator used by younger adults in China to assess a restaurant's food safety (Bai et al., 2019) and that consumers consider the food itself as a food safety factor (Min, 2016). Staff appearance (Griffith, 2013; Worsfold, 2006) and restaurant cleanliness were also considered indicators of food safety (Worsfold, 2006). Consumers also tend to evaluate food safety by restaurant reputation (Bai et al., 2019; Han et al., 2015). Although consumer perception of food safety issues did not affect the frequency of their restaurant visits (Knight et al., 2007), health inspection reports did influence consumer intentions to visit a restaurant (Choi et al., 2019).

FIGURE **1**

Three-Tier Inspection Grading System

Note. Images courtesy of https://www.haccp.or.kr.

Reports by health inspectors deliver information and mediate communication between the inspectors and restaurant managers (Kim, 2012), as well as any consumers who read the reports (Choi et al., 2013). One study demonstrated, however, that a hygiene grading system did not accurately represent a restaurant's level of food safety (Bai et al., 2019). The authors assumed that the outcome was not representative of the grading system's significance but rather stemmed from a lack of public awareness (Bai et al., 2019).

In 2017, the Korean Health Department developed and implemented a new inspection certificate (Figure 1) that is based on a three-tier inspection grading system: a 90 and above is considered excellent (3 stars), 85–90 is very good (2 stars), and 80–85 is good (1 star) (Korean Agency of HACCP Accreditation and Services, 2018). This new voluntary hygiene certificate was implemented to prevent foodborne disease and ensure consumers can choose restaurants that are actively engaging in food safety practices. Prior to this certificate, the "Good Restaurant" plaque initiated in 1994 was issued to only 5% of restaurants that met the requirement for food sanitation and good service by a borough office. A total of 2,162 restaurants examined, however, were in violation of food hygiene regulations and 805 restaurants were deemed a "Good Restaurant," but their certificates were later canceled.

Therefore, more restaurants need to engage in food hygiene practices and notify consumers of those practices; these actions allow consumers to make more informed restaurant choices. As this new inspection certificate is voluntary for restaurants, not all consumers are aware of it. The health department has not announced that this certificate will be mandatory for restaurants; however, many restaurants have requested inspections to obtain certification because the certification is posted on food delivery apps for consumers to see.

During the COVID-19 pandemic, food delivery services have become more popular than ever, and consumer conflicts with restaurants with food hygiene issues have been increasing. This new certificate can be posted to give more information about restaurants in terms of food hygiene.

Research on Korean consumers and the new certificate system is limited. The purpose of this study was to 1) evaluate the message quality of the restaurant hygiene certificates and 2) measure the evaluation criteria for restaurant food safety practices.

Methods

This study used a quantitative method to gather data. Prior to data collection, the study was submitted and approved by the institutional review board at Woosong University (#1041549-200407-SB-95). The questionnaire was active over three months (April 28–June 29, 2020) using Google Forms, an online survey platform. The target population of the study was members of the general public who were >20 years. The target sample size was determined using G*Power (Faul et al., 2009). A two-tailed *t*-test indicated that a sample size of 220 participants was required at $p < .05$ and a power of 95%.

For this study, it was decided that the study sample should consist of Korean adults. Several social clubs were contacted about the survey, and upon their agreement to participate, the survey link was sent via social network services and food club webpages, which have approximately 2,260 members. The first page of the questionnaire explained the purpose of the study and asked for participant consent. A total of 300 questionnaires were completed with a response rate of 12.8%. Screening excluded 3 questionnaires for inappropriateness; the remaining 297 were analyzed.

Respondents were first asked if they knew about the current restaurant hygiene certification (i.e., the new three-tier certificate; Figure 1). The message quality of the certificate was measured by six items excerpted from previous research (unpersuasive/persuasive; weak/strong; not convincing/convincing; bad argument/good argument; incorrect/correct; untrustworthy/trustworthy) on a 5-point Likert scale, which included statements such as "the message is weak (1)" or "the message is strong (5)" (Andrews & Shimp, 1990; Choi et al., 2013; Worsfold, 2006).

The second section of the questionnaire inquired about general eating out behaviors, including the average budget for eating out per person, weekly eating out frequency, and awareness of the restaurant hygiene certificates. The importance of the evaluation criteria for restaurant food safety practices was measured. The questionnaire contained a total of 18 questions, allowing respondents to evaluate the importance of things such as toilet and exterior cleanliness, hygiene certificates, and restaurant reputation (Bai et al., 2019; Griffith, 2013) on a 5-point Likert scale, which included statements such as "I strongly disagree that toilet cleanliness is an important aspect of restaurant food safety (1)" to "I strongly agree that toilet cleanliness is an important aspect of restaurant food safety (5)."

Statistical Analysis

The collected responses were entered in Excel and analyzed using SPSS version 23. Descriptive analyses were conducted for general eating out behaviors and demographic characteris-

tics. An independent *t*-test compared message quality between respondents who were aware of the hygiene certificates and those who were not. An exploratory factor analysis with a principal component analysis using the maximum likelihood estimation was run on 18 restaurant food safety evaluation criteria. Cronbach's α and correlations were measured for internal and construct consistency. In addition, significant differences among the respondents' general eating out behaviors and demographic characteristics were investigated using the Mann–Whitney and Kruskal–Wallis tests with Bonferroni correction.

Results

Demographic Characteristics

From the survey, there were 44.3% male respondents and 55.7% female respondents. More than one half of the respondents were single (62.6%), while 37.4% were married (Table 1). In terms of age, most of the respondents were in their 20s (56.6%), followed by 30s (10.8%), 40s (16.0%), 50s (14.1%), and 60s or older (2.4%). The majority of respondents attended a 4-year university or earned a bachelor's degree (65.3%), followed by those respondents who attended a 2-year college or earned an associate degree (13.1%), earned a master's degree and above (11.1%), and attended high school or less (10.4%). About one half of the respondents (56.2%) had a monthly income of <2,000,000 won, followed by 2,000,000 to <4,000,000 won (24%), ≥6,000,000 won (9.9%), and 4,000,000 to <6,000,000 won (9.9%) (1 U.S. dollar = 1,202 won as of February 28, 2022).

More than one half of the respondents had an average per-person budget for eating out of 10,000–19,999 won (58.1%), followed by 20,000–29,999 won (19.9%), <10,000 won (11.1%), and ≥30,000 won (10.8%). Most of the respondents ate out 2–3 times per week (56.2%), followed by 0–1 time per week (24.2%), 4–5 times per week (13.5%), 6–7 times per week (4.4%), and ≥8 times per week (1.7%). About one half of the respondents (56.3%) did not know about the restaurant hygiene certificates, while 43.7% knew about the certificates.

Message Quality of Hygiene Certificates

The survey responses indicated that the message quality of the restaurant hygiene certifi-

TABLE **1**

Demographic Characteristics and Eating Out Behaviors of Survey Respondents (*N* = 297)

Characteristic	#	%
Gender		
Male	131	44.3
Female	165	55.7
Missing/not specified	1	
Marital status		
Married	111	37.4
Single	186	62.6
Age (years)		
20–29	168	56.6
30–39	32	10.8
40–49	48	16.0
50–59	42	14.1
≥60	7	2.4
Education		
High school or less	31	10.4
Attended 2-year college or earned associate degree	39	13.1
Attended 4-year university or earned bachelor's degree	194	65.3
Master's degree or above	33	11.1
Monthly income (won)		
<2,000,000	164	56.2
2,000,000 to >4,000,000	70	24.0
4,000,000 to >6,000,000	29	9.9
≥6,000,000	29	9.9
Missing/not specified	5	
Average budget for eating out/person (won)		
<10,000	33	11.1
10,000–19,999	172	58.1
20,000–29,999	59	19.9
≥30,000	32	10.8
Missing/not specified	1	
Frequency of eating out/week		
0–1	72	24.2
2–3	167	56.2
4–5	40	13.5
6–7	13	4.4
≥8	5	1.7
Aware of restaurant hygienic certificate program		
Yes	129	43.7
No	166	56.3
Missing/not specified	2	

Note. 1 U.S. dollar = 1,202 won (as of February 28, 2022).

TABLE **2**

Comparing Message Qualities Among Survey Respondents Who Are Aware and Unaware of the Certificate Program

Message Quality[a]	All Responses (*M* ± *SD*)	Aware of Certificate Program (*M* ± *SD*)	Unaware of Certificate Program (*M* ± *SD*)	*t*-Value
Unpersuasive/persuasive	3.66 ± 1.06	3.87 ± 0.98	3.50 ± 1.10	3.030**
Weak/strong	3.40 ± 1.15	3.52 ± 1.14	3.31 ± 1.15	1.607
Not convincing/convincing	3.78 ± 1.06	4.04 ± 0.92	3.60 ± 1.12	3.667***
Bad argument/good argument	3.74 ± 1.09	3.97 ± 1.03	3.56 ± 1.11	3.243**
Incorrect/correct	3.49 ± 1.09	3.66 ± 1.06	3.36 ± 1.10	2.345*
Untrustworthy/trustworthy	3.51 ± 1.11	3.80 ± 1.06	3.30 ± 1.11	3.867***

[a]Each message quality was rated using a 5-point Likert scale (1 = negative and 5 = positive for each measurement).
*$p < .05$. **$p < .01$. ***$p < .001$.

cates was strong. Survey respondents rated the quality of each message using a 5-point Likert scale (1 = negative and 5 = positive). From the survey results, the mean respondent rates were 3.66 for unpersuasive/persuasive (*SD* = 1.06); 3.40 for weak/strong (*SD* = 1.15); 3.79 for not convincing/convincing (*SD* = 1.06); 3.74 for bad/good argument (*SD* = 1.09); 3.49 for incorrect/correct (*SD* = 1.09); and 3.51 for untrustworthy/trustworthy (*SD* = 1.11) (Table 2).

The results of an independent *t*-test between respondents who were aware of the hygiene grade and those who were not showed significant differences in persuasiveness ($p < .01$), convincingness ($p < .001$), argument strength ($p < .01$), correctness ($p < .05$), and trustworthiness ($p < .001$) (Table 2). Respondents who were aware of the grade considered the message to be stronger than respondents who were unaware of the grade.

Evaluation Criteria for Restaurant Food Safety Practices

A total of 18 questions were used to evaluate food safety practices at restaurants. An exploratory factor analysis extracted four factors (Table 3): factor 1 was having a hygiene certificate (Cronbach's $\alpha = .826$), factor 2 was interior and exterior cleanliness (Cronbach's $\alpha = .770$), factor 3 was sensory elements of the food (Cronbach's $\alpha = .710$), and factor 4 was restaurant image (Cronbach's $\alpha = .710$). Table 4 shows the correlations among the four factors.

The four factors were compared by demographic characteristics, such as gender, marital status, age, education, monthly income, awareness of hygiene grade, average per-person budget for eating out, and frequency of eating out per week (Table 5). The normality test results for the comparison between hygiene grade awareness and food safety evaluation criteria showed $p < .05$. Nonparametric tests were then conducted. Results of a Mann–Whitney U test indicate that marital status had a significant effect on hygiene certificate awareness ($p = .001$), cleanliness ($p = .001$), and sensory perception ($p < .05$). Survey respondents rated each factor using a 5-point Likert scale (1 = negative and 5 = positive). Survey results indicated that married respondents rated three factors higher than single respondents: certificates (married respondents: $M = 4.04$, $SD = 0.61$; single respondents: $M = 3.76$, $SD = 0.77$); cleanliness (married respondents: $M = 4.38$, $SD = 0.46$; single respondents: $M = 4.12$, $SD = 0.52$); and sensory perception (married respondents: $M = 4.67$, $SD = 0.42$; single respondents: $M = 4.59$, $SD = 0.39$).

Results of a Kruskal–Wallis H test showed significant differences in age, monthly income, and the average budget for eating out. For cleanliness, there were significant differences ($p < .05$) between those in their 20s ($M = 4.13$, $SD = 0.53$) and 50s ($M = 4.55$, $SD = 0.42$). Sensory perception was significantly affected ($p < .01$) by monthly income; individuals with monthly incomes <2,000,000 won and 4,000,000 to <6,000,000 won had mean sensory perceptions of 4.63 (*SD* = 0.38) and 4.80 (*SD* = 0.30), respectively. The average per-person budget for eating out was significantly related to the importance of restaurant image ($p < .05$). For those with budgets <10,000 won and 20,000–29,999 won, the means of the importance of restaurant image were 3.96 (*SD* = 0.59) and 3.61 (*SD* = 0.57), respectively. Gender, education, awareness of restaurant hygiene certificates, and frequency of eating out per week, however, showed insignificant differences among the four factors.

Discussion

This study investigated the message qualities of newly implemented restaurant hygiene certificates and evaluation criteria for food safety at restaurants. The grades were a combination of a word and a symbol with a specific number of stars (Figure 1). Consumers may not be aware of this hygiene certificate, as it is voluntary. The results of this study showed that more than one half of the respondents did not know about the hygiene certificate, which affected message qualities as well.

Respondents who knew about the restaurant hygiene certificates thought the message was more persuasive, convincing, a good argument, correct, and trustworthy. People who had attained a higher level of education showed a greater awareness of the certificates and a high comprehension of the certificates. Previous studies have shown that appropriate educational interventions and activities that incorporate the perceptions of message delivery are more relevant and more effective at providing consumers with information (Attila & Çakir, 2011).

Survey results showed significant differences in the perception of message quality between respondents who were aware of the restaurant hygiene certificates and those who were not. If the public is provided more information about the certificates, they might gain a better understanding of food safety issues and reduce their risk of contracting foodborne diseases. In general, respondents believed the hygiene certificates had a high message quality; a combination of two formats (words and symbols) was assumed to increased consumer understanding.

There are many different formats of inspection reports worldwide, including narra-

tive, numeric scores, letter grades, symbols (including a smiley face), and colors. An effective format is important, as it affects consumer behaviors. Significant differences were found in the perception of message quality between respondents who were aware of the hygiene certificates and those who were not.

Moreover, implementing two formats might synergize to enhance consumer understanding. Numeric scores were converted to the terms "excellent," "very good," and "good," which are easier to understand than numbers (Dunlop et al., 2010). Not all terms, however, indicate which of the restaurants are safer, because all terms convey meanings similar to "good."

The current format might benefit restaurant owners by showing the inspection results in a way that does not harm their business and is recognizable to consumers. As this system is voluntary, restaurant owners may choose whether to be inspected and to receive certificates. Differentiation among the certificates, however, should readily show consumers the evaluation outcomes. Future research should measure the effect of certificates on consumer behaviors.

For food safety evaluation criteria, certificates, cleanliness, sensory perception, and restaurant image were important, as previous studies have found (Bai et al., 2019). Consumers consider these elements important for evaluating restaurant food safety practices. Married people were more likely than single people to look at certificates to inform their decision to visit a restaurant. In addition, this behavior may be compounded by age, although age itself did not significantly impact how the certificatewere valued. People in their 20s consider restaurant cleanliness to be less important than do people in their 50s. Those with a monthly income of 2,000,000 to <4,000,000 won and 4,000,000 to <6,000,000 won showed significant differences in sensory perceptions. Those with an income of 4,000,000 to <6,000,000 won had higher sensory perceptions when evaluating restaurant food safety than those with an income >6,000,000 won. It can be inferred that respondents with higher incomes eat at different types of restaurants, where sensory perception is not used to evaluate food safety. A study by Nyarugwe et al. (2016) found that consumers with higher income levels had a lower perception of food safety risks.

Furthermore, a person's budget for eating out significantly influenced restaurant image.

TABLE **3**

Results of Exploratory Factor Analysis for the Aspects of Restaurant Food Safety

Sanitation Evaluation Criteria	Certificates	Cleanliness	Sensory Perception	Restaurant Image
If restaurant provides hygienic certificates	0.806			
If restaurant has an expert pest control program	0.748			
A statement about source of raw materials	0.745			
If restaurant provides disinfection equipment, such as a disinfection cabinet	0.722			
Cleanliness of ground, wall, tables, and chairs		0.637		
Toilet cleanliness		0.750		
Exterior cleanliness		0.697		
If staff clothes appear clean		0.561		
If staff have long fingernails or wear nail polish/use appropriate hair coverings		0.487		
If food smells strange			0.770	
If food looks fresh			0.716	
If a foreign object is found in food			0.566	
Cutlery cleanliness			0.488	
If staff handle food appropriately			0.522	
Reviews from friends and family/ word of mouth				0.797
Restaurant reputation				0.784
Menu pricing				0.645
If restaurant is a chain or a well-known brand				0.614
Eigenvalue	2.933	2.752	2.342	2.166
Cronbach's α	.826	.770	.710	.710

Note. An exploratory factor analysis with a principal component analysis using the maximum likelihood estimation was used.

TABLE **4**

Correlations Among Restaurant Food Safety Evaluation Criteria Factors

	Certificates	Cleanliness	Sensory Perception	Restaurant Image
Certificates	1			
Cleanliness	0.529*	1		
Sensory perception	0.381*	0.577*	1	
Restaurant image	0.337*	0.279*	0.196*	1

* Pearson's correlation coefficient $p < .01$ at two-tailed test.

TABLE **5**

Relationship Among Demographic Characteristics and Aspects of Restaurant Food Safety

Characteristic	Certificates (*M* ± *SD*)	Cleanliness (*M* ± *SD*)	Sensory Perception (*M* ± *SD*)	Restaurant Image (*M* ± *SD*)
Marital status				
Married	4.04 ± 0.61 [a]	4.38 ± 0.46 [a]	4.67 ± 0.42 [a]	3.78 ± 0.55 [a]
Single	3.76 ± 0.77 [b]	4.12 ± 0.52 [b]	4.59 ± 0.39 [b]	3.76 ± 0.62 [a]
Age (years)				
20–29		4.13 ± 0.53 [a]		
30–39		4.18 ± 0.56 [ac]		
40–49		4.32 ± 0.48 [ac]		
50–59		4.44 ± 0.42 [bc]		
≥60		4.40 ± 0.38 [ac]		
Monthly income (won)				
<2,000,000			4.63 ± 0.38 [ac]	
2,000,000 to <4,000,000			4.50 ± 0.49 [a]	
4,000,000 to <6,000,000			4.80 ± 0.30 [bc]	
≥6,000,000			4.72 ± 0.26 [ac]	
Average budget for eating out/person (won)				
<10,000				3.96 ± 0.59 [a]
10,000–19,999				3.78 ± 0.59 [ac]
20,000–29,999				3.61 ± 0.57 [bc]
≥30,000				3.75 ± 0.60 [ac]

Note. Mean scores denoted by the same letter are not significantly different from each other. Results based on the Mann–Whitney U test (two groups) or the Kruskal–Wallis H test (>two groups). Aspects of restaurant food safety were rated using a 5-point Likert scale (1 = negative and 5 = positive for each measurement). 1 U.S. dollar = 1,202 won (as of February 28, 2022).

The group with the lowest budget considered restaurant image to be more important than the other groups, as they believe that opinions from others, menu price, brand, and reputation represent restaurant food safety practices.

There are some limitations to this study. First, the study measured six of many message qualities. Additional message qualities, such as informativity, competency, bias, and objectivity should be included in future research. Second, measuring actual consumer responses after viewing hygiene grades is necessary to confirm effectiveness in both restaurant consumers and staff. The grade certificates are used for all food service outlets, but consumers might respond differently depending on the restaurant type, price range, and brand image. Future research should include these variables to measure how effectively grade certificates reach consumers. Moreover, the study sample was a convenience sample and therefore may not represent the general public. Future studies should also involve a sample that is representative of the general public to more closely determine opinions on restaurant hygiene certificates.

Conclusion

The purpose of this study was to investigate consumer perception of newly implemented restaurant hygiene certificates in Korea. To measure the perception of the certificates, aspects of restaurant food safety were also measured. This study reviewed relevant literature to determine what consumers consider when evaluating food safety. This study also utilized the current Republic of Korea restaurant health inspection format with words and symbols. Interestingly, an awareness of hygienic grade certificates made significant differences in message quality; however, some insignificant differences were found in the evaluation criteria for restaurant food safety. Most of the respondents comprehended the message, confirming that current grade certificates were well received by consumers.

Clearly, the restaurant hygiene certificates currently in use by restaurants convey their messages to consumers; however, greater differentiation among these three-tier certificates is needed for consumers to have a better understanding of food safety practices at restaurants as more restaurants receive hygiene certificates. The new certificate system has been in place for approximately four years, with certificates now posted on food delivery apps for consumers to view. Certificates are powerful components of food safety and should be accepted by restaurants, although actual consumer responses to certificates remain unknown. Future studies should investigate the effectiveness of grade certificates for both consumers and restaurants.

Corresponding Author: Jinkyung Choi, Associate Professor, Department of Food Science and Nutrition, Pukyong National University, 45 Yongso-ro, Nam-gu, Busan, South Korea, 48513. Email: choijk@pknu.ac.kr.

References

Andrews, J.C., & Shimp, T.A. (1990). Effects of involvement, argument strength, and source characteristics on central and peripheral processing of advertising. *Psychology & Marketing*, *7*(3), 195–214. https://doi.org/10.1002/mar.4220070305

Attila, S., & Çakir, B. (2011). Energy-drink consumption in college students and associated factors. *Nutrition*, *27*(3), 316–322. https://doi.org/10.1016/j.nut.2010.02.008

continued on page 24

References *continued from page 23*

Bai, L., Wang, M., Yang, Y., & Gong, S. (2019). Food safety in restaurants: The consumer perspective. *International Journal of Hospitality Management*, *77*, 139–146. https://doi.org/10.1016/j.ijhm.2018.06.023

Barkley, J.S., Gosciminski, M., & Miller, A. (2016). Whole-genome sequencing detection of ongoing *Listeria* contamination at a restaurant, Rhode Island, USA, 2014. *Emerging Infectious Diseases*, *22*(8), 1474–1476. https://doi.org/10.3201/eid2208.151917

Bettman, J.R., & Zins, M.A. (1979). Information format and choice task effects in decision making. *Journal of Consumer Research*, *6*(2), 141–153. https://doi.org/10.1086/208757

Choi, H.C., MacLaurin, T., Cho, J.-E., & Hahm, S.-P. (2010). Food hygiene standard satisfaction of Singaporean diners. *Journal of Foodservice Business Research*, *13*(3), 156–177. https://doi.org/10.1080/15378020.2010.500225

Choi, J., Miao, L., Almanza, B., & Nelson, C.D. (2013). Consumers' responses to restaurant inspection reports: The effects of information source and message style. *Journal of Foodservice Business Research*, *16*(3), 255–275. https://doi.org/10.1080/15378020.2013.810536

Choi, J., Nelson, D., & Almanza, B. (2019). Food safety risk for restaurant management: Use of restaurant health inspection report to predict consumers' behavioral intention. *Journal of Risk Research*, *22*(11), 1443–1457. https://doi.org/10.1080/13669877.2018.1501590

Dunlop, S.M., Wakefield, M., & Kashima, Y. (2010). Pathways to persuasion: Cognitive and experiential responses to health-promoting mass media messages. *Communication Research*, *37*(1), 133–164. https://doi.org/10.1177/0093650209351912

Faul, F., Erdfelder, E., Buchner, A., & Lang, A.-G. (2009). Statistical power analyses using G*Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods*, *41*(4), 1149–1160. https://doi.org/10.3758/BRM.41.4.1149

Griffith, C.J. (2013). Advances in understanding the impact of personal hygiene and human behaviour on food safety. *Advances in Microbial Food Safety*, *1*, 401–416. https://doi.org/10.1533/9780857098740.5.401

Han, S.H., Nguyen, B., & Lee, T.J. (2015). Consumer-based chain restaurant brand equity, brand reputation, and brand trust. *International Journal of Hospitality Management*, *50*, 84–93. https://doi.org/10.1016/j.ijhm.2015.06.010

Henson, S., Majowicz, S., Masakure, O., Sockett, P., Jones, A., Hart, R., Carr, D., & Knowles, L. (2006). Consumer assessment of the safety of restaurants: The role of inspection notices and other information cues. *Journal of Food Safety*, *26*(4), 275–301. https://doi.org/10.1111/j.1745-4565.2006.00049.x

Kim, R.B. (2012). Determinants of brand equity for credence goods: Consumers' preference for country origin, perceived value and food safety. *Agricultural Economics (Czech Republic)*, *58*(7), 299–307. https://doi.org/10.17221/45/2012-AGRICECON

Knight, A.J., Worosz, M.R., & Todd, E.C.D. (2007). Serving food safety: Consumer perceptions of food safety at restaurants. *International Journal of Contemporary Hospitality Management*, *19*(6), 476–484. https://doi.org/10.1108/09596110710775138

Korea Agro-Fisheries & Food Trade Corporation. (2019). *2019 Food & food service statistics* [Webpage in Korean]. https://www.atfis.or.kr

Korean Agency of HACCP Accreditation and Services. (2018). *Introduction to restaurant hygiene grade certificate* [Webpage in Korean]. https://www.haccp.or.kr/site/haccp/boardList.do?boardSeq=883&key=2408

Min, K.-H. (2016). Selection attributes and satisfaction of ethnic restaurant customers: A case of Korean restaurants in Australia. *International Journal of Tourism Sciences*, *16*(4), 151–169. https://doi.org/10.1080/15980634.2016.1205298

Nyarugwe, S.P., Linnemann, A., Hofstede, G.J., Fogliano, V., & Luning, P.A. (2016). Determinants for conducting food safety culture research. *Trends in Food Science & Technology*, *56*, 77–87. https://doi.org/10.1016/j.tifs.2016.07.015

Witt, W. (1976). Effects of quantification in scientific writing. *Journal of Communication*, *26*(1), 67–69. https://doi.org/10.1111/j.1460-2466.1976.tb01359.x

Worsfold, D. (2006). Eating out: Consumer perceptions of food safety. *International Journal of Environmental Health Research*, *16*(3), 219–229. https://doi.org/10.1080/09603120600641417

Yalch, R.F., & Elmore-Yalch, R. (1984). The effect of numbers on the route to persuasion. *Journal of Consumer Research*, *11*(1), 522–527. https://www.jstor.org/stable/2489139

Yiridoe, E.K., Bonti-Ankomah, S., & Martin, R.C. (2005). Comparison of consumer perceptions and preference toward organic versus conventionally produced foods: A review and update of the literature. *Renewable Agriculture and Food Systems*, *20*(4), 193–205. https://doi.org/10.1079/RAF2005113

Did You Know?

Earth Day is April 22. Celebrated first in 1970, Earth Day mobilizes approximately 1 billion individuals for action every year across over 190 countries. The 2022 Earth Day theme is "Invest in Our Planet." Learn more at www.earthday.org.

Governmental Food Safety Professional Workforce Estimation Model

Kieran Fogarty, PhD
Western Michigan University

Bryan Harmer, MA
Western Michigan University

Craig Kaml, EdD
International Food Protection Training Institute

Chris Weiss, PhD
International Food Protection Training Institute

Paul K. Dezendorf
Western Carolina University

Gerald Wojtala
International Food Protection Training Institute

Abstract **Governmental food safety professionals (FSPs) play a critical role in verifying that the food industry is fulfilling its responsibilities. Without the ability to accurately estimate the workforce population of FSPs, there is a high likelihood of misalignment of governmental spending and other allocated resources that raises potential concerns regarding the effectiveness of the U.S. food safety system. The development of our Governmental Food Safety Professional Workforce Estimation Model was based on a rigorous process to gain a better understanding of the estimated number of FSPs within various nonfederal governmental agencies. The modeling process indicated the population of the nonfederal governmental FSP workforce in the U.S. to be an estimated 43,289. This estimate does not include the federal FSP workforce population, which would significantly increase the projected overall FSP governmental workforce population. This study provides a workforce estimation model that can a) aid in the allocation of crucial federal resources to fill gaps in staffing and competency-based training and b) increase awareness of the need for and access to a standardized training curriculum for this country's FSPs.**

Introduction

Modern food safety systems recognize that those who produce, manufacture, or offer food for sale have the ultimate responsibility to ensure the safety of the food they handle. In the U.S., governmental food safety professionals (FSPs) play a critical role in verifying that the food industry is fulfilling its responsibilities. These FSPs include individuals employed by federal, state, local, tribal, or territorial government agencies that have any regulatory responsibility in food safety and the prevention of foodborne illness.

Despite the importance of FSPs for food safety, no accurate estimate exists of the size of the FSP workforce. The prevailing workforce estimate of FSPs was informally determined to be 45,000 (Kaml et al., 2013), but this estimate was not based on an identifiable evidence-based systematic assessment. One barrier to accurate estimates of the FSP workforce is a lack of standardized and universally accepted job definitions to describe the types of professionals involved in food safety regulation. At present, a host of agencies use dozens of job titles for persons whose qualifications can vary greatly from one agency to another, including professionals who might only have limited or tangential responsibilities in food safety. In addition, most FSPs are not required to maintain licensure or certification, and as a result there are no licensing or certifying bodies that can help estimate the workforce.

The lack of understanding about the nation's FSP workforce stands in contrast to U.S. food safety challenges, which in 2019 included an estimated 47.8 million illnesses, 127,839 hospitalizations, and 3,037 deaths caused by foodborne pathogens and agents (Centers for Disease Control and Prevention [CDC], 2018). Of the 31 most common pathogens that cause 9.4 million illnesses, there is an estimated $15.5 billion annual burden (Hoffmann et al., 2015). In 2019, the infection rate of some foodborne illnesses increased in comparison to the previous 3-year period (Tack et al., 2020).

Background

While the food industry in general is directly responsible for the safety of the food the industry handles, FSPs play an essential verification role in reducing the incidence of foodborne illnesses around the world. In the U.S., challenges to the food safety system arise due to factors such as rapid changes in food production and supply, new and emerging pathogens, and various unexpected sources of foodborne illnesses against which FSPs are the frontline defense (CDC, 2021). An accurate estimate of the total number and type of FSPs working in some food safety

TABLE **1**

Professional Tiers of Responsibility in Food Safety

Tier 1	Tier 2
Positions with direct responsibility for food safety regulation and oversight (including supervisors, managers, and directors)	**Positions with indirect or nonregulatory responsibilities**
Food inspector	State food or feed laboratorian (e.g., microbiologist, chemist)
Consumer safety inspector	Epidemiologist
Veterinary medical officer	Food technologist
Public health veterinarian	Food scientist
Consumer safety officer	State toxicologist
Investigator	Science adviser
Local environmental health sanitarian	Seafood grader
State manufactured food inspector	Egg grader
State retail food inspector	Produce grader
Food safety policy analyst	Animal health veterinarian
Shellfish growing, harvest, and depuration specialist	Municipal water, wastewater, well, and septic sanitarian
Dairy inspector	Migrant housing inspector
Dairy survey officer	Public health nurse
Canning/process control specialist	Extended care facilities inspector
Food program accreditation officer	State correctional facilities inspector
Produce farm inspector	Land grant extension specialist
Food defense coordinator	School nutrition specialist
Feed safety official	
Indian Health Service inspector	
Compliance officer	
Regulatory officer	

regulatory capacity, however, is unknown. In contrast, the number of persons in professions with a high degree of responsibility for a population's health and wellness, such as primary care physicians, are for the most part accurately measured and available. Data regarding such professionals are relatively easy to collect as these professionals are required to be licensed or certified and their job titles are standardized.

FSPs differ greatly in terms of their job titles and level of responsibility over food safety. The lack of commonly accepted standard definitions for the different professions in food safety makes it difficult to determine who should be included in workforce estimation models. As Stevenson (2015) pointed out, there are many different professions that can fall under the category of food safety, because the scope of duties in food safety varies widely among roles found in this field. For example, many federal- and state-employed FSPs are responsible for on-site inspections at manufactured food facilities. Local inspectors typically are responsible for routine inspection of commercial and noncommercial food service establishments, as well as follow-up with foodborne illness complaints. These inspectors often balance multiple responsibilities in their role that do not involve food safety, such as inspecting public pools, body art facilities, wells, and septic systems. For many other professionals, food safety may only account for a small portion of their job requirements, but their participation is still an essential component of our nation's food safety integrated response network, which includes epidemiologists and microbiologists who might not conduct direct inspections or provide management of food safety practices—but still have a profound impact on food safety.

FSPs also do not have required, standardized training programs or formal certification/licensure for which centralized records are maintained. Individuals often enter the profession with science-related education or degrees not directly related to food safety, which places a burden on government agencies to ensure proper education and training. Moreover, at this time, food safety education and training requirements vary greatly among agencies. In direct response to this need for a standards-based national curriculum framework for regulatory food safety training, the International Food Protection Training Institute (IFPTI) received funding from the Food and Drug Administration (FDA) to develop an integrated framework to address this issue (Kaml et al., 2013). At the current time, however, the training that has been developed against the curriculum framework is not universally required for all FSPs.

The difficulty in accurately determining the number of FSPs could impact the allocation of resources for food safety regulation training. For instance, food safety training often is supported by state and federal grants (Food and Drug Administration, 2020), which require estimates of the target audience. The lack of an accurate workforce estimation could hamper academic institutions from receiving an appropriate level of funding to address the educational and training needs for the future FSP workforce.

These issues have prompted the development of this Governmental Food Safety Professional Workforce Estimation Model of the state and local FSP workforce. The model is based on available survey data, with inclusion and exclusion criteria leading to classifications as Tier 1: Direct Responsibilities in Food Safety and Tier 2: Positions With Indirect or Nonregulatory Responsibilities.

Table 1 lists the two different tiers of responsibility and includes the various professions found within each tier. Professions with direct responsibility for food safety regulation and oversight are categorized as Tier 1 and include but are not limited to inspectors, sanitarians, and regulatory officers. Professions that are involved with food safety but have indirect responsibility or the responsibility is nonregulatory in nature are categorized as Tier 2. These professions include but are not limited to epidemiologists, laboratorians, advisers, and food graders. For the purposes of developing this estimation model, ancillary positions that have

TABLE **2**

Estimates of Tier 1 and Tier 2 Food Safety Professionals (FSPs) at Local Health Departments

Health Department Type	# of Responses	Average Tier 1 FSP Estimate	Average Tier 2 FSP Estimate	Tier 1 and Tier 2 FSP Average	95% CI
County	36	6.17	3.83	10.00	[5.75, 14.24]
City	11	7.30	3.27	10.57	[0.30, 20.83]
Total	47	6.74*	3.55*	10.29*	[6.70, 13.97]

Note. The 95% confidence interval (CI) values were calculated for the mean.
* Average of all responses.

TABLE **3**

Estimates of Tier 1 and Tier 2 Food Safety Professionals (FSPs) at State Regulatory Agencies (per 100,000 Population)

State Agency	# of Agencies	Average Tier 1 FSP Estimate	Average Tier 2 FSP Estimate	Tier 1 and Tier 2 FSP Average	95% CI
Department of agriculture	13	1.60	0.73	2.33	[1.28, 3.38]
Department of health	10	1.16	1.06	2.22	[0.71, 3.74]
Total	23	2.76	1.79	4.55	[2.71, 6.40]

Note. The 95% confidence interval (CI) values were calculated for the mean.

limited involvement in food safety are not included (e.g., weights and measures official, plant and pesticide inspector, farm environmental stewardship specialist, food marketing specialist, county emergency manager).

Problem Statement

At present, estimates of the nonfederal governmental FSP workforce are hampered by the lack of standardized job definitions and their location in multiple agencies within varying levels of jurisdiction. Without the ability to accurately estimate the workforce population of FSPs, there is a high likelihood of misalignment of governmental spending and other allocated resources, which raises potential concerns regarding the effectiveness of the food safety system in the U.S. This issue should be of concern to legislative bodies who are responsible to the public for the best use of taxpayer funds. The development of this Governmental Food Safety Professional Workforce Estimation Model based on a rigorous, evidence-based process is therefore necessary to gain a better understanding of the estimated number of FSPs within various nonfederal governmental agencies.

Methods

The primary data were collected from a 15-item online survey that was developed by IFPTI internal subject matter experts. In 2021, the survey was sent to alumni of the IFPTI Fellowship Program to test the model. Participants were asked to indicate the type of agency they worked for (federal, state, county, or city); their agency location; the specific department they worked for (e.g., department of health, department of agriculture); and the population size served by their agency. Participants were provided with Tier 1 and Tier 2 job descriptions (Table 1) and asked to estimate the number of FSPs in each category. Data from the questionnaire were collected through SurveyMonkey. Respondents were also able to include additional job titles for Tier 1 and Tier 2, which will help inform future studies.

Analysis

Statistical analysis was performed using IBM SPSS Statistics version 27.0. Histogram plots were used to test for normality and categorical data are reported as frequency (n) and percentage, with numerical data as means and confidence intervals (CIs). A 95% CI was used as the critical value for this study. Values were determined separately for county and city local health departments (LHDs) and state agencies. After each value was determined, the results were added to estimate the total number of nonfederal governmental FSPs in the U.S. Responses were grouped into two primary categories: state agencies and LHDs.

A total of 96 respondents completed the survey; established exclusionary criteria resulted in 7 responses being excluded due to limited or questionable information. Therefore, we used a total of 89 responses in this estimation. The responses represented a wide range of city (n = 13), county (n = 37), and state (n = 39) departments that are responsible for food safety. Survey results represented

TABLE **4**

Estimates of Food Safety Professionals (FSPs) at State Regulatory Agencies Responsible for Food Safety

State Agency	# of States	Estimated Population	Tier 1 and Tier 2 FSP Estimates per 100,000 Population	Total FSPs in State Agencies
Department of agriculture	47	314,549,796	2.33	7,329
Department of health	46	321,996,972	2.22	7,148
Total				14,477

departments from 27 states, which supports the generalizability of the findings.

Estimation Modeling Method

The development of this Governmental Food Safety Professional Workforce Estimation Model required a systematic data collection process of the reported number of FSPs within various state and local agencies. The model excluded federal governmental FSPs because obtaining the necessary data was problematic due to Freedom of Information Act requirements and/or the existing data lacked rigor despite the U.S. Government Accountability Office (2011) having identified as many as 15 federal agencies—including FDA and the Food Safety and Inspection Service of the U.S. Department of Agriculture—as collectively administering at least 30 laws related to food safety (Bradsher et al., 2015).

The model calculated the state and LHD FSP workforce separately by agencies for analytical purposes. State agencies were calculated first and adjusted to determine the prevalence rate of FSPs per 100,000 population for each state reported. Each number was then plotted to determine the total average of FSPs per 100,000 population and multiplied by the total population served by state-based departments of agriculture and departments of health.

A different approach was taken for LHDs because agencies serving low population areas have significantly higher numbers of FSPs per 100,000 population. For this calculation, the average number of FSPs per health department was determined and multiplied by the total number of LHDs in the U.S. The results represent the minimum estimated projections of the total governmental FSP workforce population in the U.S.

Results

A total of 49 respondents representing LHDs completed the survey. These respondents included both city (n = 11) and county (n = 38) departments. Population size served by LHDs ranged from 2,337 to 994,205 inhabitants. Exclusionary criteria resulted in 2 responses being omitted due to limited information, which resulted in a total of 47 responses being used in this model to estimate the total number of FSPs working at LHDs. Initial estimations determined the number of FSPs per 100,000 population served by LHDs.

The data, however, were skewed by respondents from low-population LHDs (specifically those that served populations <20,000) with significantly higher rates of FSPs. This bias posed a statistical issue, as there were wide ranges of FSPs between various LHDs, which resulted in an abnormally wide CI. Without the total number of LHDs that serve populations <20,000, using FSP rates per 100,000 population is not reliable to determine the total number of FSPs working for LHDs. Instead of using rates of FSPs per 100,000 population, we calculated the average number of FSPs at LHDs. This approach resulted in an average of 10.31 FSPs (Tier 1 and Tier 2 estimates) located at LHDs in the U.S. Table 2 provides a breakdown of the average number of FSPs between county and city departments and provides specific estimates for Tier 1 and Tier 2 averages. With 2,800 LHDs in the U.S. (National Association of County and City Health Officials, 2020), and an average of 10.31 FSPs per department, our analysis indicated a total of 28,812 Tier 1 and Tier 2 FSPs working at LHDs in the U.S.

A total of 40 respondents from state agencies, representing 21 states, completed the survey. All responses except for one response represented either a state department of agriculture or department of health. Several respondents who completed the survey represented the same department in the same state. Similar estimates were provided from the same department, which supported the validity of the responses. When multiple respondents represented the same department, the estimates were averaged for the purposes of our study. Additionally, exclusionary criteria resulted in two responses being omitted due to limited information.

A total of 23 state food regulatory departments were represented across 21 states, 13 departments of agriculture, and 10 departments of health. The estimates provided were compared to the state population to determine the rate of FSPs in each department for their representative state per 100,000 population. Table 3 provides a breakdown of the estimates. The estimated rates of Tier 1 and Tier 2 FSPs per 100,000 population for state departments of agriculture and departments of health were combined, which resulted in an estimate of 4.55 FSPs per 100,000 population.

The analysis determined that 44 states have both a department of health and a department of agriculture that have various responsibilities for food safety (Association of Food and Drug Officials, 2021). The department of health had no food regulatory responsibility in three states. In two states, the department of agriculture had no food regulatory responsibility. In Alaska, both the department of agriculture and the department of health had no regulatory food responsibility. We calculated the population for the 47 states where the department of agriculture has regulatory responsibility over food. We did the same for the 46 states where the department of health has regulatory responsibility over food. Table 4 reflects these estimates, including the total number of FSPs per 100,000 population for each department. Overall estimates for both departments of agriculture and departments of health were calculated and added together. This study estimates that there are 14,477 FSPs working at state departments of health and departments of agriculture in the U.S.

Discussion

This study provides direct evidence of the difficulties in determining the precise number of

government workers with direct responsibility for food safety regulation and oversight. These difficulties are further increased when the additional governmental positions with indirect or nonregulatory responsibilities for food safety are factored in, as they are found throughout agencies at multiple levels of engagement in the governmental food safety system in the U.S. Our model, however, does provide some evidence of the minimum range for the FSP workforce. Based on the inclusion and exclusion criteria used in this model, the findings indicate that the model provides a reasonable, systemic modeling estimate of the nonfederal governmental food safety workforce population in the U.S. across various agencies and levels of the government. These model projections estimate the reported Tier 1 food safety workforce to be 27,625 and Tier 2 to be 15,664, with a total calculated adjusted Tier 1 + Tier 2 nonfederal governmental food safety workforce to be conservatively estimated at 43,289, which does not include FSPs at the federal level.

Workforce Estimation Model Formula (Tier 1)

Estimated state food safety workforce + Estimated local food safety workforce (city, county, tribal, territorial) = Total (27,625)

Adjusted Workforce Estimation Model Formula (Tier 1 + Tier 2)

Estimated state food safety workforce + Estimated local food safety workforce (city, county, tribal, territorial) = Total (43,289)

Strengths and Limitations

This model has several strengths and limitations, as do most workforce estimation models. The significant strength of this study is that the resulting model represents the first known application of a rigorous process to estimate the U.S. governmental FSP workforce. There are, however, several limitations to the model.

The data sources utilized in this model are subject to variability in estimation levels based on quality and completeness of the available data sources. For example, determining the number of FSPs is further complicated when we included in the analysis the additional governmental positions with indirect or nonregulatory responsibilities for food; these positions are found throughout the various governmental agencies at multiple levels of engagement in the nation's food safety integrated response network. The understanding of what constitutes indirect support staff across the various nonfederal governmental agencies might have varied greatly among the survey respondents and their understanding was not independently verified.

There also may be unique changes in the number of FSPs due to funding cycles and/or regulatory-based initiatives that can impact the hiring and retention practices of the reported workforce within these agencies. Further, the survey asked the respondents to estimate the number of FSPs at their agency. These estimates might not have been accurate, are subject to recall bias, and there might have been misinterpretations of Tier 1 and Tier 2 descriptions. Additionally, the findings of this study were limited to a group of state and local agencies and the estimates of these agencies may not be generalizable to other agencies.

Conclusion and Recommendations

Our study indicates that the population of the nonfederal governmental workforce of FSPs in the U.S. is 43,289. This number does not include an estimate of the federal FSP workforce population, which would significantly increase the projected overall governmental FSP workforce population. In computing that number, our study provides direct evidence of the difficulty in determining the precise number of persons in the governmental workforce with responsibility for food safety. This study does demonstrate, however, that an evidence-based workforce estimation model can a) aid in the allocation of critical federal resources for competency-based training and b) increase awareness of the need for and access to a standardized training curriculum for FSPs in the U.S.

Corresponding Author: Kieran Fogarty, Director and Professor, Interdisciplinary Health Sciences PhD Program, Western Michigan University, 2344 Crane Avenue, Kalamazoo, MI 49001. Email: kieran.fogarty@wmich.edu.

References

Association of Food and Drug Officials. (2021). *Jurisdiction and enforcement authority*. https://www.afdo.org/directories/jea/

Bradsher, J., Wojtala, G., Kaml, C., Weiss, C., & Read, D. (Eds.). (2015). *Regulatory foundations for the food protection professional*. Springer. https://doi.org/10.1007/978-1-4939-0650-5

Centers for Disease Control and Prevention. (2018). *Burden of foodborne illness: Findings*. https://www.cdc.gov/foodborneburden/2011-foodborne-estimates.html

Centers for Disease Control and Prevention. (2021). *CDC and food safety*. https://www.cdc.gov/foodsafety/cdc-and-food-safety.html

Food and Drug Administration. (2020, July 27). *FDA announces new round of funding to support FSMA education, training, and technical assistance*. https://www.fda.gov/food/cfsan-constituent-updates/fda-announces-new-round-funding-support-fsma-education-training-and-technical-assistance

Hoffmann, S., Maculloch, B., & Batz, M. (2015, May). *Economic burden of major foodborne illnesses acquired in the United States* (Report summary). U.S. Department of Agriculture. https://www.ers.usda.gov/webdocs/publications/43984/52806_eib140_summary.pdf

Kaml, C., Fogarty, K.J., Wojtala, G., Dardick, W., Bateson, A., Bradsher, J.E., & Weiss, C.C. (2013). The development of a standards-based national curriculum framework for regulatory food safety training in the United States. *Journal of Environmental Health*, *76*(2), 38–42.

National Association of County and City Health Officials. (2020). *2019 national profile of local health departments*. https://www.naccho.org/uploads/downloadable-resources/Programs/Public-Health-Infrastructure/NACCHO_2019_Profile_Final2.pdf

References

Stevenson, C.D. (2015). Occupational analysis of the present and future food safety workforces. *Food Protection Trends*, *35*(2), 101–105. http://www.foodprotection.org/files/food-protection-trends/Mar-Apr-15-Stevenson.pdf

Tack, D.M., Ray, L., Griffin, P.M., Cieslak, P.R., Dunn, J., Rissman, T., Jervis, R., Lathrop, S., Muse, A., Duwell, M., Smith, K., Tobin-D'Angelo, M., Vugia, D.J., Zablotsky Kufel, J., Wolpert, B.J., Tauxe, R., & Payne, D.C. (2020). Preliminary incidence and trends of infections with pathogens transmitted commonly through food—Foodborne Diseases Active Surveillance Network, 10 U.S. sites, 2016–2019. *Morbidity and Mortality Weekly Report*, *69*(17), 509–514. https://doi.org/10.15585/mmwr.mm6917a1

U.S. Government Accountability Office. (2011). *Federal food safety oversight: Food safety working group is a positive first step but governmentwide planning is needed to address fragmentation* (GAO-11-289). https://www.gao.gov/assets/gao-11-289.pdf

BUILDING CAPACITY

Darryl Booth, MBA

Building Capacity by Normalizing Addresses

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

This column will be authored by technical advisors of the National Environmental Health Association (NEHA) data and technology section, as well as guest authors. The conclusions of this column are those of the author(s) and do not necessarily represent the views of NEHA.

Darryl Booth currently serves as a NEHA technical advisor for data and technology. He is the general manager of environmental health at Accela and have been monitoring regulatory and data tracking needs of agencies across the U.S. for over 20 years.

Managing addresses can be a hidden burden on your environmental health department and staff. The impact of bad addresses ranges from wasted inspector time, returned mail (including renewals and invoices), late payments, and administrative "special projects." Environmental health must track the addresses of licensed and permitted facilities (primarily businesses), land parcels (primarily development), and "everything else." The "everything else" category includes location information for locations with no address, such as festivals, cell phone towers, and some complaints.

Under the "special projects" category, we see frequent list matching and data cleanup projects. Unfortunately, manually comparing two lists can be labor intensive. Worse still, the same sort of matching projects seem to pop-up again and again. These projects should be automated through your software, internal tools, or third-party service.

Best Practices for Managing Addresses

Adopt Addressing Standards

The U.S. Postal Service, not surprisingly, maintains documented standards for addresses. As described on www.usps.com, "A standardized address is one that includes all required address elements and that uses the Postal Service standard abbreviations."

Most people know the proper two-digit state abbreviations. Far fewer people, however, know the standard abbreviations for a street type. Apply these standards to both your in-office and public-facing systems. And, if your data system can enforce these standards, that is the best situation.

Validate Addresses as Valid

Many internal and external resources can validate an address in your jurisdiction. These services can sometimes also augment the address by putting it in a standard format and adding elements such as parcel number, property ownership, ZIP+4 code, and latitude and longitude. The following are services that can be used for validating addresses:

- county assessor's office,
- GIS technology,
- U.S. Postal Service, and
- commercial services (some services may be fee-based).

The validation should happen in real time, if possible. That is, as the user keys and stores the address, it is validated (and sometimes corrected) as the record is stored.

County health departments have an easier path, with the assessor's office or GIS technology "in their own buildings" and primed to assist. Health districts—often spanning counties—and cities might need to negotiate to get these services. State regulators might need to use a commercial service.

Geocode Addresses

Geocoding is the task of connecting a valid address to a pin on a map and establishing its location on Earth. Mapping facility locations or suspected foodborne illness complaints

TABLE **1**

Example of a Full Versus Parsed Address

Type of Address	Example
Full	Address: 10903 New Hampshire Avenue
Parsed	Number: 10903
	Number fractional:
	Pre-directional:
	Name: New Hampshire
	Suffix: Ave
	Post-directional:
	Suite type:
	Suite number:

or inspections or vector sites is an everyday function of your GIS team and might even be built into your software system. In either case, automatically capturing the location (frequently expressed as latitude and longitude) once the address is validated makes mapping these records later much easier.

Parsed Addresses

While tabbing into an empty address field and keying the whole address feels very natural (like addressing an envelope), the downstream data activities will eventually need a parsed address.

A parsed address is when there is a separate field for every address element, such as the street number, street direction, street name, street type, unit, and unit type (Table 1). To meet this practice, your system should maintain separate distinct fields for every element of the address, even if it is out of view from your users. Note that the list of address elements shown in Table 1 is not comprehensive.

Normalizing Addresses

Matching lists of facilities from other sources (e.g., a list from state regulators) is common. You already know that matching on facility name alone almost never works due to all the various spellings for a business. Matching on addresses is preferred, but the external list probably did not follow the best practices above. Maybe your list is also imperfect. The task becomes putting the two lists in a standard format necessary for matching addresses.

Normalizing a File of Addresses

You have been given a list of facilities, most of which you track already. But we expect to find some previously unknown businesses, too. That is a matching project that we want to automate.

Here is one easy way to normalize addresses using a service provided by Texas A&M University (TAMU) GeoServices.

- Prepare your data file in Excel with column headings for ID (a unique ID for the facility if one exists), SiteAddress, City, State, and ZIP.
- Save the file as a CSV (command separated value), which can be done in the Excel Save As dialog box.
- Navigate to the TAMU GeoServices webpage at https://geoservices.tamu.edu/ and create a free account (username and password required).
- Click on Services in the top toolbar and then on Address Processing in the left-hand toolbar.
- Follow the steps provided for the address processing service selected. When the processing is done, the download of your processed file will contain columns for StreetNumber, StreetName, StreetType, SuiteNumber, SuiteType, and more. These columns will be filled-in with perfectly formatted address elements ready for matching.

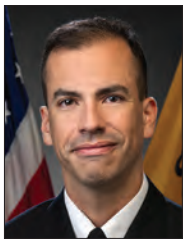
If you have other tips or insights on streamlining addressing operations for environmental health department staff, please add them to our LinkedIn Group at www.linkedin.com/groups/6945520.

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

CALL FOR SUBMISSIONS

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

DIRECT FROM CDC ENVIRONMENTAL HEALTH SERVICES



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

Holly Wilson, MHSE, MCHES

Data Modernization: Making Environmental Health Services Data More Accessible

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

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

CDR Luis Rodriguez is an environmental health specialist and Holly Wilson is a health communication specialist at the National Center for Environmental Health within CDC.

Environmental health programs routinely generate and collect data on inspection results and violations, facility closures, permits or licenses issued, investigation findings, public inquiries, and responses to complaints. High-quality environmental health services data are essential for timely identification and detection of environmental hazards, decision making, and evidence-based practices guidance. The Centers for Disease Control and Prevention (CDC, 2021a) has begun a public health Data Modernization Initiative to create connected, resilient, adaptable, and sustainable data systems that can help produce solutions before problems occur and limit negative effects caused by problems that do occur. The Environmental Public Health Tracking Program and the Water, Food, and Environmental Health Services Branch (WFEHSB) of CDC are working together to enhance and expand environmental health data modernization efforts across the country.

The Tracking Program and WFEHSB fund 11 projects from state and local tracking programs to modernize the collection, integration, dissemination, and application of timely, local environmental health data. The funded jurisdictions work on a range of projects to improve use and dissemination of data related to environmental health services, such as inspections; permits; investigations; public inquiries; and complaints for food, private wells, and septic systems. Table 1 provides website links to information about how these jurisdictions use environmental health data.

Projects

- **California** is building a standardized and sustainable statewide data set on vehicle traffic that will be accessible to the public, researchers, and environmental health services through an updated version of its 2007 Traffic Tool.
- **Connecticut** is developing and implementing modern data pipelines for food protection, private well, and childhood lead surveillance data, as well as environmental health dashboards for leadership and the public. The state is also increasing the amount of available data on the Connecticut Tracking Data Explorer.
- **Florida** is accelerating data and health system modernization related to COVID-19 and environmental health services data. The state is replacing legacy technology and working with the Bureau of Epidemiology and Environmental Health database managers to incorporate COVID-19 and inspection results into the state tracking web portal.
- **Kentucky** is enhancing the framework for environmental health service data collection, sharing, and application by applying modernized syndromic surveillance, SQL Server management, and Tableau visualization techniques. The state is also strengthening partnerships between public health programs by collaborating on data usage and grant deliverables to improve strategic decision-making skills within the IT infrastructure of the tracking system.
- **Maryland** is addressing current data gaps in the sharing of data related to inspections, permits, investigations, public inquiries, and complaints pertaining to private

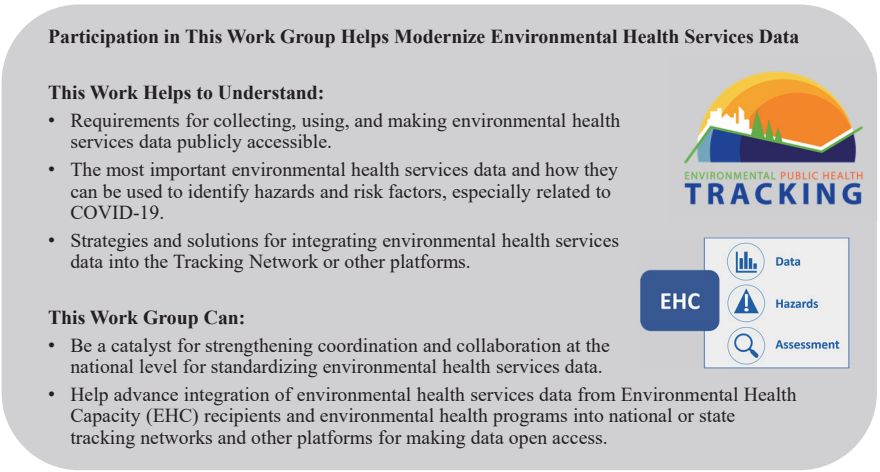
TABLE **1**

Website Links to Explore Environmental Health Data Modernization Efforts in Different Jurisdictions in the United States

Jurisdiction	Website Link
California	www.trackingcalifornia.org
Connecticut	https://stateofhealth.ct.gov
Florida	www.floridatracking.com/healthtracking
Kentucky	https://kyibis.mc.uky.edu/ehl
Maryland	https://health.maryland.gov/phpa/oehfp/eh/tracking/Pages/home.aspx
Michigan	www.michigan.gov/mdhhs/0,5885,7-339-71548_54783_54784_78428---,00.html
New Mexico	https://nmtracking.org
New York City	https://a816-dohbesp.nyc.gov/IndicatorPublic/publictracking.aspx
Oregon	www.oregon.gov/OHA/PH/HealthyEnvironments/TrackingAssessment/EnvironmentalPublicHealthTracking/Pages/index.aspx
Rhode Island	https://health.ri.gov/programs/detail.php?pgm_id=1123
Washington	www.doh.wa.gov/DataandStatisticalReports/WashingtonTrackingNetworkWTN

FIGURE **1**

Importance of the Environmental Health Data Modernization Work Group



wells and septic systems. The state is also integrating wastewater monitoring data for COVID-19 within its tracking portal.

- **Michigan** is establishing mini grants with local health departments to identify data priorities and gaps. The state is also establishing pilot initiatives to improve data systems, collection, management, and distribution.
- **New Mexico** is building and strengthening partnerships between the New Mexico Tracking Program, New Mexico Environmental Health Capacity, and Liquid Waste Bureau of the New Mexico Environment Department for assessment of threats to groundwater (e.g., private wells) and water quality, as well as strategic decision making to mitigate harmful drinking water exposures including those related to onsite wastewater liquid waste disposal.
- **New York City** is developing a platform to provide secure data access through an application programming interface (API) and pilot testing the platform with environmental health services data. The jurisdiction is also creating a content management system to help nontechnical staff members produce online narrative content for a public data-sharing portal, including data stories and annual reports.
- **Oregon** is modernizing the collection, integration, dissemination, and application of domestic well testing data, including programmatic and water quality data collected during routine real estate transactions and special projects (e.g., a wildfire-impacted domestic well test voucher project).
- **Rhode Island** is pilot testing a data integration and automation project using data from the Center for Food Protection within the Rhode Island Department of Health to link food protection, environmental public health tracking, and geographic information into a public health data surveillance system that is modern, interoperable, and real time.
- **Washington** is building on existing relationships, capacity, and expertise to modernize the collection, integration, distribution, and application of environmental health data to include lead in school drinking water testing results and pesticide illness investigations on the Washington Tracking Network.

In addition to working on their own projects, the funded jurisdictions participate in an environmental health data modernization work group to aid collaboration and adoption of best practices across programs and among unfunded jurisdictions. The work group focuses on a variety of topics, including data standards, data pipelines, data display and dissemination, integration of data with tracking systems, and tool development (Figure 1). These jurisdictions also participate in projects for CDC's Environmental Health Capacity (EHC) program or the National Environmental Public Health Tracking Network. To learn more about these programs, visit www.cdc.gov/nceh/ehs/ehc/index.html and www.cdc.gov/nceh/tracking/default.htm.

The Road Ahead in Data Modernization

CDC is dedicated to unlocking the full potential of data for disease detection, elimination, and prevention by supporting projects such

as those highlighted here. The Data Modernization Initiative marks the first comprehensive strategy to modernize data, technology, and workforce capabilities together. This initiative supports public health surveillance, research, and ultimately, decision making. In the long term, this initiative will help CDC and its partners chart a course to the future where data drives action in real time—efficiently, flexibly, rapidly, and effectively (CDC, 2021b). To learn more about the CDC Data Modernization Initiative, visit www.cdc.gov/surveillance/projects/dmi-initiative.

Corresponding Author: CDR Luis Rodriguez, Environmental Health Specialist, National Center for Environmental Health, Centers for Disease Control and Prevention, 4770 Buford Highway, Atlanta, GA 30341.
Email: ved8@cdc.gov.

Additional Environmental Health Informatics Resources

- Using Informatics to Improve Environmental Health Practice: www.cdc.gov/nceh/ehs/activities/using-informatics.html
- Leveraging Informatics to Improve Environmental Health Practice and Innovation: https://phii.org/wp-content/uploads/2021/09/Environmental-Health-Final-Project-Report-Final-August-2021-V5.pdf
- Environmental Public Health Performance Standards: www.cdc.gov/nceh/ehs/envphps/default.htm
- National Environmental Public Health Tracking Network Data Explorer: https://ephtracking.cdc.gov/DataExplorer

References

Centers for Disease Control and Prevention. (2021a). *Data modernization initiative*. https://www.cdc.gov/surveillance/surveillance-data-strategies/data-IT-transformation.html

Centers for Disease Control and Prevention. (2021b). *Data modernization initiative—DMI basics: The why, what, and how of data modernization*. https://www.cdc.gov/surveillance/pdfs/dmi_basics_external_audiences-March_2021.pdf

Did You Know?

National Public Health Week is April 4–10. This year's theme is "Public Health Is Where You Are." During this week, the American Public Health Association brings together communities to recognize the contributions of public health and highlight issues that are important to improving our nation's health. Learn more at www.nphw.org.

EH CALENDAR

UPCOMING NATIONAL ENVIRONMENTAL HEALTH ASSOCIATION (NEHA) CONFERENCE

June 28–July 1, 2022: NEHA 2022 Annual Educational Conference & Exhibition—Now a Hybrid Event, Spokane, WA, https://www.neha.org/aec

NEHA AFFILIATE AND REGIONAL LISTINGS

Colorado
September 13–16, 2022: 66th Annual Education Conference, Colorado Environmental Health Association, Crested Butte, CO, http://www.cehaweb.com

Indiana
April 28, 2022: IEHA Spring Conference, Indiana Environmental Health Association (IEHA), Plainfield, IN, https://www.iehaind.org/Conference

Iowa
May 3–4, 2022: Public Health Conference of Iowa, Iowa Environmental Health and Public Health Associations, Ames, IA, https://www.ieha.net/PHCI2022

Missouri
April 4–8, 2022: Annual Education Conference, Missouri Environmental Health Association, Springfield, MO, https://mehamo.org

Montana
April 11–13, 2022: MEHA/MPHA Conference and Annual Meeting, Montana Environmental Health Association (MEHA) and Montana Public Health Association (MPHA), Helena, MT, http://www.mehaweb.org

Nevada
May 3–5, 2022: NVEHA and NFSTF Joint Education Conference (Virtual), Nevada Environmental Health Association (NVEHA) and Nevada Food Safety Task Force (NFSTF), http://nveha.org

North Carolina
April 27–29, 2022: NCPHA Fall Educational Conference (Rescheduled), North Carolina Public Health Association (NCPHA), Asheville, NC, https://ncpha.memberclicks.net

Ohio
April 14–15, 2022: Annual Educational Conference, Ohio Environmental Health Association, Dublin, OH, http://www.ohioeha.org

Oregon
April 5–7, 2022: Annual Educational Conference, Oregon Environmental Health Association, Bend, OR, https://oregoneha.org/aec

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

Utah
May 4–6, 2022: UEHA Spring Conference, Utah Environmental Health Association (UEHA), Kanab, UT, http://www.ueha.org/events.html

TOPICAL LISTING

Food Safety
April 26–29, 2022: 2022 Integrated Foodborne Outbreak Response and Management (InFORM) Conference (Virtual), https://www.neha.org/inform

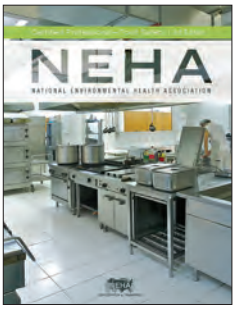
RESOURCE CORNER

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

NEHA BOOKSTORE
www.neha.org/store

Certified Professional–Food Safety Manual (3rd Edition)

National Environmental Health Association (2014)

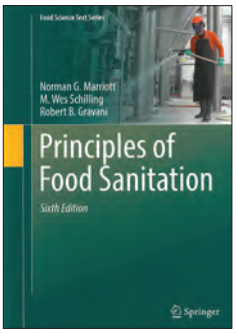


The Certified Professional–Food Safety (CP-FS) credential is well respected throughout the environmental health and food safety field. This manual has been developed by experts from across the various food safety disciplines to help candidates prepare for the National Environmental Health Association (NEHA) 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)

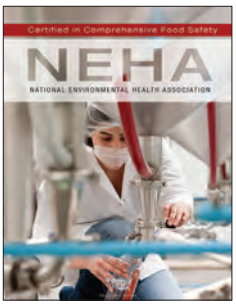


Now in its 6th edition, this highly acclaimed book provides sanitation information needed to ensure hygienic practices and safe food for food industry professionals and students. It addresses the principles related to contamination, cleaning compounds, sanitizers, and cleaning equipment. It also presents 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

Certified in Comprehensive Food Safety Manual

National Environmental Health Association (2014)

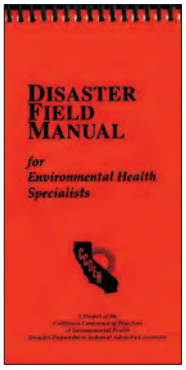


The Food Safety Modernization Act has recast the food safety landscape, including the role of the food safety professional. To position this field for the future, NEHA offers the Certified in Comprehensive Food Safety (CCFS) credential. CCFS is a midlevel credential for food safety professionals that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

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

Disaster Field Manual for Environmental Health Specialists

California Association of Environmental Health Administrators (2012)



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

224 pages / Spiral-bound hardback
Member: $37 / Nonmember: $45

SPECIAL **LISTING**

The National Environmental Health Association (NEHA) Board of Directors includes 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.

Traci (Slowinski) Michelson, MS, REHS, CP-FS
Region 5 Vice-President

Nichole Lemin, MS, MEP, RS/REHS
Region 6 Vice-President

National Officers

www.neha.org/national-officers

President—Roy Kroeger, REHS
President@neha.org

President-Elect—D. Gary Brown, DrPH, CIH, RS, DAAS
PresidentElect@neha.org

First Vice-President—Tom Butts, MSc, REHS
FirstVicePresident@neha.org

Second Vice-President—CDR Anna Khan, MA, REHS/RS
SecondVicePresident@neha.org

Immediate Past-President—Sandra Long, REHS, RS
ImmediatePastPresident@neha.org

Regional Vice-Presidents

www.neha.org/RVPs

Region 1—William B. Emminger, Jr., REHS, CPM
Region1RVP@neha.org
Alaska, Idaho, Oregon, and Washington. Term expires 2023.

Region 2—Michele DiMaggio, REHS
Region2RVP@neha.org
Arizona, California, Hawaii, and Nevada. Term expires 2024.

Region 3—Rachelle Blackham, MPH, REHS
Region3RVP@neha.org
Colorado, Montana, Utah, Wyoming, and members residing outside of the U.S (except members of the U.S. armed services). Term expires 2024.

Region 4—Kim Carlton, MPH, REHS/RS, CFOI
Region4RVP@neha.org
Iowa, Minnesota, Nebraska, North Dakota, South Dakota, and Wisconsin. Term expires 2022.

Region 5—Traci (Slowinski) Michelson, MS, REHS, CP-FS
Region5RVP@neha.org
Arkansas, Kansas, Louisiana, Missouri, New Mexico, Oklahoma, and Texas. Term expires 2023.

Region 6—Nichole Lemin, MS, MEP, RS/REHS
Region6RVP@neha.org
Illinois, Indiana, Kentucky, Michigan, and Ohio. Term expires 2022.

Region 7—Tim Hatch, MPA, REHS
Region7RVP@neha.org
Alabama, Florida, Georgia, Mississippi, North Carolina, South Carolina, and Tennessee. Term expires 2023.

Region 8—CDR James Speckhart, MS, REHS, USPHS
Region8RVP@neha.org
Delaware, Maryland, Pennsylvania, Virginia, Washington, DC, West Virginia, and members of the U.S. armed services residing outside of the U.S. Term expires 2024.

Region 9—Larry Ramdin, REHS, CP-FS, HHS
Region9RVP@neha.org
Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, and Vermont. Term expires 2022.

NEHA Staff

www.neha.org/staff

Seth Arends, Graphic Designer, NEHA EZ, sarends@neha.org

Rance Baker, Director, NEHA EZ, rbaker@neha.org

Gina Bare, RN, Associate Director, PPD, gbare@neha.org

Kate Beasley, Digital Communications Specialist, kbeasley@neha.org

Jesse Bliss, MPH, Director, PPD, jbliss@neha.org

Faye Blumberg, Instructional Designer, NEHA EZ, fblumberg@neha.org

Nick Bohnenkamp, Program and Operations Manager, PPD, nbohnenkamp@neha.org

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

Renee Clark, Director, Finance, rclark@neha.org

Holly Cypress, Administrative Support, PPD, hcypress@neha.org

Kristie Denbrock, MPA, Chief Learning Officer, kdenbrock@neha.org

Rosie DeVito, MPH, Program and Operations Manager, rdevito@neha.org

Steven Dourdis, MA, Human Resources Business Partner, sdourdis@neha.org

David Dyjack, DrPH, CIH, Executive Director, ddyjack@neha.org

Doug Farquhar, JD, Director, Government Affairs, dfarquhar@neha.org

Soni Fink, Sales Manager, sfink@neha.org

Anna Floyd, PhD, Instructional Designer, EZ, afloyd@neha.org

Heather Folker, Director, Member Services and Credentialing, hfolker@neha.org

Nathan Galanos, Contracts Administrator, ngalanos@neha.org

Chana Goussetis, MA, Marketing and Communications Director, cgoussetis@neha.org

Elizabeth Grenier, Senior Project Coordinator, NEHA-FDA RFFM, egrenier@neha.org

Madelyn Gustafson, Project Coordinator, PPD, mgustafson@neha.org

Thyra Kimbell, Project Coordinator, tkimbell@neha.org

Nicole Kinash, Administrative and Logistical Support, NEHA EZ, nkinash@neha.org

Becky Labbo, MA, Evaluation Coordinator, PPD, rlabbo@neha.org

Terryn Laird, Public Health Communications Specialist, tlaird@neha.org

Melodie Lake, Editor/Copy Writer, NEHA EZ, mlake@neha.org

Angelica Ledezma, AEC Manager, aledezma@neha.org

Stephanie Lenhart, MBA, Senior Accountant, slenhart@neha.org

Matt Lieber, Database Administrator, mlieber@neha.org

Dillon Loaiza, Accounts Payable Specialist, dloaiza@neha.org

Julianne Manchester, PhD, Senior Research and Evaluation Specialist, NEHA-FDA RFFM, jmanchester@neha.org

Bobby Medina, Credentialing Specialist, bmedina@neha.org

Jaclyn Miller, Marketing and Communications Specialist, NEHA-FDA RFFM, jmiller@neha.org

Avery Moyler, Training and Contractor Supervisor, NEHA EZ, amoyler@neha.org

Eileen Neison, Credentialing Manager, eneison@neha.org

Michael Newman, A+, ACA, MCTS, Director, Information Technology, mnewman@neha.org

Nick Ogg, Media Production Specialist, NEHA EZ, nogg@neha.org

Liz Otero, MLIS, Web Developer, lotero@neha.org

Kim Pacifico, Senior Accountant, kpacifico@neha.org

Amber Potts, REHS, CP-FS, Senior Project Coordinator, PPD, apotts@neha.org

Kristen Ruby-Cisneros, Managing Editor, *JEH,* kruby@neha.org

Michéle Samarya-Timm, MA, HO, REHS, MCHES, DLAAS, Senior Program Analyst, Environmental Health, PPD, msamaryatimm@neha.org

Katherine Sheppard, Executive Assistant, ksheppard@neha.org

Sadie Shervheim, Public Health Associate, sshervheim@neha.org

Jordan Strahle, Marketing and Communications Manager, jstrahle@neha.org

Reem Tariq, MSEH, Senior Project Coordinator, PPD, rtariq@neha.org

Christl Tate, Training Operations and Logistics Manager, NEHA EZ, ctate@neha.org

Sharon Unkart, PhD, Associate Director, NEHA EZ, sdunkart@neha.org

Gail Vail, CPA, CGMA, Associate Executive Director, gvail@neha.org

Christopher Walker, MSEH, REHS, Senior Program Analyst, Environmental Health, PPD, cwalker@neha.org

Laura Wildey, CP-FS, Senior Program Analyst, Food Safety, PPD, lwildey@neha.org

Cole Wilson, Operations Manager, NEHA-FDA RFFM, nwilson@neha.org

Alyssa Wooden, MHS, Project Coordinator, PPD, awooden@neha.org

2021–2022 Technical Advisors

www.neha.org/technical-advisors

CLIMATE AND HEALTH

David Gilkey, PhD
dgilkey@mtech.edu

Steven Konkel, PhD
steve.konkel@gmail.com

DATA AND TECHNOLOGY

Darryl Booth, MBA
dbooth@accela.com

Timothy Callahan, MPH
tim.callahan@dph.ga.gov

EMERGENCY PREPAREDNESS

Latasha A. Allen, MSPH, MEDM
latisha.allen@hhs.gov

Martin Kalis
mkalis@cdc.gov

Luis Rodriguez
ved8@cdc.gov

FOOD SAFETY

Eric Bradley, MPH, REHS, CP-FS, DAAS
ericbradley30252@gmail.com

Tracynda Davis, MPH
tracynda.davis@fda.hhs.gov

Zachary Ehrlich
zachary.ehrlich@doh.nj.gov

Adam Kramer, MPH, ScD, RS
akramer2@cdc.gov

Cindy Rice, MSPH, RS, CP-FS, CEHT
cindy@easternfoodsafety.com

Christine Sylvis, REHS
sylvis@snhd.org

GENERAL ENVIRONMENTAL HEALTH

Michael Crea, MS
crea@zedgepiercing.com

Tara Gurge, MS, RS, CEHT
tgurge@needhamma.gov

Greg Kearney, MPH, DrPH, REHS
kearneyg@ecu.edu

Adam Mannarino
adam.mannarino@gmail.com

Clint Pinion, Jr., DrPH, RS, CIT
clint.pinion@sw.edu

HEALTHY COMMUNITIES

Stan Hazan, MPH
hazan@nsf.org

Robert Powitz, MPH, PhD, RS, CP-FS
powitz@sanitarian.com

Robert Washam, MPH, RS, DAAS
b_washam@hotmail.com

INFECTIOUS AND VECTORBORNE DISEASES

Tyler Zerwekh MPH, DrPH, REHS
tyler.zerwekh@dshs.texas.gov

SPECIAL POPULATIONS

Natasha DeJarnett, MPH, PhD
natasha.dejarnett@louisville.edu

Welford Roberts, MS, PhD, REHS/RS, DAAS
welford@erols.com

WATER QUALITY

Jason Ravenscroft, MPH, REHS, CPO
jravensc@marionhealth.org

Andrew Whelton, MPH
awhelton@purdue.edu

Steve Wilson
sdwilson@illinois.edu

WORKFORCE AND LEADERSHIP

Robert Custard, REHS, CP-FS
bobcustard@comcast.net

Lauren DiPrete, MPH, REHS
diprete@snhd.org

Affiliate Presidents

www.neha.org/affiliates

Alabama—Russell Harry
russell.harry@adph.state.al.us

Alaska—Joy Britt
jdbritt@anthc.org

Arizona—David Morales
david.morales@maricopa.gov

Arkansas—Richard Taffner, RS
richard.taffner@arkansas.gov

Business and Industry—Michael Crea
nehabia@outlook.com

California—Darryl Wong
president@ceha.org

Colorado—Josh Skeggs
jskeggs@tchd.org

Connecticut—Chris Buter, RS/REHS
sanitarianc@esdhd.org

Florida—Eric Maday
eric.maday@flhealth.gov

Georgia—Jessica Badour
jessica.badour@agr.georgia.gov

Idaho—Vacant

Illinois—Justin Dwyer
jadwyer84@gmail.com

Indiana—Holley M. Rose
hrose@ripleycounty.com

Iowa—Matt Even
meven@bentoncountyia.gov

Jamaica (International Partner Organization)—Karen Brown
info@japhi.org.jm

Kansas—Tanner Langer
tdlanger@cowleycounty.org

Kentucky—Brittany Wells, RS
kentuckyeha@gmail.com

Louisiana—Carolyn Bombet
carolyn.bombet@la.gov

Massachusetts—Diane Chalifoux-Judge, REHS/RS, CP-FS
diane.chalifoux@boston.gov

Michigan—Andrew Priest
apriest@meha.net

Minnesota—Lisa Schreifels, REHS
president@mehaonline.org

Missouri—Ryan Tilley
rtilley@sccmo.org

Montana—Sarah Robbin
sarahrobbin1@gmail.com

National Capital Area—Julia Balsley, REHS
NCAEHA.President@gmail.com

Nebraska—Harry Heafer, REHS
hheafer@lincoln.ne.gov

Nevada—Brenda Welch, REHS
welch@snhd.org

New Jersey—Lynette Medeiros
president@njeha.org

New Mexico—Samuel Frank
samuel.frank@ihs.gov

New York State Conference of Environmental Health—Isaiah Sutton
isaiahs@co.chenango.ny.us

North Carolina—Tonya Zimmerman

North Dakota—Julie Wagendorf
jwagendorf@nd.gov

Northern New England Environmental Health Association—Brian Lockard
blockard@ci.salem.nh.us

Ohio—Steve Ruckman, MPH, RS
mphosu@gmail.com

Oklahoma—Jordan Cox
coxmj12@gmail.com

Oregon—Sarah Puls
sarah.puls@co.lane.or.us

Past Presidents—Vince Radke, MPH, RS, CP-FS, DLAAS, CPH
vradke@bellsouth.net

Rhode Island—Dottie LeBeau, CP-FS
deejaylebeau@verizon.net

South Carolina—M.L. Tanner, HHS
tannerml@dhec.sc.gov

Tennessee—Kimberly Davidson
kimberly.davidson@tn.gov

Texas—John Shrader
shrader@ehspecialties.com

Uniformed Services—MAJ Nathaniel Sheehan
nathaniel.sheehan@outlook.com

Utah—Karl Hartman
khartman@utah.gov

Virginia—Jessica Stewart
jessica.stewart@virginiaeha.org

Washington—Tom Kunesh
tkunesh@co.whatcom.wa.us

West Virginia—Jennifer Hutson
wvaos@outlook.com

Wisconsin—Carrie Pohjola
carrie.pohjola@wisconsin.gov

Wyoming—Chelle Schwope
chelle.schwope@wyo.gov

Safeguarding a Road Less Traveled

85TH ANNUAL EDUCATIONAL CONFERENCE & EXHIBITION

NATIONAL ENVIRONMENTAL HEALTH ASSOCIATION

AEC 2022

Spokane, WA · June 28–July 1

Feature events include...

GRAND SESSION KICKOFF PANEL

Challenges Facing the Environmental Health Workforce Regarding COVID-19 Practices

Umair A. Shah

OPENING SESSION BY

Umair A. Shah, MPH, MD
Secretary of Health
Washington State Board of Health

William "Bill" Marler

CLOSING SESSION BY

William (Bill) Marler, JD
Managing Partner
Marler Clark, The Food Safety Law Firm

Visit us online for the latest information

NEHA.ORG/AEC

Maximize Your Experience

BY JOINING US IN-PERSON

- *Network with your environmental health colleagues over coffee breaks and outdoor networking events*
- *See what new technology and tools are available in the Exhibit Hall*
- *Gain access to educational sessions within all 10 educational tracks*
- *Enjoy the beauty of Spokane with the conference set right on the banks of the Spokane River*

	In- Person	Virtual
Network with leading environmental health professionals	X	
Attend social and networking events	X	
Explore the Exhibit Hall	X	
Preconference offerings	X	
In-person Poster Hall	X	
Enjoy beautiful Spokane	X	
Number of sessions during each time slot	14+	3–4
Three featured sessions	X	X
Virtual Poster Hall	X	X
Access to recorded sessions (available for 6 months)	X	X
Ability to access content anywhere you have an internet connection	X	X

Use this QR code to learn more about what is in store and the precautions we are taking for COVID-19.

NATIONAL ENVIRONMENTAL HEALTH ASSOCIATION

PRESENTING SPONSOR:

HEALTH SPACE

IN MEMORIAM

James Dingman

The National Environmental Health Association (NEHA) was saddened to learn that James (Jim) Dingman passed away January 12, 2022. His passion for and career in environmental health spanned more than four decades and he was a respected and recognized leader in the profession. Beyond the professional impact, however, was the personal impact that he made in many people's lives—bringing joy, humor, friendship, compassion, and big bear hugs to those fortunate enough to have known him.

Dingman was born on February 1, 1954, in Longmont, Colorado. He developed a passion for nature early in life with the dream of becoming a park ranger. That dream led Dingman to attend Colorado State University in Fort Collins, Colorado, where he graduated with a bachelor of science degree in wildlife biology in 1976. He went on to attend graduate school at the University of Denver and earned his master of science degree in biological sciences in 1980. He also married his wife Cheryl in 1980 and they celebrated 41 years together before she passed away in October 2021.

Dingman began his environmental health career in 1982 at Tri-County Health Department in Colorado. He remained there for over 16 years. At the time of his departure, he was an education and enforcement coordinator who was responsible for enforcement actions and hearings against noncompliant establishments, as well as providing educational opportunities for his fellow environmental health staff and employees of facilities regulated by the health department. In 1998, the Dingman family moved from Colorado to Illinois so that he could accept an employment offer from Underwriters Laboratories (UL), Inc. Dingman coordinated regulatory activities for UL's environmental and public health programs, including drinking water additives and system components, food safety, and swimming pool equipment. He also served as the administrator of UL's International Environmental and Public Health Council. Dingman worked at UL for 16 years, departing in 2014 and embarking on a new position in a new state in 2015. The new state was Texas and the new position was environmental health manager at the City of Plano Environmental Health and Sustainability Department, a position Dingman held until his passing. For over 7 years, he was responsible for managing the programs, projects, and staff of the Environmental Health Division.

The scope and span of Dingman's career is impressive, as was the time he found to volunteer for numerous state, professional, and national organizations. His involvement in NEHA began as a member in 1984. He earned his Registered Environmental Health Specialist/Registered Sanitarian credential from NEHA in 1985 and it was in 1994 that he began his service on the NEHA Board of Directors as Region 3 vice-president (from 1994–1998). Dingman was elected and served as a national officer of NEHA from 1999–2004, holding the position of NEHA president from 2002–2003. He then went on to be the NEHA Region 6 vice-president from 2004–2010. In total, he served over 16 years on the NEHA Board of Directors. He also was a peer reviewer for the *Journal of Environmental Health* (*JEH*) and sat on numerous NEHA committees over the years.

Jim Dingman (right) gets into the Western spirit with Keith Krinn (left) at the NEHA 2006 Annual Educational Conference (AEC) & Exhibition held in San Antonio, Texas.

In his first presidential column in the July/August 2002 *JEH*, Dingman acknowledged several colleagues who urged him to become active in NEHA early in his career. He would take up that mantle of his colleagues and become an advocate for involvement in NEHA throughout his career. He was also very wise in acknowledging the "unwavering support and encouragement throughout my years of involvement with NEHA" from Cheryl, his wife. In his final column in the June 2003 *JEH*, Dingman stated, "I can truthfully say that this opportunity to serve the association, the membership, and the profession has been the high point of my career."

Service was central in Dingman's life and he gave freely of his time, energy, knowledge, and passion. In addition to his service with NEHA, Dingman served in leadership roles for the Colorado, Illinois, and Texas Environmental Health Associations, as well as the NEHA Past Presidents Affiliate. More recently, Dingman served as a board member for several different organizations—the Council for the Model Aquatic Health Code (CMAHC), American Academy of Sanitarians (AAS), and National Environmental Health Science and Protection Accreditation Council. He also was the presiding officer for the Texas Registered Sanitarian Advisory Board. In a memorial email, CMAHC leadership called Dingman a "force in the environmental health and aquatics industries."

Dingman received several honors during his career. In 2003 he was awarded the A. Harry Bliss Editor's Award for contributions that advanced the cause and interests of NEHA and the environmental health profession through the *JEH*. He became the fifth person to be awarded Diplomate Laureate status from AAS. Dingman was also awarded the Colorado Environmental Health Association's highest honor, the Milton M. Miller Award,

IN MEMORIAM

Jim Dingman (right) shares his expertise with an attendee during the exhibition at the NEHA 2012 AEC held in San Diego, California.

Always bringing laughter to those around him, Jim Dingman is caught striking a pose after a long NEHA Board of Directors meeting held at the NEHA 2006 AEC.

and received the P.W. Jacoe Memorial Award from the Colorado Public Health Association.

The following quotes from colleagues and friends showcase Dingman's contributions and dedication to environmental health, as well as his spirit and the lasting impact he had on many individuals.

"Jim was one of the greats, a true giant in environmental health. He was such a nice guy, always willing to help. When I first became a member of NEHA and attended my first AEC, I could not believe how much time he spent with me learning my story and sharing his incredible journey so modestly," Dr. D. Gary Brown, NEHA president-elect.

"We lost a good friend, a wonderful colleague, and a great environmental health professional. I enjoyed working with Jim at different levels in the best interest of the profession. We always looked forward to seeing him during our visits to the NEHA AECs where his genuine collegiality, warm friendship, and broad smile were always enjoyed," Dr. Amer El-Ahraf, NEHA past president.

"Jim had a passion beyond measure for the environmental health profession and our fellow practitioners. He especially loved spreading the good word by being an invaluable resource to state affiliates and aspiring professionals. Connecting with Jim at a conference, meeting, or by phone meant reuniting with a friend. He was personable, professional, and giving of his time and expertise. Jim had a magnificent and surefire, yet humble, presence. Over the years, it was a delight to receive updates about his wife Cheryl and adventuresome tales about his grandson. Jim was an environmental health champion and will be dearly missed," Alicia Enriquez Collins, NEHA past president.

"We are saddened with the untimely passing of Jim Dingman, one of our dedicated sanitarians and leaders, especially after the passing of his wife just a couple of months earlier. We have known and loved Jim for so many years. He always was the consummate professional and possessed a great sense of humor. We will miss that. He always led by example and did what he promised he would do," Harry Grenawitzke, NEHA past president.

"I knew Jim long before I worked with him. As a professional, Jim had an enthusiasm for environmental health that was compelling and his presentations were memorable. On a personal level, I will always remember the sparkle in his eyes for cherry pie," Sandra Long, NEHA immediate past-president.

"Jim was dedicated to the environmental health profession. Even in his last years before he was going to retire, he worked hard and with passion. He was a mentor and became a friend to me. He always put others before himself and was always willing to help. I worked under him for almost two years and he cared about me as a person. I miss him daily," Amber Potts, NEHA staff member and former City of Plano employee.

At his request, Dingman's family asks that in lieu of gifts or flowers, donations can be made to the NEHA/AAS Scholarship Fund at www.neha.org/donate.

NEHA extends its deepest sympathies to the family, friends, and colleagues of Jim Dingman. He had a profound impact on the environmental health profession and the people around him. His knowledge and wisdom, willingness to serve the profession, and passion for environmental health will be greatly missed.

Editor's Note: If you would like to share information about the passing of an environmental health professional to be mentioned in a future In Memoriam, please contact Kristen Ruby-Cisneros at kruby@neha.org. The *Journal* will publish the In Memoriam section twice a year in the June and December issues, or in other issues as determined appropriate.

NEHA **NEWS**

NEHA Government Affairs: 2021 Accomplishments and 2022 Goals

By Doug Farquhar, JD (dfarquhar@neha.org)

I've completed my first full year as director of Government Affairs for the National Environmental Health Association (NEHA) and, as such, would like to list the accomplishments of the program in 2021. This work is not only of the program but also of the NEHA Board of Directors, NEHA Policies and Bylaws Committee, the many public health associations NEHA works with, our federal environmental health partners, and the NEHA staff who provided much needed support to make government affairs happen. All of us working together made government affairs work at NEHA.

On behalf of the members of NEHA and the environmental health workforce, NEHA Government Affairs would like to share the following highlights:

- NEHA adopted 12 new policy statements for a total of 18 current policy statements available on the NEHA website at the end of 2021.
- NEHA issued eight new position statements.
- The policy statements gave direction for NEHA to sign-on to 20 letters to Congress and the Biden Administration in 2021.
- The policy statements led to NEHA supporting five congressional bills and one congressional resolution in 2021.
- NEHA got Congress to thank the environmental health workforce via the Congressional Public Health Thank You Resolution (H.R. 62).
- NEHA sent a letter to the White House and Congress regarding the inclusion of the environmental health workforce in the $7.4 billion effort to rebuild the public health workforce.
- NEHA sent 33 testimonials to state legislatures regarding state bills on cottage foods, food freedom, natural disasters, and the importance of credentialing the environmental health workforce.
- Through the fourth annual Hill Day held on April 22, 2021, the NEHA Board of Directors visited 44 congressional offices virtually, meeting with 102 congressional staff and 1 congressperson to support funding for the environmental health workforce and federal environmental health agencies.
- NEHA Government Affairs posted 12 blogs and hosted 3 webinars in 2021 that kept environmental health professionals apprised of public affairs.

The NEHA Government Affairs program had a successful 2021 and we're planning for even more success in 2022, which will provide new challenges in government affairs. Being the foremost association advocating for environmental health, NEHA is in a unique role. Many associations advocate for public health, and several for the environment, but only NEHA advocates for environmental health. NEHA is one of the few associations that advocates at both federal and state levels, especially since almost 95% of funding for environmental health comes from state and local sources.

In 2022, NEHA will remain an active voice before Congress and the White House. Some of the activities the NEHA Government Affairs program plans for in 2022 includes:

- Working with the Congressional Public Health Caucus and NSF International to organize a congressional briefing on food safety for congressional staff.
- Hosting a congressional site visit on food safety through a tour of a Publix Market in Northern Virginia with the office of Representative Rob Wittman (VI-R).
- Holding a Hill Day for the NEHA board in March to promote environmental health and the Food and Drug Administration budget before members of the Congressional Appropriations Committee, as well as highlighting NEHA before congressional appropriators.
- Promoting the Environmental Health Workforce Act (H.R. 2661), Public Health Workforce Loan Forgiveness Program (H.B. 3297), Public Health Infrastructure Save Lives Act (S. 674), and Test Your Well Water Act.
- Tracking and responding to state legislation on the foremost environmental health concerns, including food freedom, environmental health credentialing and licensing, body art, food safety, private wells, septic systems, and threats to environmental health programs.
- Providing states with the Food Code Adoption Toolkit created by the Retail Food Safety Regulatory Association Collaborative to assist in efforts to update state food codes.

These efforts align with the NEHA Strategic Plan to promote environmental health and highlight the profession before policy makers at federal, state, and local levels. Each of these planned events is designed to advance the profession, one that is unknown to many elected officials. The basic elements of the profession—that it protects the public from environmental threats; saves both the public and private sectors from millions of dollars in lost workdays and excess illness; and is a professional, credentialed profession that requires a trained and educated workforce—are unknown to most policy makers. NEHA intends to bring environmental health out of the shadows and the goal of the Government Affairs program in 2022 is to make environmental health important to federal, state, and local officials.

To learn more about the 2021 achievements and 2002 goals, please visit www.neha.org/GA-blog.

NEHA Releases Food Freedom Operations Policy Statement

The NEHA Board of Directors adopted a policy statement related to food freedom operations in January 2022. This action is a first step in raising awareness about the risk of allowing some foods to

be sold without food safety oversight or training, an effort many states and local jurisdictions have been putting in place.

Laws permitting some form of food freedom operations, home-based restaurants, or cottage food operations have been passed in every state. Laws exempting almost every form of regulatory food safety oversight have been enacted in Maine, New Mexico, North Dakota, Utah, and Wyoming. Home-based restaurants, in which an individual prepares and serves a restaurant-style meal in their home to paying customers, are permitted in California.

Unfortunately, with increased popularity of alternative food production and sales operations comes the increased potential for negative health consequences. Data from the National Outbreak Reporting System show that in the decade from 2008–2018, there were 1,225 reported foodborne illness outbreaks, 22,893 illnesses, 2,737 hospitalizations, and 89 deaths attributed to food prepared in private homes and residences. A 2017 study collected swab samples from 100 homes in Pennsylvania and found that 45% of home kitchens tested positive for a foodborne pathogen and 12% had more than one pathogen present, including fecal coliforms and *Staphylococcus aureus*.

"We recognize the value of these operations, particularly as economic opportunities," said NEHA Executive Director David Dyjack, DrPH, CIH. "We're also concerned about the inherent food safety hazards that could arise from these practices and subsequent foodborne illnesses it could cause. That's why it's so important that some food safety standards are incorporated for these alternative operations."

The Food and Drug Administration (FDA) model *Food Code* is a model for ensuring food is unadulterated and honestly presented when offered to the consumer. It represents the best advice for a uniform system that addresses the safety and protection of food offered at retail and in food service. The FDA *Food Code* explicitly states that "food prepared in a private home may not be used or offered for human consumption in a food establishment."

To best protect the public from illness, hospitalization, and even death caused by foodborne illness, the NEHA policy statement on food freedom operations recommends a series of protections that should be in place if the FDA model *Food Code* is not required to be followed. These protections include requiring organizations operating according to food freedom laws, home-based restaurant guidance, and/or cottage food laws to provide prominent labeling of any food prepared and sold, acquire food only from inspected facilities, ensure the water supply used to prepare the food is potable, ensure the operator has liability insurance, provide training for food workers, and practice time/temperature controls and proper handwashing.

Individuals and organizations are encouraged to use the NEHA Policy Statement on Food Freedom Operations to help describe food safety concerns and solutions with local and state decision makers who influence food policy. View the policy at www.neha.org/policy-statements.

NEHA Selects National Registry as Exam Provider for Professional Food Manager Certificate

NEHA announced in March that it is now partnering with the National Registry of Food Safety Professionals (NRFSP) to be the exam provider for the NEHA Professional Food Manager Certificate exam. Certified food managers are an essential part of a food safety culture that keeps customers safe from foodborne illnesses and the Professional Food Manager Certificate assures the knowledge and skills of entry-level food managers. "Our decision to partner with NRFSP was focused on making it as seamless as possible for trainers and proctors," said Rance Baker, NEHA Entrepreneurial Zone director. "We'll be able to offer a one-stop shop for food safety trainers and proctors."

Trainers will be able to order the Professional Food Manager Certificate exams in English, Spanish, Modern and Traditional Chinese, and Korean, as well as the *Professional Food Manager (6th Edition)*, and other training materials from NEHA. To become a proctor with NRFSP, individuals need to complete the NRFSP online Test Administrator/Proctor Training Course and then the proctor application at https://www.nrfsp.com/exam-center/become-a-test-administrator-proctor/administrator-proctor-application. After the NRFSP proctor process is complete, applicants will receive a proctor number and then will be ready to start proctoring the Professional Food Manager Certificate exam.

To receive NEHA Trainer benefits, individuals should include "NEHA" along with their company name in the "Company Name" field of the application. For customer service support with the NRFSP proctor application, individuals should email NRFSP at customerservice@nrfsp.com or call (800) 446-0257.

Professional Food Manager Certification exams, the *Professional Food Manager (6th Edition)*, and other training materials are available in the NEHA Bookstore (www.neha.org/store) or by contacting Trisha Bramwell at tbramwell@neha.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
- LinkedIn: www.linkedin.com/company/national-environmental-health-association

DirecTalk
continued from page 50

None of us really know what burdens and pain our coworkers and the regulated community carry within themselves. While I believe technical and administrative excellence is environmental health excellence, I also believe compassion and empathy are essential to maximum performance. There is abundant evidence in the clinical world that soft, unobjective, nonmedical attributes are effective in improving health and patient well-being.

Let's start with a condition common to most adults, low back pain, which will affect 80% of all humans sometime during their life. Approximately 20% of us will develop chronic low back pain, often resulting in disability. In a recent randomized control trial of people with low back pain, those who received traditional treatment accompanied by a compassionate tone of voice and supportive nonverbal behaviors reported more than double the pain relief of the control group. A meta-analysis of 34 studies of individuals recovering from heart attacks or major surgery revealed that emotional support from healthcare providers showed a positive association in 85% of the beneficial patient outcomes measures. Lastly, a growing body of evidence demonstrates that palliative care and hospice is more humane for individuals with terminal diagnoses such as lung cancer and they live 30% longer than those receiving traditional medical treatment. The science foundation in support of empathy and compassion in clinical practice is growing. Is there something here for us?

I convened our first organizational leadership call just after the first of the year

Permanently disabled commercial diver. Photo courtesy of David Dyjack.

with the plea to our management team to remain committed to acknowledging and improving our common human condition. I encourage you to approach your work in the same spirit. Science, technology, and fidelity to the rule of law are essential. At the same time, remain cognizant of your nonverbal cues, eye contact, tone of voice, and expressions of understanding. Yes, there are some recalcitrant bad actors in the regulated community. I've dealt with my share of them early in my career. On most days, however, I believe most people are trying to do the right things and conduct their business the right ways.

I close with an observation that our national public health enterprise seems to be chronically addicted to and comforted by data, law, informatics, and finance. Where has that gotten us? Many of us seem to have overlooked the value of heart, compassion, and empathy. It's time for us to radically rethink our approach to the art of prevention in the confidence that science has affirmed what we have always known to be true—the spirit and care we bring to work is our greatest hope for each of us and the ones we love to reach full potential as people, businesses, and professionals.

Thank you, Drs. Rudy and Goff. The way you conducted yourselves during my brief visit in 1995 imparted a lifetime impression.

ddyjack@neha.org
Twitter: @DTDyjack

DirecTalk

David Dyjack, DrPH, CIH

Gracias a Dios

"Eww, yuck, awful!" This moment was not my finest as the principal producer of safe drinking water. We were deep in the Río Plátano Biosphere Reserve in Honduras, surrounded by magnificent and ancient cedars, mahogany, and laurel. I was the self-appointed leader of the water committee and while a village standpipe produced clear water, I was uncertain to the quality. With the health and well-being of two dozen students and faculty to consider, option A seemed logical: treat each gallon of water with 8 drops of unscented 5.25% sodium hypochlorite regular strength bleach, mix vigorously, wait 20 minutes, and open the container lid to aerate. I prayed no one would notice the residual chlorine. Fat chance. This infamous concoction would go on to gain notoriety as the Dyjack Cocktail.

While this tale of aqueous woe occurred almost 30 years ago, I can recall much of it with clarity. We chartered a Mission Aviation Fellowship flight from San Pedro Sula on the Honduran coast to visit the inland Clínica Evangélica Morava, aka the Ahuas Clinic. This missionary hospital serves the La Mosquitia region of Honduras, which at that time was accessible only by plane. The two primary physicians in residence were Drs. Gerard Rudy and Norvelle Goff. We hear much about servant leadership in professional development circles and here they were in the flesh. What immediately struck me about Dr. Rudy was his University of Michigan baseball cap and unpretentious manner. Not long after we arrived, I found him hunched over a ham radio receiving guidance from the U.S. on how to perform a complex surgery. Dr. Rudy possessed a medical degree from one of the most recognizable institutions in the world and his patients had probably never heard of Maize and Blue.

I also believe compassion and empathy are essential to maximum performance.

The humility of Drs. Rudy and Goff was striking as we toured their clinic, equipped with—to my surprise—a decompression chamber. Decompression sickness is an occupational health problem in the Mosquito Coast. This medical condition is caused by dissolved nitrogen emerging from body tissues during abrupt scuba diving ascents. Arterial and cerebral embolisms, among other serious health effects, are undesirable outcomes. Divers can become permanently paralyzed, or in severe cases, die. The benefit of a decompression chamber in the jungle of Honduras becomes evident as you learn more about the region.

A 2004 report from the Pan American Health Organization estimated 9,000 divers practiced underwater lobster fishing at that time. Among these divers, 97% had some degree of decompression syndrome and at least 4,200 Miskito people were diagnosed with total or partial occupational disability. The Association of Disabled Honduran Miskitos Divers has reported that around 400 divers have died from work-related illnesses. As we traveled on the Río Patuca by dugout canoe, crippled young men or others propped up on canes seemed to be everywhere. What lures these individuals to engage in such risky behavior?

Honduras is a major producer of Caribbean spiny lobsters, second only to Nicaragua. The destination for those lobsters? The dinner plates of people in the U.S. Regretfully, a powerful combination of poverty and desperation lead to young people who risk their lives and futures to scavenge for these pricey crustaceans. As a diver myself, the dilemma of the Central American commercial lobster industry resonated with me on a personal level.

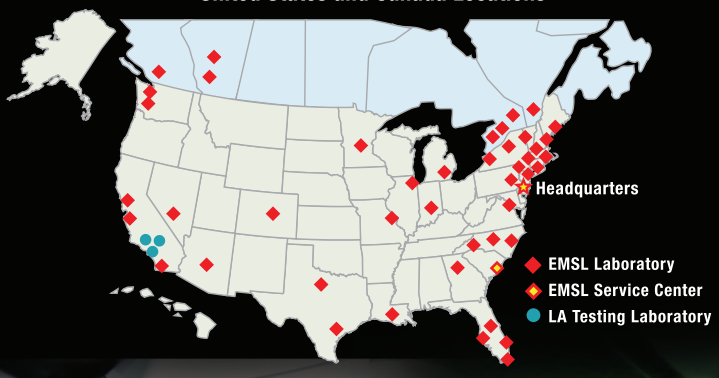
Those of us in public health seem to possess a chromosome that predispose us for caring, even for those people that are not members of our immediate social or professional circles. My admiration for Drs. Rudy and Goff and their team grew measurably in parallel with my understanding of what might drive individuals from Central America to embark on a precarious and dangerous journey north to the U.S. in search of better lives. What can we learn from these medical and public health missionaries, and does science support the notion that compassion and empathy matter when working in health sciences?

continued on page 49

LABORATORY TESTING SERVICES

- ☑ **WATER QUALITY TESTING:** *E. Coli, Fecal Coliforms, Total Coliforms & More*
- ☑ **FOOD SAFETY TESTING:** *Salmonella, Listeria, Pathogens*
- ☑ **LEGIONELLA TESTING:** *CDC Elite Certified Labs*
- ☑ **LEAD & METALS TESTING:** *Air, Water, Soil, Dust, Paint Chips*
- ☑ **ENVIRONMENTAL TESTING:** *VOC's, PCB's, PFAS, TCLP*
- ☑ **INDOOR AIR QUALITY TESTING:** *Formaldehyde, Particulates & More*
- ☑ **MOLD TESTING:** *Spore Traps, Tape Lifts, Swabs, ERMI, Culture Plates*
- ☑ **ASBESTOS TESTING:** *TEM, PLM, PCM, SEM, XRD*
- ☑ **SILICA TESTING:** *Crystalline Silica & Amorphous Silica ID*
- ☑ **FIRE & SMOKE TESTING:** *Soot, Char, Ash, Cigarette & Marijuana Smoke*

United States and Canada Locations



EMSL℠

EMSL ANALYTICAL, INC.

TESTING LABS • PRODUCTS • TRAINING

www.EMSL.com

Sampling supplies available!

West Coast
866.798.1089

East Coast
800.220.3675

700,000
PERSON DAYS SAVED!

When The Pandemic Hit - Health Departments Immediately Became The Front Lines.

HealthSpace *delivered the nation's first fully automated contact tracing and surveillance tool, saving the state of Hawaii - according to their own numbers -* ***700,000*** *person days of contact tracing!*

Does Your Current Software Provider Go All In To Support Your Agency This Way?

HEALTHSPACE

Scan to visit
gethealthspace.com

Contact Robin Loughran today to schedule a demo or to answer any questions you might have.

980-375-6060

Robin.Loughran@hscloudsuite.com

HealthSpace is proud to be the presenting sponsor of NEHA 2022 AEC