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# Environmental Health

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Volume 79, No. 7 March 2017

## ABOUT THE COVER



Past and recent foodborne illness outbreaks continue to illustrate the difficulties in determining when to go public with food safety information about potential

public health risks. Health authorities suggest that how and when public information is released is evaluated on a case-by-case basis, but no common blueprint or playbook exists on how to evaluate each case to make these important decisions. This month's feature article provides a review of risk communication literature related to outbreaks, explores case studies of actual incidences, and provides a blueprint for health authorities to follow.

See page 8.

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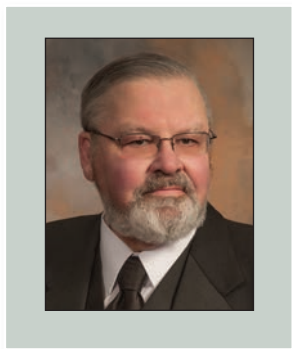


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## ► PRESIDENT'S MESSAGE



David E. Riggs,  
MS, REHS/RS

## The Generational Bridge

As I reviewed the literature used for my last two *Journal* columns, I noticed that Generation X, or Gen X, is sometimes overlooked as an integral and vital part of the environmental health profession. Before I talk about Gen X as a resource for our profession, let me give you some general information about the generation.

While the usual defined boundaries of Gen X are a little hazy around the edges, generations are not only defined by temporal boundaries but also, and arguably more importantly, by the changes and influences of a rapidly evolving society. There are several different dates used to define Gen X. The Pew Research Center uses a range of people born between 1965 and 1980, resulting in a generation that is between the ages of 36 and 52. There are approximately 65 million Gen Xers in the U.S. compared with approximately 77 million baby boomers and 83 million Millennials. Gen X makes up about one fifth (20%) of the U.S. population and 30% of the U.S. workforce. Approximately 65% of Gen X is employed full time and many are self-employed. Gen Xers believe they will work longer and retire later, and expect their standard of living to decrease in retirement.

Gen Xers grew up in a time of shifting societal values, such as both parents holding jobs and increased divorce rates. They had less parental supervision than previous generations, which is why they are also referred to as the "Latchkey Generation." They grew up in a time of great technological advancement. The Internet did not exist when they were growing up, yet as a generation, they have adapted readily to technological changes.

*The key to a  
successful and  
productive workplace  
is to address and  
take advantage of  
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generational  
mindsets, values,  
and expectations.*

Gen Xers are described as independent, resourceful, self-managing, cynical, pragmatic, and skeptical of authority.

Gen Xers value work place flexibility as one of the top benefits offered by an employer. They are more likely to walk away from their current job if flexibility is absent. Furthermore, the balance between work and life is very important. They are at a midpoint in their careers where their needs are not only work related but also focus on a balance between career, family, and social and charitable endeavors.

Now to the point of this column. Environmental health professionals are grappling with generational differences in their agencies and businesses. Sometimes problems and conflicts can arise from different values, work ethics, and communication styles. The profes-

sional conflicts can be exaggerated by new and evolving technology, evolving work patterns, and new or modified environmental health practices and programs. The key to a successful and productive workplace is to address and take advantage of the differences in generational mindsets, values, and expectations.

Summarizing the general workforce based upon stereotypes, one might say that baby boomers feel they have "paid their dues," Gen Xers are skeptical and independent, and Millennials seek group action and team work. We must be careful to **not** categorize environmental health professionals using broad generational stereotypes. Though each of us is part of a certain generation, we might not represent any (or even all) of the traits attributed to that generation.

We are used to reading and listening to articles, essays, and presentations on how to retain baby boomers and recruit and retain Millennials. Gen Xers are, however, typically forgotten or taken for granted since they are in the middle of their careers, occupying midlevel positions and possessing seasoned knowledge and experiences. The focus with Gen X should be on how we can build up that generation to lead our profession into the future.

Send your Gen Xers to career, technical, management, and interpersonal training. They may be seasoned but they appreciate continuing education and training opportunities. It is important to them to keep abreast of technical, social, political, and economic changes. It is important for Gen Xers to have the chance to improve and expand their profession knowledge.

Regular educational and training opportunities, as well as career advice, will keep all generations of environmental health practitioners interested and engaged. It is also important to accommodate different learning styles and mindsets. Baby boomers might appreciate more static tools like PowerPoint presentations while Gen Xers and Millennials might appreciate more technology-based interactive ways of learning. The overall goal should be to provide training, support, and advancement for all the generations in our workforce.

Facilitate mentoring between generational environmental health professionals. Millennials may seek the experience and knowledge from Gen Xers. On the other hand, the baby boomers can import their leadership, institutional history, and political and economic backgrounds that influence present day decisions and trends. Gen Xers and baby boomers should learn to appreciate the fresh perspectives from Millennials.

Junk the old routines and open up the workplace. Much of the current literature suggests that Gen Xers, as well as Millenni-

als, dislike formal routine meetings especially when there is no need to meet and with little or nothing to discuss. It is necessary for the needs, knowledge, experiences, and mindsets of all three generations to work harmoniously and productively.

We can't, however, just focus on the current generations as another generation is soon to enter the workforce—Generation Z. Generation Z is generally defined as people born between 1996 and 2010. With some of this generation now their teens, we can expect them to enter the environmental health workforce in less than a decade. Experts think the differences in mindset, behavior, and expectation of this generation may be as different as that between baby boomers and Millennials.

One last note is on communication. We all have preferred ways of communication, whether it follows generational conventions or not (e.g., baby boomers prefer to communicate in person or on the phone, Gen Xers prefer e-mail, and Millennials prefer constant communication through texting, instant messages, and social media). The

form of communication should not matter as we need to be open to all types of communication in the workforce.

Overall, it is important to foster a work environment that encourages and promotes a forum for all generations to present ideas, concerns, and complaints. We all possess different strengths and it is our duty to promote those strengths. For example, Gen Xers, who are more likely to be skeptical and independent minded, can be the professional, technical, and political bridges between baby boomers and Millennials.

This often-overlooked generation, Gen X, has contributed to the environmental health profession for years. Even though they are sandwiched between two dominant generations and are fewer in number, Gen X is a rising power in the workforce and society. We need to invest in this subset of our profession and foster their growth as leaders for now and the future 🐼

*David E. Riggs*

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## ► SPECIAL REPORT



# Going Public: Early Disclosure of Food Risks for the Benefit of Public Health

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**Abstract** Often during an outbreak of foodborne illness, there are health officials who have data indicating that there is a risk prior to notifying the public. During the lag period between the first public health signal and some release of public information, there are decision makers who are weighing evidence with the impacts of going public. Multiple agencies and analysts have lamented that there is not a common playbook or decision tree for how public health agencies determine what information to release and when. Regularly, health authorities suggest that how and when public information is released is evaluated on a case-by-case basis without sharing the steps and criteria used to make decisions. Information provision on its own is not enough. Risk communication, to be effective and grounded in behavior theory, should provide control measure options for risk management decisions. There is no indication in the literature that consumers benefit from paternalistic protection decisions to guard against information overload. A review of the risk communication literature related to outbreaks, as well as case studies of actual incidents, are explored and a blueprint for health authorities to follow is provided.

## Introduction

On June 2, 2008, the Centers for Disease Control and Prevention (CDC) announced its investigation of an ongoing multistate outbreak of human *Salmonella* serotype Saintpaul infections. CDC identified the consumption of raw tomatoes as the likely source of the illnesses in at least two states and a public advisory was issued (CDC, 2008). By the time the outbreak was officially declared over on August 28, 2008, 1,442 people had been reported infected, at least 286 people had been hospitalized, and the infection might have contributed to 2 deaths.

Despite the early identification of tomatoes as a potential pathogen source, jalapeño peppers were subsequently identified as the major source, with some implication of serrano peppers as well (Behraves et al., 2011; Jungk et al., 2008). Was the public advisory to avoid raw tomatoes issued too early in the outbreak investigation, despite its intent as a control measure? Some, including the Florida Tomato Committee, may believe so, considering the outcome of the investigation: the estimated economic cost to the tomato industry was more than \$600 million in Florida and close to \$100 million in Georgia (Beach, 2013).

This outbreak is one of many examples that could be used to illustrate the difficulties in determining when to go public with food safety information about potential public health risks. In a 1999 news article about a *Listeria monocytogenes* outbreak, CDC foodborne illness epidemiologist Paul Mead summed up the conundrum that health officials face when reviewing preliminary data during an outbreak investigation: "Food safety recalls are always either too early or too late. If you're right, it's always too late. If you're wrong, it's always too early." Go public too early, and make a mistake, and a corporation or industry's reputation could unduly suffer. Go public too late, and individuals and businesses can be denied critical information they could use to protect public health.

Contributing to the difficulties is the lack of guidelines for health officials and the food industry on when to go public with risk information. Providing timely information is good risk communication practice. How to determine what is timely is often unclear. Each investigation is unique, nonlinear, and dynamic—and can involve a number of different organizations and various government departments (Health Canada, 2011). Communication with the public about risks, however, plays an important role in disease prevention (Liang & Scammon, 2011).

In 2012, the U.S. Government Accountability Office (GAO) identified weaknesses in the Food and Drug Administration's (FDA) food advisory and recall process. According to the GAO report, FDA officials indicated that they use professional experience to look for a tipping point, defined as



the time when evidence collected is sufficient to allow the agency to provide consumers with information that will help them avoid unsafe food (GAO, 2012). Without predetermined guidelines, determining the right time to provide the public with information becomes a subjective, rather than an objective, decision.

FDA is not alone in its lack of clarity on when to go public with food risk information. Dr. David Williams, Ontario's chief medical officer of health during the time of a 2008 *Listeria monocytogenes* outbreak linked to Maple Leaf deli meats, stated that to wait until one has evidence beyond doubt "is often too late to protect the public." Dr. David McKeown, Toronto's public health medical officer during that time, remarked that the Canadian Food Inspection Agency often waits for conclusive evidence that a specific product is responsible for documented human illness before taking action (Parliament of Canada, 2009).

The intent of this special report is to contribute to the discourse on public risk communication related to foodborne hazards, and to argue for the establishment of guidelines for determining what is timely, the information content of going-public messages, and to aid public health entities in protecting consumers' health.

## Role of Risk Communication in Mitigating Foodborne Illness

Risk communication is an integral component of risk governance. Risk governance is based on principles of cooperation, participation, mitigation, and sustainability—and demands an approach that is guided by resilience, as well as knowledge management and exchange (Sellke & Renn, 2010). Information provision on its own is not enough. Risk communication should provide individuals with all the insights they need in order to make decisions or judgments that reflect the best available knowledge and their own preferences (Renn, 2009).

Communicators should explain what the responsible institutions and other relevant food chain actors are doing to identify, prevent, and mitigate food-related risks, as well as provide information on what self-protection strategies consumers can undertake (Cope et al., 2010). A national consumer survey conducted by Hallman and colleagues

(2009) demonstrated that while the public values recall information, much of what is presented is either confusing (resulting in incorrect actions) or not heeded (because of optimistic bias).

To support consumer decision making, available information must support what consumers want and need to know, which might or might not be what information authorities want to relay (Harro-Loit, Viha-lemm, & Ugur, 2012). Using a combination of qualitative and quantitative methods, Cope and coauthors (2010) suggest experts perceived consumers as unable to conceptualize implications of risk and uncertainties of risk assessment, while the consumers' perception was that institutions with responsibility for consumer protection deliberately masked the uncertainty associated with risk in order to protect vested and economic interests.

Trust is a key tenet of risk communication. Organizations can use open, transparent information and dialogue to build and sustain public trust. Communication begins even before a single word is said; the very willingness to engage in dialogue can set a foundation for building trust (Fischhoff, 1995). Yet public trust can be undermined by failures in the public's belief in the competence and knowledge of authorities, their fairness and honesty, and their ability to communicate scientific information in a meaningful way (Abraham, 2011; Renn, 2009). Vos and coauthors (2011) noted that authorities often keep silent about a risk in an attempt to avoid raising public concern and generating panic. Accurate, extensive, and timely information is more likely to reduce anxiety, however, and to activate people in self-efficacy and protective measures. Funk and coauthors (2009) have shown that disease transmission risk management decisions are dependent on the quality of the information available and that the tendency to act is reduced with decreasing quality of information. The literature indicates that trust, timeliness, and the quality of information provided when going public are all factors in a consumer's likelihood to act.

## Defining Timely

The literature on what timely communication means or how it is measured is vague. The U.S. Department of Health and Human Services (HHS), the principal agency for

protecting the health of people in the U.S., reported that it "values the free exchange of ideas, data, and information, and doing so in a manner that is timely, responsive, and accurate" (HHS, 2017). The risk communication guidelines published by the European Food Safety Authority (EFSA) defined timely communication as "published as soon as practical" with respect to the release of risk assessment and related communications that may inform public decision making (EFSA, 2012). Other descriptions of timely communications have incorporated a sense of urgency in their descriptions. For example, FDA's guidelines for industry call for the prompt issue of a press release in a situation where the product could pose a significant health hazard and the recalled product is in the hands of consumers (FDA, 2003).

Likewise, CDC has recognized that people want information immediately at the onset of a crisis. In 2002, CDC developed and adopted the integrative model of crisis and emergency risk communication (CERC). CERC provides six guiding principles for institutions or groups with official crisis response roles: be first, be right, be credible, express empathy, promote action, and show respect. The first of these—be first—acknowledges the importance of communicating information quickly; for the public, the first source of information often becomes the preferred source (CDC, 2016). This guiding principle of be first is not as explicit, however, as the response timelines of the U.S. Federal Emergency Management Agency (FEMA) that target the provision of response-level operational communications in high-risk urban areas within 1 hour of an incident (FEMA, 2012).

Every outbreak and incident is unique, and any guidelines used to determine when to go public should be sufficiently flexible to adapt risk communications protocols on a case-by-case basis, while still providing sufficient structure to allow objective evaluation. Chess and coauthors (1988) argued that the early release of information sets the pace for resolution of the problem, protects an organization and authorities against loss of credibility and trust, allows for better control of the accuracy of information, and provides people with information that affects their lives. They cautioned that communities find it difficult to accept any justification for withholding information when health risks are involved,

regardless of the risks. Generic guidelines for the release of information were suggested (Table 1).

## Arguments Against Timely Disclosure of Risks

### Protecting the Public From Information Overload

In March 2009, *The Globe and Mail* newspaper reported on an investigation by the Polaris Institute into bottled water use in Canada and the number of recalls of the product that had been issued by the Canadian government. Of the 49 recalled products, the Polaris Institute was only able to find public warnings issued for seven of the recalls. Garfield Balsom, a food safety and recall specialist at the Canadian Food Inspection Agency, stated that there are no hard-and-fast rules on what requires public notification (Mittelstaedt, 2009).

There is no indication in the literature that consumers benefit from paternalistic protection decisions to guard against information overload. Good risk communication practice is to be open and transparent; withholding information, for whatever seemingly logical reason, denies consumers the opportunity to take measures to protect their health. The information might eventually leak out anyway, thereby undermining an organization's credibility (Chess, Hance, & Sandman, 1988).

### Unintended Consequences

On June 12, 1996, the Ministry of Health in Ontario, Canada, issued a public health advisory on the presumed link between consumption of California strawberries and an outbreak of diarrheal illness among some 40 people in the metropolitan Toronto area. The announcement followed a similar statement from the Department of Health and Human Services in Houston, Texas, which was investigating a cluster of 18 cases of *Cyclospora* illness among oil executives. By choosing to go public about a presumptive source during the early stages of the outbreak investigation, health officials took a proactive measure in the interest of public health. Two outcomes were possible: if it turned out that strawberries were implicated, the ministry made a smart decision, warning people against something that could hurt them. If the strawberries were not implicated, then the ministry made a bad decision, with the result that strawberry

TABLE 1

### Guidelines for Releasing Information and Decision Making

Guiding Principle	Approach
Evaluate risk	If people are at risk, do not wait to communicate in order to protect public health.
Trust	Consider the impact of delaying communications on the credibility of the organization.
Transparency	Consider publicizing investigations of potential risks that are underway and explain how and why the investigation is being carried out.
	If the decision is made to delay information, explain why in a forthright way. Don't merely remain silent.
	Release information yourself before it is leaked by media or someone else.
	Speak first about an ongoing story to avoid others filling in the information gaps.
Uncertainty	If you don't trust your data, talk to the public about your procedures without releasing the data.
	If preliminary results show a problem—and you are fairly confident of the results—release them and explain the uncertainties in the data.
	Release information while risk management options are tentative rather than waiting to develop solutions.
Note. Adapted from Chess, Hance, & Sandman, 1988.	

growers and sellers lost money and people stopped eating something that was good for them. By the end of August 1996, 1,465 cases of cyclosporiasis had been reported in North America, and traceback investigations had identified Guatemalan raspberries as the source of the pathogen (Manuel et al., 2000; Powell, 2011).

The limited research that has been carried out to assess the impacts of proactive measures to deal with defective products has yielded mixed results. Siomkos (1999) reported that consumers appreciate the recall of an unsafe product if the recall is decided spontaneously by the company and not imposed by national authorities. Companies that go further, taking aggressive action to recall the harmful product immediately—informing customers about what to do with the harmful product and being in constant contact with them—will rapidly recapture lost business (market) share. Claeys and coauthor (2012) called this form of proactive self-disclosure of a crisis “stealing thunder,” and found that it can be effective in minimizing crisis damage and maintaining the organization's credibility.

Conversely, Chen and coauthors (2009) determined that, regardless of the company or product characteristics, proactive recall

strategies had a more negative effect on company value than more passive recall strategies because stock markets interpret a proactive strategy as a signal that the potential harm from the defective product is severe. Ulmer and coauthor (2000) demonstrated that the strategic ambiguity employed by Jack in the Box's corporate leaders in their crisis communications during their 1993 *E. coli* outbreak benefited their financial stakeholders over other audiences.

### Consumer Misinterpretation or Lack of Understanding

Successful risk communication occurs when there is mutual learning, where the gap in knowledge between the information sender and receiver is minimal (Shaw, Takeuchi, Matsuura, & Saito, 2012). The information receiver uses common sense mechanisms to process the information and draw inferences, which is important for establishing risk perceptions (Renn, 2009). According to Andrews (2011), misconceptions about the public's lack of interest or understanding of warnings and disclosures are common. If efforts are made, however, to accommodate audience characteristics, prior beliefs, message content, and proper delivery modes, warnings and disclosures can be effective communication tools

and remedies for consumer and public health policy (Andrews, 2011).

Simply providing the data on potential risks is never enough. Putting out numerical or scientific information without appropriately framing the message and providing adequate explanation often leads to public confusion. Lofstedt and coauthors (2012) provided the example of medical data released through the FDA Adverse Event Reporting System (FAERS). FAERS is a database that contains information on adverse event and medication error reports submitted to FDA. As a database, FAERS is designed to simply offer data. As a consequence, more than 25% of U.S. adults surveyed by the researchers indicated that they would stop taking their medication outright if it were posted on FAERS, and almost half would not know what to do. Lofstedt and coauthors (2012) advocated for the incorporation of sound risk communication strategies by FDA into its transparency efforts in order to communicate risks properly.

### The Challenge of New Media

The Internet has erased the formal distinction between communicator and audience; there has been a shift in the balance of power related to voice. In traditional media, government or industry had greater control over how their message was prepared and conveyed, and who received it. Blogs and other platforms that support user-generated content such as YouTube, Facebook, and Twitter have created a conversation space where anyone can participate and the distinction between expert and layperson is erased (Abraham, 2011; Reynolds, 2011).

Effective communication about risks remains important; the advent of the Internet and new media simply shorten timelines dramatically. Kasperson and coauthors (1988) first formalized the theory of the social amplification of risk, which helped explain why minor technical risks become major public risks. New media accelerates the speed at which this shift can take place. Organizations that are not nimble in sharing information will lose their place in the dialogue and may be usurped by others who do not have the public's best interest in mind (Reynolds, 2011).

### Examples/Case Studies

In 2008, an investigation of a cluster of *E. coli* O157:H7 infections in California pointed to a

single restaurant as the source (Marler, 2012a). The investigation led to linked illnesses in other states, causing investigators to suspect a common contaminated ingredient. Later, the same strain was found in an outbreak in Canada, where a traceback investigation led to lettuce as the source, which had also been supplied to the unnamed restaurants in California. Dr. Robert Tauxe, CDC's deputy director of the Division of Foodborne, Waterborne, and Environmental Diseases, defended the practice of not naming a company's identity, saying it protects the public's health and the businesses that could be hurt by bad publicity (Marler, 2012b; Powell, 2012). He argued that "the longstanding policy is we publicly identify a company only when people can use that information to take specific action to protect their health. On the other hand, if there's not an important public health reason to use the name publicly, CDC doesn't use the name publicly" (Marler, 2012b; Powell, 2012). It is not clear, however, what standards are considered to determine what is defined as an "important public health reason," and why some identities are revealed and some are not. Tauxe acknowledged the lack of written policy and said it's a "case-by-case thing" (Marler, 2012b; Powell, 2012).

An *E. coli* outbreak investigation involving romaine lettuce in 2011 also failed to disclose the identity of the responsible grower and distributors (Beach, 2012). FDA press officer Sebastian Cianci acknowledged they knew the farm from where the lettuce originated but didn't want to implicate a specific member in the supply chain when they weren't sure at what point the produce was contaminated (Beach, 2012). Many of the affected people reported eating from Schnucks salad bars, leading Schnucks stores to voluntarily pull romaine lettuce from their salad bars (PRWeb, 2012). By the end of the year Schnucks acknowledged they were "Chain A" mentioned in CDC reports, but they refused to name their lettuce supplier. The final CDC report issued in 2012, however, updated the number of cases and repeated previous statements, but still did not name the company involved (CDC, 2012; PRWeb, 2012).

In May 2012, the South Carolina Department of Health and Environmental Control (DHEC) refused to name a restaurant linked to an ongoing *E. coli* outbreak. Even though they sent an advisory regarding the outbreak

to physicians, they did not alert the public ("DHEC Had No Business," 2012). People used social media to demonstrate their frustration and demanded to know the name of the restaurant, posting statements such as, "I smell some hush hush money so the name doesn't get in the public! Like others, I love Mexican food but not at the risk of my health. And if it's so safe, why not release the name? Other Mexican restaurants may suffer loss of business because of this, including this restaurant!" (Chapman, 2012). After approximately a week, the name of the restaurant was released, only after the El Mexicano restaurant allowed the agency to release its name, raising questions as to the priorities of DHEC ("DHEC Had No Business," 2012). DHEC assured the public that the restaurant was safe to eat at once again.

Evensen and coauthors (2012) documented an example of candor and openness in information provision that shifted public perception of the risk in question towards an improved understanding of the risk and its potential impact on human health. The authors described local residents' anxiety about the sudden deaths of nearly 3,000 birds and countless fish in Sleeping Bear Dunes National Lakeshore, Michigan, in 2006. People's anxiety was eased by scientists sharing their knowledge about type E botulism in wildlife. The public's concerns were addressed by information through multiple methods, including local newspaper coverage and public presentations by local experts. Communication by officials was immediate and direct, which helped to maintain public trust. Members of the public cited increased knowledge about botulism, its causes, and its effects, which helped to shift their concerns away from human and pet health toward an understanding of botulism in wildlife and the effect on environmental well-being.

### Conclusion: A Blueprint for When to Go Public and What to Say

If foodborne outbreaks are not being publicly disclosed, or are not disclosed in a timely manner, how will people become aware that there are problems? Communication about foodborne risks allows the public to make informed decisions about what they choose to eat. Acquiring risk knowledge also allows the public to build risk literacy—the ability

to access, analyze, evaluate, and recommunicate information—that can facilitate efficient public risk communication when a crisis arises (Harro-Loit et al., 2012).

Public health officials have a challenging job: it can be difficult to discern true signals about an emerging risk from random noise. But establishing some ground rules—and publicizing those rules—would help build public trust. Past risk communication research has demonstrated that if people have confidence in the decision-making process, they will have more confidence in the decision. People might not agree about when to go public, but if the assumptions are laid on the table, and value judgments are acknowledged, then maybe the focus can be on fewer sick people.

Choo (2009) suggests that, in theory, a rational decision threshold could be set based on threat probability and a cost-benefit analysis of false alarms and actual occurrence. In practice, however, economic, political, and social forces—as well as by individuals, groups, and institutions that act according to their beliefs, values, and interests—influence when to go public.

We propose that communicators and public health organizations develop guidelines for public disclosure of risks based on the questions in Table 2. Clear, accurate, and timely communication with the public is an important public health function, and such communication becomes especially critical during public health emergencies. Communication is important for educating the public about steps that individuals can take to reduce the spread of infectious disease and to protect themselves.

TABLE 2

**Questions for Public Health Agencies to Address When Communicating a Risk to the Public**

Address the Question	Questions
Externally	Who is at risk? How many people are at risk? Are vulnerable populations at risk?
	What is the nature of the risk? Is it acute risk or a long-term risk?
	Is there a potential for fatalities?
	Is the public already aware of the risk?
	When did you find out about the problem?
	What is known about the source of the issue currently?
	What is being done by the agency to investigate what is known?
	What is your role or your organization's role in handling the risk?
Internally	Are there security concerns that complicate the public's right to know?
	Will the risk be socially amplified or attenuated by the media?
	How will social media be used? Is it a tool for the agency to engage with the affected population/public?
	Is risk information being communicated by someone who is perceived as trustworthy?
	Is the information being communicated in a high-trust or low-trust environment?
<i>Note.</i> Adapted from Chess, Hance, & Sandman, 1988; Lofstedt, Boudier, & Chakraborty, 2010; and Youngblood, 2012.	

Not naming the source of an outbreak or giving recall information too late affects the public's trust in agencies. Furthermore, when the agencies themselves do not have a standard procedure regarding when to name or not name implicated firms in an outbreak, it seems as though the agencies' priority is the firm and not public health. 🐷

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## ► SPECIAL REPORT

# Food Safety Program Performance Assessment in Tennessee, 2003–2011

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**Abstract** To assess food safety program performance, the Tennessee Department of Health conducted food service surveys of randomly selected establishments and reviewed routine inspection reports by environmental health specialists (EHSs) of the same facilities. The individual restaurant sanitation scores, along with types and frequencies of violations noted by the survey team, were compared with records from the previous year. In addition, EHSs were observed as they each performed two routine inspections. Survey team staff consistently marked more critical violations than did field EHS staff. Differences between survey teams and field EHS staff in marking critical violations were statistically significant for all 10 critical violations in the first review cycle, 8 in the second cycle, and 7 in the third cycle. Over the course of the review period, there was a small but measurable improvement in scoring by field EHS staff. Marking of critical violations increased, sanitation scores decreased, and discrepancies with survey teams in both areas decreased.

## Introduction

Ensuring food safety is a core responsibility of state and local health departments. Restaurant inspection is a prominent part of that responsibility. Regulatory inspections are based on guidance established by the Food and Drug Administration's (FDA) *Food Code*, which provides a set of criteria for evaluating and correcting foodborne illness risk factors (U.S. Department of Health and Human Services, 2008).

Inspection practices can vary considerably across jurisdictions; therefore, Tennessee and other states undergo a process of standardization and certification developed by FDA for retail food safety inspectors. The

FDA standardization process provides retail food inspectors the opportunity to subject their knowledge and skills related to the *Food Code*'s provisions to a uniform system of measurement. The process and criteria for demonstrating proficiency in the required performance areas are described in the FDA Procedures for Standardization of Retail Food Safety Inspection Personnel (Food and Drug Administration [FDA], 2015).

Within the Tennessee Department of Health, the Environmental Health (TDH-EH) program is responsible for the inspection of food service establishments (with the exception of operations in convenience and grocery stores, which are regulated by

the Tennessee Department of Agriculture). Environmental health specialists (EHSs) from county health departments perform restaurant inspections. EHSs are employed either by the state or by a county under contract with the state and therefore work within the policies and standardized procedures of the TDH-EH program. In Tennessee, some 150 EHSs inspect approximately 27,000 food service establishments. Additionally, EHSs are responsible for inspecting public swimming pools, correctional facilities, organized camps, hotels, bed and breakfast establishments, child care centers, and tattoo and body piercing shops, with food inspections making up just over half of their workload. EHSs work directly with food service operators to achieve safe and sanitary food handling practices through inspections, training, and enforcement of food service rules and regulations.

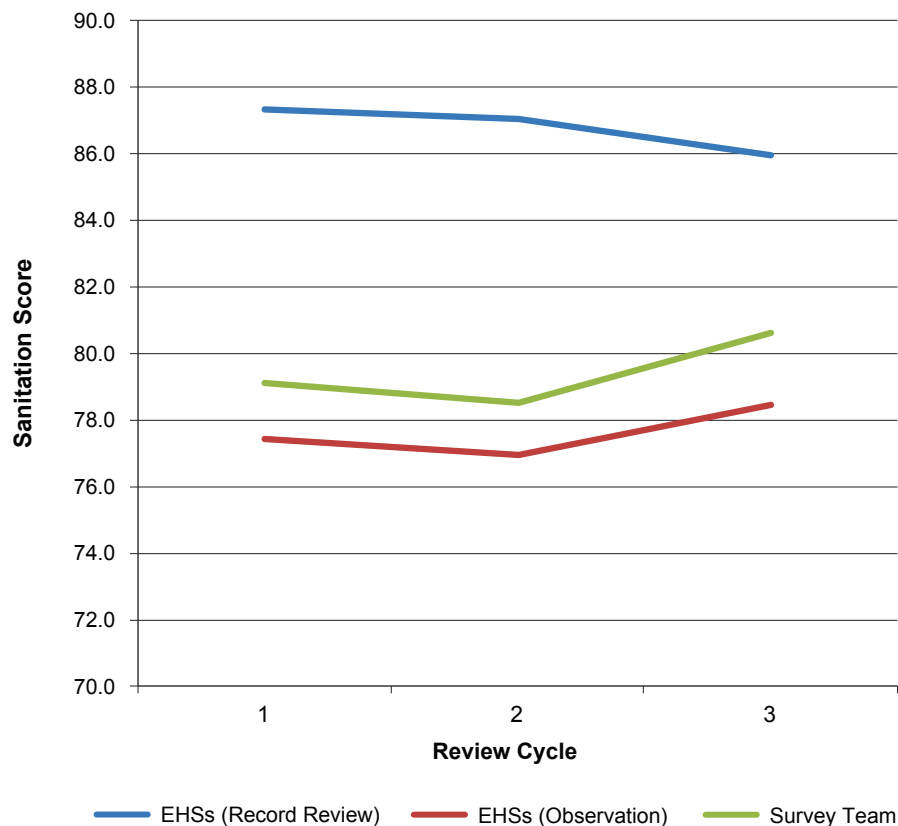
The 95 county health departments within Tennessee comprise eight regions, each coordinated by a regional field office, and include five counties under contract with the state. For the purposes of this special report, the contract counties will be considered regions.

The Hotel, Food Service Establishment, and Public Swimming Pool Inspection Act of 1985 established authority for TDH to create rules to regulate food service establishments, issue permits, and perform inspections (Tenn. Code Ann., 2014). The law specifies that TDH may enter into agreements with county health departments for implementation of these activities, provided the county health department program standards are identical to those of the state law and TDH rules. Prior to 2015, Tennessee's law, and therefore



FIGURE 1

### Mean Sanitation Scores Assigned by Survey Teams and Environmental Health Specialists (EHSs)



food inspections and standardization, were based on FDA's 1976 *Food Service Sanitation Manual*. Under those rules, establishments that prepare and serve food and beverages were each inspected twice a year, or more often as deemed necessary to ensure compliance. Food inspections were composed of 44 inspection categories or items. The 13 critical violations were each weighted more heavily than the 31 noncritical violations, for a total of 100 points (Table 1).

For quality assurance and program improvement, and in accordance with the FDA's procedures for standardization, TDH-EH conducted regular reviews over a 9-year period (2003–2011) of the EHSs' compliance with state law, regulations, program standards, and policies. Data were analyzed to assess any changes in the performance of inspections during the review period.

### Methods

A survey team was formed, utilizing all levels of TDH-EH field staff (EHSs, supervisors, and managers), as well as TDH-EH central office staff. Survey team members were primarily veteran staff and were given standardized training by the program manager prior to their participation in surveys. Some turnover of survey team members and EHS staff occurred during the period of analysis; the percentage of turnover was not tracked. Each region underwent a review every 3 years.

A random sample of approximately 70 food service establishments that serve potentially hazardous food was selected from the region. This number was based on guidance from FDA on obtaining a representative sample for the region. The survey team reviewed the selected establishments' field office files to assess program performance

and conducted (nonregulatory) inspections in the facilities. If any critical issues were noted during these inspections, the person in charge of the establishment was informed as a courtesy. If an imminent health hazard was present, the local EHS or supervisor would be notified to address the issue immediately.

The scores were averaged to obtain a mean overall sanitation score. The 70 individual restaurant sanitation scores, along with types and frequencies of violations noted by the survey team, were tabulated and compared with records from the previous year (two routine inspections by EHSs) of the same facilities. In addition, either the TDH-EH program manager or a food trainer observed all EHSs as each EHS performed two routine regulatory inspections. Deficiencies and inconsistencies noted during the establishment inspection and file review processes were reported to the regional managers.

The survey team produced a summary document from each review. Average inspection scores assigned by the survey team were compared to those of EHSs, both from file review and during observation. Violations were tabulated as the percentages of restaurants in which each violation was marked out of the total number of restaurants sampled. Discrepancies in violations marked between the survey team and reviewed files were also tabulated as percentages. Any discrepancy of greater than 50% required a written plan from regional managers describing how the finding would be corrected. Performance was measured against TDH-EH inspection standards, to which all EHSs had been trained; therefore, the corrective actions were typically additional training and oversight by the supervisor or regional manager. Records of these corrective actions were not kept, however, and thus were not available for analysis. Prior to the third review cycle, the focus was shifted to place emphasis on the 13 critical food safety violations (i.e., only discrepancies of greater than 50% in critical violations would require a written plan for correction).

Data from 37 regional reviews were analyzed. The unit of analysis was a regional review summary.

### Results

During 2003–2011, 11 of the 13 regional field offices were assessed three times by the

survey team, and the remaining two were assessed twice. The standardized survey teams consistently marked more critical violations than did EHSs throughout all regions and years (Table 2). The mean sanitation score assigned by the survey teams was 79.4, whereas the mean score obtained from file review was 86.8 (Figure 1). According to a standard defined by FDA, scores within 7 points of those of the survey team were considered acceptable. Among the 37 reviews, 16 had mean scores within this range. When being observed performing inspections, field staff assigned a mean score of 77.6.

Of the 13 critical violations shown in Table 1, numbers 4, 7, and 11 were omitted from the analysis because of low frequency of citation. The survey teams marked 8 of the remaining 10 critical violations more than twice as frequently than did EHSs (Table 2). A trend toward increased marking of critical violations by EHSs was observed from the first to third review cycles (Table 3). Mean restaurant scores assigned by EHSs concomitantly decreased from 87.3 to 85.9. Differences between survey teams and field staff were statistically significant for all 10 violations in the first review cycle, 8 in the second cycle, and 7 in the third cycle (Table 3).

## Discussion

Continuous quality improvement should be incorporated into food safety programs. Our data show a small but measurable change in sanitation scoring by EHSs. Marking of critical violations increased, sanitation scores decreased, and discrepancies with survey teams in both areas decreased. The improvements in performance might have resulted, at least in part, from the program's evaluation and training efforts during this time period; however, the ecological data do not allow a causal effect to be inferred. When being observed, EHSs assigned sanitation scores about 2% lower than those of survey teams, indicating that deficiencies in marking violations during routine inspections were not due to lack of knowledge or awareness. Anecdotally, a single critical violation may be addressed verbally during routine inspections without being documented, so as to avoid necessitating a follow-up inspection. This practice might account for some of the discrepancies between violations marked during routine inspections and those performed

TABLE 1

### Critical Violations

Violation Category #	Description
1	Food is from an approved source in sound condition with no spoilage.
3	Potentially hazardous food meets temperature requirements during storage, preparation, display, service, and transportation.
4	Facilities are available to maintain product temperatures.
7	Unwrapped and potentially hazardous food is not re-served.
11	Personnel with infections are restricted from potentially hazardous work.
12	Hands are washed according to good hygienic practices.
20	Food equipment and utensils are sanitized using appropriate methods.
27	Water comes from a safe source, with hot and cold water under appropriate pressure.
28	Sewage and wastewater disposal are sanitary.
30	Plumbing prevents backflow, back-siphonage, or dangerous cross-connections.
31	Toilet and hand washing facilities are convenient, accessible, well designed, and appropriately installed.
35	There is no detectable presence of insects, rodents, birds, turtles, or other animals and outer openings are protected.
41	Toxic items are properly stored, labeled, and used.

TABLE 2

### Critical Violations Marked<sup>a</sup> by Survey Team and Environmental Health Specialists (EHSs)

Violation <sup>b</sup>	EHSs		Survey Team		p-Value
	Range	Mean	Range	Mean	
1	0–18.9	3.7	1.4–19.2	8.4	<.0001
3	4.7–37.8	14.5	13.5–59.7	29.0	<.0001
4 <sup>c</sup>	0–2.7	0.18	0–1.8	0.22	-
7 <sup>c</sup>	0–0.7	0.02	0–1.3	0.10	-
11 <sup>c</sup>	0–0.6	0.02	0–1.7	0.05	-
12	0–36.4	9.3	12.2–50.7	33.9	<.0001
20	1.4–16.1	5.9	2.9–25.0	12.7	<.0001
27	0–10.3	3.5	1.4–10.5	5.8	.0002
28	0–12.4	4.7	1.3–26.0	7.5	.004
30	0–17.6	3.8	1.6–27.4	10.2	<.0001
31	0–6.3	2.8	5.1–33.8	15.5	<.0001
35	2.3–24.5	9.9	5.0–45.3	20.5	<.0001
41	5.5–47.6	19.3	17.9–66.2	43.4	<.0001
All		7.0		17.0	

<sup>a</sup>Percentage of restaurants in which violation was marked out of total number of restaurants sampled.

<sup>b</sup>See Table 1 for key to critical violations.

<sup>c</sup>Omitted from analysis.



TABLE 3

**Comparison of Critical Violations Marked<sup>a</sup> and Sanitation Scores Assigned by Environmental Health Specialists (EHSs) and Survey Team per Review Cycle**

Violation <sup>b</sup>	Review Cycle 1			Review Cycle 2			Review Cycle 3		
	EHSs	Survey Team	p-Value	EHSs	Survey Team	p-Value	EHSs	Survey Team	p-Value
1	3.2	9.5	<.0001	2.7	7.8	.002	5.4	7.9	.15
3	11.7	22.7	.001	14.9	31.8	<.0001	17.4	33.2	.004
12	10.1	29.8	<.0001	8.7	36.6	<.0001	8.9	35.6	<.0001
20	5.1	12.7	.0007	5.6	13.0	<.0001	7.2	12.3	.03
27	2.8	7.2	<.0001	3.3	4.7	.09	4.6	5.4	.52
28	3.3	6.3	.04	4.4	6.7	.08	6.7	10.0	.13
30	4.0	11.5	.0002	3.5	10.5	.001	3.8	8.4	.03
31	2.6	20.4	<.0001	2.6	12.9	<.0001	3.4	12.8	<.0001
35	8.7	20.9	<.0001	11.1	23.0	.001	9.9	17.2	.01
41	17.6	45.5	<.0001	19.2	42.7	<.0001	21.3	41.6	<.0001
Mean score	87.3	79.1	<.0001	87.0	78.5	<.0001	85.9	80.6	.0002

<sup>a</sup>Percentage of restaurants in which violation was marked out of total number of restaurants sampled.

<sup>b</sup>See Table 1 for key to critical violations.

while being observed. The Hawthorne effect, a phenomenon whereby workers improve or modify an aspect of their behavior in response to being under observation, might account for the remainder of the discrepancy.

Future efforts could be directed toward discerning other reasons underlying the discrepancies and developing potential solutions. For example, EHSs might view some violations as more important than others and assign scores accordingly. In our analysis, discrepancies in inspection scores between EHSs and survey teams decreased in the third review cycle, after the emphasis was shifted to critical violations. Although causality cannot be established, it is possible that this increased focus on critical violations had an impact on scoring by EHSs.

The top five contributing factors for foodborne illness nationally have been identified as 1) food from unsafe sources, 2) poor personal hygiene, 3) inadequate cooking, 4) improper holding/time and temperature, and 5) contaminated equipment/pro-

tection from contamination (FDA, 2014). Since 2015, when Tennessee adopted the 2009 *Food Code*, inspections focus heavily on these core issues. As Tennessee moves forward after adopting the 2009 FDA *Food Code*, greater emphasis will be placed on violations that are known to directly contribute to foodborne illness. Data from Tennessee foodborne outbreaks show infectious food handlers are most often implicated as contributing factors, followed by contaminated products that are intended to be consumed raw or undercooked. This more risk-based approach to food safety regulation could improve consistency and compliance of EHSs performing restaurant inspections.

### Conclusion

Systematic and ongoing assessment and training of staff are necessary to promote standardized and appropriate scoring during restaurant inspection. Over time, training and evaluation of EHSs were associated with a small positive effect on performance.

Analysis of future program evaluation efforts will determine the effect of transitioning to the 2009 FDA *Food Code* on performance of food service establishment inspections. As the focus of restaurant inspections and EHS training shifts to the most important foodborne illness contributing factors, the desired outcome will be improved food safety, leading to fewer restaurant-associated foodborne disease outbreaks in Tennessee. 🐷

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# The Let's Beat the Bug! Campaign—A Statewide Active Public Education Against Bed Bugs in Minnesota

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**Abstract** Bed bugs continue to affect society and place a burden on public health systems. Experiences of the Let's Beat the Bug! campaign are presented to help information networks prepare personnel to effectively address questions about this pest. Following recommendations from the Minnesota state bed bug working group, an information line was established and the Web site ([www.bedbugs.umn.edu](http://www.bedbugs.umn.edu)) was revised. Data from both services were analyzed by geographic region and type of information requested. InformationLine primarily assisted people who had issues dealing with failed treatments and landlord reluctance to take effective measures against this pest. Web site visits indicated a preference for learning do-it-yourself control methods. There were commonalities in the information sought from both services. People were often looking for reassurance, in addition to information about basic prevention and control of bed bugs. We present here priority topics that public health personnel should be prepared to answer if they receive inquiries about bed bugs.

## Introduction

Public education has been emphasized as the primary mechanism for reducing the spread of bed bugs (Rossi & Jennings, 2010). The rapid spread of bed bugs, an antiquated knowledge base, and changes in societal interconnectedness, however, have forced a "learn-as-we-teach" method of simultaneous information development and distribution. Informational silos within society have presented additional difficulties in distributing information to those affected by bed bug infestations (Ensor, 1988). Public health and medical personnel often receive information in different formats and from different sources; additionally, they may not have access to pest-centric information sources (e.g., trade journals) where knowledge about bed bugs has been published. Further, it is

likely that public health personnel will be required to coordinate with entities outside of the public health domain (e.g., pest management companies, pesticide regulators, housing and property standards inspectors, or legal aid) to successfully address a bed bug problem. Maintaining a research effort to uncover more about bed bug biology and collecting experiential information, while simultaneously teaching the general public how to cope with this pest, is an ongoing challenge.

As a pest of public health importance, bed bugs have spread by taking advantage of the interconnectedness of society and the delayed responses to controlling infestations after they are first detected (Harlan, Faulde, & Baumann, 2008; Kells, 2006; Paul & Bates, 2000). Through human-mediated transfer, bed bugs are now being found in low-income

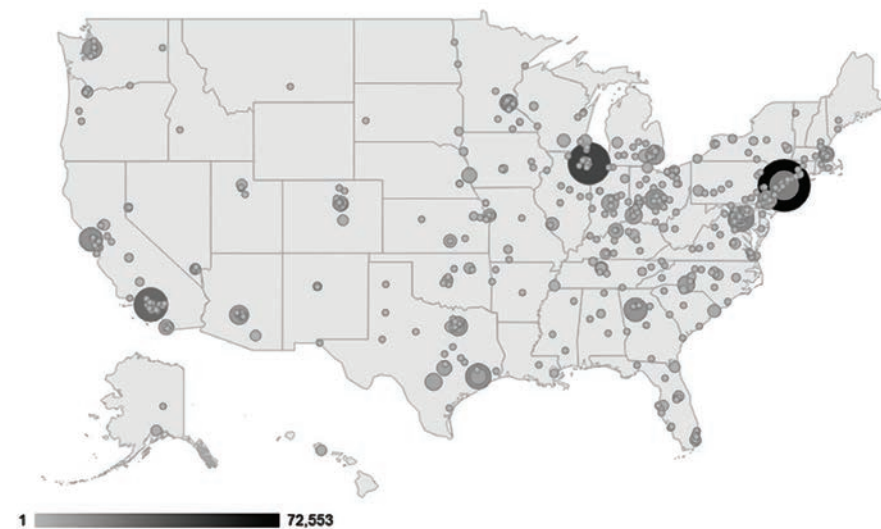
areas (Hwang, Svoboda, De Jong, Kabasele, & Gogosis, 2005). Reports have also been received from public transportation (Anders, Bröcker, & Hamm, 2010), business offices (Baumblatt et al., 2014), as well as various media outlets (Davies, Field, & Williamson, 2012). Personal communications between the authors and various stakeholders indicate that bed bugs have also been found in theaters, hotels, hospitals, libraries, schools, retail stores, apartment buildings, condominiums, and single-family homes.

Health problems related to bed bug bites range from minor itching and rashes to more severe bullous (characterized by blistering) reactions and other severe injuries (Goddard & deShazo, 2009; Leverkus et al., 2006). Psychological impacts of bed bug infestations present a more serious problem, including increased anxiety, depression, sleeplessness, and post-traumatic stress disorder, whether an infestation is actually present or not (Burrows, Perron, & Susser, 2013; Goddard & deShazo, 2012; Rieder et al., 2012; Susser et al., 2012). People frequently resort to dangerous do-it-yourself treatments such as overuse of over-the-counter insecticides or misapplication of garden and agricultural insecticides when they are dealing with a bed bug infestation and are not able to access effective professional pest control. These practices have led to acute illness and one reported death (Centers for Disease Control and Prevention, 2011). Additionally, self-treatments using high temperatures or rubbing alcohol have also resulted in structural fires and other types of property damage.

Bed bugs represent a burden to the public health system and many public health programs are affected by this pest, including refugee health; home visitation programs,

FIGURE 1

**Location Where Web Site Sessions Originated in the U.S. by City, May 1, 2012–April 30, 2016**



*Note.* The bubble plot represents in relative size and color intensity the number of visitors (including repeated sessions) whose server or Internet provider address was identified by Google Analytics.

such as healthy baby initiatives; and home environmental initiatives, such as healthy homes and lead abatement. There are many factors that lead to chronic bed bug infestations in low-income housing. Foremost among these is a lack of credible information about effective prevention and control. In addition, property managers and owners can be reluctant to provide effective treatment. Even when services are provided, poor communication between landlords and tenants on preparing for treatment or preventing reinfestation (e.g., scavenging infested furniture), often leads to failed control efforts.

Additionally, there have been workplace health and safety issues affecting public health workers arising from the unintentional transfer of bed bugs to offices and workers' homes after they visited infested locations. Also, social support mechanisms put vulnerable people at risk of infestation through furniture redistribution, toy-lending libraries, legal aid offices, public transit, and emergency services, among others. Essentially, any location with a reservoir infestation—combined with activities that allow bed bugs to hitchhike—increases the risk of creating new

infestations. Strategically, reducing reservoir populations of bed bugs will prevent the continuing spread of this societally systemic pest (Kells, 2006).

Despite continued efforts by both public and private sectors, bed bug infestations continue to increase. Minnesota's Let's Beat the Bug! campaign is a formalized, public-education program created to increase knowledge about effective prevention and control of bed bugs, make information usable by the widest possible audience, decrease confusion surrounding the bed bug resurgence, and encourage more effective responses to this pest.

Program development is described herein, as are the current findings and the questions that continue to arise as the program evolves. The goal with this article is to present the experiences of the Let's Beat the Bug! campaign and communicate priorities to help other information networks (e.g., 311 systems) and prepare personnel to address questions about bed bugs.

## Methods

Responding to bed bug issues in Minnesota started with the convening of a multidisci-

plinary advisory committee for understanding bed bug issues in specific circumstances and discussing possible solutions. Committee members included representatives from state and county public health offices, the Minnesota Department of Agriculture, property managers and owners, social service groups, municipal and church representatives, tenants' rights and legal aid personnel, school health and safety officials, and representatives from pest management companies. The initial need identified by the advisory committee was for an authoritative, centralized information source for the general public and other interested stakeholders to obtain accurate and understandable information concerning bed bug prevention and control. As the campaign progressed, the committee also provided information on a variety of attempts to address bed bug issues in different types of buildings.

A fundamental requirement for the information program was a method to quickly connect affected individuals with knowledgeable personnel, resources to identify insects, and information relevant to their specific spaces (e.g., homes, apartments, schools, hotels). InformationLine, a telephone and e-mail hotline for bed bug questions, was established in September 2011. Shortly after its establishment, the launch of InformationLine was announced to several media outlets. This announcement resulted in news articles about the bed bug epidemic in Minnesota and the new service being offered via InformationLine. Since 2011, advertising has been mainly through word of mouth, networking with social services and health agencies, and ongoing use of social media.

A Microsoft Access 2007 database was constructed to track inquiries from InformationLine. Data collected from calls and e-mail queries included date received, phone number or e-mail address, home type, question type, and other notes. By recording the phone number or e-mail of the individual seeking information, it was possible to return calls and follow up if necessary, as well as track repeat callers. Identifying previous callers allowed us to provide more specific information and advice on their particular situation. Additional information was also collected, such as status of issue (in process or completed), suggestions and recommendations, and if the caller was referred to another organization (e.g., legal aid). Specimens received



for identification and the outcome of InformationLine services were also documented.

InformationLine was also supported by a library of information presented on the Let's Beat the Bug! Web site ([www.bedbugs.umn.edu](http://www.bedbugs.umn.edu)). Based on the visitor's specific concerns, pertinent task sheets and videos were presented in easy-to-follow formats that shared the latest information on bed bug prevention and control. Early in Web site development, needs were identified and additional materials were posted to address new problems brought up by affected callers. Translating selected content into multiple languages (e.g., Hmong, Spanish, Arabic, Somali) was an additional feature implemented to reach a geographically broad and culturally diverse audience. Tracking visitor behavior on [www.bedbugs.umn.edu](http://www.bedbugs.umn.edu) was accomplished using Google Analytics, the standard tracking software used by the University of Minnesota. Google Analytics provided several metrics, such as the number of times pages were viewed, location of visitors, and keywords used to direct individuals to the site. An improved Web site was initiated in May 2012, and the sampling period for the study presented here spanned 4 years (May 1, 2012–April 30, 2016).

Data collected from the caller and e-mail database, as well as Web site data, were totaled and tabulated in order of relative importance within predefined categories (Tables 1–3). Data summaries were generated via queries accessing data tables created from the data entry form. Geographical representations of the origin of Web site inquiries within the U.S. were presented as a bubble plot generated by the Google Analytics program (Figure 1).

## Results

Between the dates of this study, InformationLine received 2,836 inquiries, with 1,794 (63.3%) of the inquiries originating from the state of Minnesota. The majority of these contacts represented single calls or e-mails (84.2%). Occasionally, individuals would make two calls or e-mails to follow up and receive additional information (15.83% of total inquiries); only 41 individuals made more than two inquiries (5.25%).

During the early phases of collecting data from InformationLine, it was observed that questions could be placed into one of 20 topic areas (Table 1); further calls were classified based on these general topics. The most

TABLE 1

### Reasons Given for Contacting InformationLine

Question Type	# of Inquiries	%
How do I get rid of bed bugs on my own	430	13.2
Identification	285	8.8
How do I prevent bed bugs	273	8.4
Landlord is not taking care of bed bug situation	245	7.5
How do I know if I have bed bugs	242	7.4
How do I identify these bites	241	7.4
Understanding treatments	214	6.6
What can I do about bed bugs while traveling	153	4.7
What are my rights	150	4.6
Where can I get assistance for low income individuals	150	4.6
Bed bugs in public places	131	4.0
Unsuccessful treatment	115	3.5
I am looking for an education/training opportunity	110	3.4
Who is responsible for treatment	100	3.1
Do you provide assistance	86	2.6
Does X product work	84	2.6
Which pest management professional should I hire	80	2.5
I want to report bed bugs	71	2.2
How do I prepare for a treatment	61	1.9
How do I find a pest management professional	33	1.0
Total	3,254	

*Note.* The totals for these tables may exceed the total number of inquiries, as one individual may have posed more than one question.

common questions received by InformationLine during May 1, 2012–April 30, 2016, were: “How do I get rid of bed bugs on my own?” (13.2%); questions regarding identification of bed bugs (8.8%); “How do I prevent bed bugs?” (8.4%); and “The property owner/manager is not taking care of a bed bug infestation, what should I do?” (7.5%). Other questions tended to focus on the pest management industry: “Whom should I hire?”; “How do I prepare for a control procedure?”; “What if the control procedure failed?”; and “What are the different treatment options?”

There were 14 common responses to requests for information (Table 2); the principal topic discussed was how a person could control bed bugs using do-it-yourself (DIY) methods (14.4%). This recommendation, however, was not an automatic response when a person complained of an infestation. Rather, DIY methods

were discussed when the caller indicated that they were not able to work with a professional, either because the person could not afford a pest control company, or because the landlord was unresponsive to the problem. Basic information of bed bug biology and behavior was often discussed with the caller (12.5%). Another common topic of discussion was how to monitor a bed bug infestation (8.1%) and approximately the same number of callers received information about preventing bed bugs from infesting their home (7.9%). Directions for obtaining legal assistance were given in 7.6% of calls, most often as a result of tenants complaining about noncompliant landlords. In 7.2% of the calls, the caller was discouraged from using over-the-counter insecticides. With 0.5% of calls, staff provided directions about dealing with bed bugs to people who were communicating behaviors consistent with Ekbohm

TABLE 2

**Suggestions Provided to People Calling or E-mailing InformationLine**

Outcomes and Observations	# of Inquiries	%
Discussion of do-it-yourself methods	545	14.4
Bed bug basics	472	12.5
Monitoring for bed bugs	306	8.1
Hire a pest management professional	300	7.9
Prevention information	300	7.9
Talk to a lawyer	289	7.6
Explained professional treatments	281	7.4
Discouraged use of over-the-counter products	271	7.2
Send insect for identification	264	7.0
Other	229	6.1
Use an encasement	195	5.2
Call property owner or manager	170	4.5
Discussion of proper preparation methods	118	3.1
Individual expressed characteristics of possible Ekbohm syndrome	20	0.5
How to inspect a hotel room	19	0.5
Total	3,779	

syndrome (also called delusory or delusional parasitosis) (Hinkle, 2011).

Between May 1, 2012–April 30, 2016, 1,770,592 sessions were logged on [www.bedbugs.umn.edu](http://www.bedbugs.umn.edu). Of these, 1,158,368 (66.9%) sessions originated in the U.S. Sessions were defined as the number of times a user was actively engaged with the Web site whether it was a first-time visit or a repeat visit. Counts were not weighted with respect to population. Within the U.S., cities providing the most sessions included New York City, NY (95,759); Chicago, IL (48,833); Los Angeles, CA (30,389); Houston, TX (23,168); Minneapolis and St. Paul, MN (20,281); Washington, DC (20,205); Philadelphia, PA (17,938); San Francisco, CA (14,445); Dallas, TX (14,393); and Atlanta, GA (13,339) (Figure 1).

The site average for new visitors (i.e., the percent of visitors accessing the site for the first time) was 86.4%. Information being sought on the Web site corresponded closely with topics being sought by those calling and e-mailing InformationLine. The most popular pages (as determined by a raw count of page views) were task sheets, which discussed in detail how to control bed bugs without professional assistance (Table 3).

## Discussion

This study demonstrated two of the critical pathways for educating those in society who are, or have the potential to be, affected by bed bugs: person-to-person communication (InformationLine) and individual access to online resources ([www.bedbugs.umn.edu](http://www.bedbugs.umn.edu)). These two methods complemented each other by enabling both coverage and data collection from two different sources. InformationLine provided direct stakeholder interaction, while the Web site provided a larger and more diverse audience with information regarding bed bugs, and permitted analysis of visitor behavior on a greater scale. Connecting with the public through phone calls and e-mails provided for active discussions of a person's concerns, and enabled further engagement that often assisted with secondary concerns. After initial answers were provided, there tended to be additional discussions for the purpose of reassurance or of building confidence. This extra discussion improved the chances that the caller could work progressively through the control steps and self-worries to achieve a bed bug-free living space.

While specific numbers or ratings were not collected relative to the callers' confidence, callers often expressed relief, and the low fre-

quency of repeat calls (15.8%) was treated as an indication that success had been obtained, or at least that the caller had a direction for further help (e.g., tenants calling legal aid for help dealing with recalcitrant landlords.) Follow-up calls were considered for the purpose of determining programmatic outcomes, but this idea was discarded due to concerns of causing more worries by reminding people that they once suffered from bed bugs (Godard & deShazo, 2012).

The behavior of those visiting the Web site reflected similar concerns as those calling or e-mailing InformationLine, with the additional advantage that the available data could be analyzed both nationally and internationally. Many of the most frequently accessed pages pertained to DIY methods of controlling bed bugs, especially those such as laundering or freezing to control these pests. The topics, "What NOT to do when you have bed bugs" and "Have I found a bed bug?" were also frequently accessed; the reason that visitors selected these pages might have been a result of highlighting these topics on the front page. Results from this study provide suggestions for which topics service providers should be ready to discuss with their clients regarding bed bug prevention and control (Tables 1–3).

Another commonly highlighted topic, "Hiring a pest management professional," was not accessed as frequently as the DIY topics. In fact, this topic was 28th in ranking of the most frequently accessed pages, and represented a very small percentage (0.4%) when compared with the most popular topics (Table 3). Considering similar results from InformationLine, employing a pest management professional seemed to be a distant priority to wanting to control an infestation by oneself. Whether this low frequency in obtaining professional pest control information was an attempt to understand or augment other methods of controlling these pests, frustration with professional pest control, a response to the high price of pest control (Aultman 2013), or uncertainty about control methods (Koganemaru & Miller, 2013; Wu, Tracy, Barbarin, Barbu, & Levy, 2014) is not known. It appeared, however, that the majority of visitors were willing to attempt control measures themselves, either before or in addition to a professional pest-control service.

Another issue encountered was that a small number of individuals exhibited pos-

sible Ekbohm syndrome. Ekbohm syndrome is a condition where an individual believes that insects are living on or in their bodies (Hinkle, 2011). Subsequently, the affected person often takes drastic actions to relieve themselves of this perceived infestation (e.g., applying bleach, insecticides, or other harmful chemicals directly on themselves), when in fact no insect infestation is present. Twenty individuals who contacted InformationLine (0.5%) discussed or exhibited many behaviors consistent with Ekbohm syndrome. These suppositions, however, should not be considered conclusive medical diagnosis of the affected person, nor could Ekbohm syndrome or similar medical issues be confirmed. Callers were encouraged to seek medical help if they mentioned injury as a result of bed bug bites or exhibited signs of mental distress.

At the time of this writing, there were hundreds of Web sites offering advice to consumers on preventing and controlling bed bugs; searching “bed bug” on Google returns over six million results. The Web site, [www.bedbugs.umn.edu](http://www.bedbugs.umn.edu), is an attempt at filling an identified need for scientifically based information that is also easily consumable by a population unaccustomed to combating these insect pests. When affected by bed bugs, many individuals wanted to be able to discuss their bed bug prevention and control questions with an unbiased expert; others relied on the Web site as their sole source of information from us, even though the offer of e-mail or phone contact was displayed throughout the Web site. With eight of the most popular task sheets translated into Arabic, Hmong, Somali, and Spanish, the number of page views—as well as discussions with community stakeholders—provided anecdotal evidence that bed bugs are a significant issue in communities that speak these languages (Table 3). Therefore, active efforts are required to educate communities where English is not the primary language.

Bed bugs are nest parasites that live in people's homes, and they are particularly adapted to hiding and spreading to new infestation sites by hitchhiking on people's possessions. Within a society, reservoir populations of bed bugs can become established in communities that cannot afford or do not have access to proper treatment techniques. The result is that bed bugs from these communities are then repeatedly reintroduced into other areas.

TABLE 3

**Top 20 Pages Accessed by Those Visiting [www.bedbugs.umn.edu](http://www.bedbugs.umn.edu), May 1, 2012–April 30, 2016**

Page Title	Page Views	% of Total Page Views
Laundering items for bed bug control	418,811	19.1
What not to do when you have bed bugs	278,541	12.7
Using freezing conditions to kill bed bugs	242,096	11.1
Home page	148,369	6.8
Bed bug control in residences	132,945	6.1
Inspecting your hotel room for bed bugs	128,252	5.9
Bed bug control in residences (Arabic)	125,813	5.7
Controlling bed bugs by hand	113,524	5.2
Using steamers to control bed bugs	95,213	4.4
Have I found a bed bug	91,174	4.2
Controlling bed bugs by hand (Arabic)	89,005	4.1
Guidelines for dealing with bed bugs in school settings	65,004	3.0
Controlling bed bugs by hand (Spanish)	62,138	2.8
Vacuuming to capture bed bugs	47,802	2.2
Understanding bed bug treatments	35,080	1.6
Home visitors	32,477	1.5
Home owners and tenants	29,128	1.3
How to prevent bed bugs from entering your home	26,767	1.2
How do I know if a bed bug treatment has been successful	26,376	1.2
Information for property owners and managers (landlords)	25,430	1.0
Total	2,213,945	

Involvement of public health agencies has been identified as important for dealing with this problem (Shum et al., 2012). Coordination among research, extension, and outreach education has been critical in identifying such unique bed bug–human interactions, rapidly responding by instructing those affected on how to control the infestation, and in seeking other people who may be affected by similar situations. This coordination has been necessary to find and correct misinformation, or to prevent the distribution of outdated information that can also be inaccurate, nonapplicable, or potentially hazardous. Expanding educational content and methods that provide both proper information and confidence-building techniques to other geographic and socioeconomic sectors will help society further reduce bed bug reservoirs and subsequent incidences. 🐛

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► INTERNATIONAL PERSPECTIVES

# Presence of Household Mold, Children's Respiratory Health, and School Absenteeism: Cause for Concern

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**Abstract** A study examining the relationship between housing conditions, respiratory health, and school absenteeism was conducted in the city of Winnipeg in Manitoba, Canada. As part of this study, a survey was completed by 3,424 parents of children in grades 3 and 4 to determine the a) relationship between self-reported visible mold in homes and tested airborne mold; b) relationships of self-reported visible mold, tested airborne mold, and asthma and/or persistent colds; c) school absenteeism rates due to asthma and/or persistent colds; and d) children's socioeconomic status (SES) and incidence of asthma and/or persistent colds. In addition, a complete inspection of a subset of 715 homes was conducted, including the collection of over 1,400 indoor and 500 outdoor air samples for mold analysis. Results indicate a significant association between self-reported visible mold and airborne mold. Additionally, a significant association was found between *Cladosporium* levels from air samples (the most common genus type found) and children's asthma in combination with persistent colds. Children with persistent colds in combination with asthma miss significantly more school than children who have only asthma or only persistent colds. Children from poorer families reported more persistent colds than children from high-income families. No association was found between income and asthma. Furthermore, SES was not a significant factor for number of school days missed.

## Introduction

One of the most comprehensive Canadian surveys completed to date on the state of asthma reported that 2 million Canadians, including 10%–15% of children, are currently affected by this condition (Glaxo Wellcome, Inc., 2000). In the U.S., approximately 10.2 million children (9.2%) were diagnosed with asthma (National Center for Health Statistics [NCHS], 2015). Each year, approximately 10

children and 450 adults die in Canada from asthma, while 23% of children with asthma miss school every year due to their condition. A study by the Winnipeg Regional Health Authority reported that inner-city Winnipeg has the highest number of physician visits for asthma by children in the province of Manitoba (Winnipeg Regional Health Authority, 2004). Between 2001 and 2003, in one of the inner-city Winnipeg neighborhoods (Ink-

ster West), there were 174.9 physician visits by children 5–9 years of age for asthma per 1,000 population. For comparison, the average number of physician visits by children of the same age for asthma for the entire Winnipeg Health Authority region was 138.6 per 1,000 population. Similar studies in the U.S. have indicated that asthma-related hospitalizations have risen disproportionately for inner-city children (Crain et al., 2002; Malveaux & Fletcher-Vincent, 1995).

A number of studies have found a significant increase in school absenteeism for children who have asthma (Bener, Kamal, & Shanks, 2007; Bonilla et al., 2005; Freeman, Schneider, & McGarvey, 2003; Gasana et al., 2016; Hsu, Qin, Beavers, & Mirabelli, 2016; Meng, Babey, & Wolstein, 2012). Weber and coauthors (2003) surveyed 6,433 parents of children in six elementary schools in the Bronx in New York. They found that the prevalence of asthma was 19.9% and children with asthma missed an average of 21.3 school days per year. A study conducted by Parcel and coauthors (1979) found that children with asthma have a significantly higher absenteeism rate (8.4% of school days) than do nonasthmatic children (5.9% of school days). In fact, asthma has been found to be the major cause of absenteeism due to chronic illness (Shendell, Alexander, Sanders, Jewett, & Yang, 2010; Wang, Zhong, & Wheeler, 2005).

Asthma severity is also a significant indicator of days absent from school. Parcel and coauthors (1979) concluded that the mean number of absent days increased according to the mother's perception of the severity of her child's asthma. Those with mild asthma



TABLE 1

**Response Rates for Initial Contact Survey and House Inspection by Group**

Study Part	Health Condition	No Asthma	Asthma <sup>a</sup>	Total
Initial contact survey	No/few colds	1,956 (57%)	171 (5%)	2,127 (62%)
	Persistent colds <sup>b</sup>	841 (25%)	456 (13%)	1,297 (38%)
	Total	2,797 (82%)	627 (18%)	3,424 (100%)
House inspection	No/few colds	201 (28%)	72 (10%)	273 (38%)
	Persistent colds	225 (31%)	217 (30%)	442 (62%)
	Total	426 (60%)	289 (40%)	715 (100%)

<sup>a</sup>Asthma = having received a formal diagnosis of asthma from a physician or having had at least one asthma attack, gone one or more times to a hospital emergency department due to asthma, been hospitalized at least once due to an asthma attack, or been prescribed steroids, over the last 12 months.

<sup>b</sup>Persistent colds = having  $\geq 4$  respiratory infections/colds in the past year (more conservative than Williamson and coauthors' (1997) definition of  $\geq 3$ /year).

missed 6.9% of school days, those with moderate asthma missed 7.9% of school days, and those with severe asthma missed 13.9% of school days. Similarly, Moonie and coauthors (2006) found a significant difference in absent days per school year based on severity of symptoms: mild intermittent asthma (8.5 days), mild persistent asthma (11.3 days), and severe persistent (11.6 days).

Waking up during the night due to asthma symptoms was also associated with school absenteeism. Diette and coauthors (2000) showed that among children with severe symptoms, 58% missed school because of asthma when awakened 1–3 nights, but only 20% missed school if there were no nights when their sleep was disturbed due to asthma.

There is also evidence to suggest that absenteeism rates due to asthma are greater for girls than for boys (Bener, Abdulrazzaq, Debuse, & Abdin, 1994) and that, as students get older, absenteeism due to asthma decreases (König & Shaffer, 1996; Parcel, Gilman, Nader, & Bunce, 1979). Moonie and coauthors (2006) concluded that the differences between the rates of absenteeism between asthmatic and nonasthmatic children were so high as to warrant further studies.

The results presented here are part of a larger study examining the relationship between housing conditions and respiratory health among 9-year old children in Winnipeg (Polyzois, Polyzois, Wells, & Koulis, 2016; Wells, 2014). In the current paper, we

examine the a) relationship between self-reported visible mold in homes and association with tested airborne mold; b) relationships of self-reported visible mold, tested airborne mold, and incidence of asthma and/or persistent colds; c) school absenteeism rates due to asthma and/or persistent colds; and d) children's socioeconomic status (SES) and incidence of asthma and/or persistent colds.

## Methods

### Participants

A total of 3,424 students, drawn from six main school divisions in the city of Winnipeg in Manitoba, Canada, participated in this study. The mean age of the students at the time of the survey was 8.4 years (minimum 6.5 years; maximum 10.3 years; standard deviation 7.3 months). There were 1,714 (51%) males and 1,675 (49%) females (35 missing information); of these, 1,777 (52%) were in grade 3 and 1,623 (48%) in grade 4 (24 missing information).

The University of Manitoba Education/Nursing Research Ethics Board approved this study (protocol # E2005:058: Respiratory Health, Housing Conditions, and School Absenteeism among Nine-Year-Old Children in Winnipeg).

### Procedure

In September 2005, following formal permission from all six school-division chief superin-

tendents, an initial contact survey was distributed through the individual school teachers to the entire third- and fourth-grade school student population of 13,729 children in Winnipeg. This survey was designed to obtain parental information on a) their child's respiratory health, including incidents of respiratory infections/asthma over the past academic year (2004–2005), as well as trips to the doctor and/or hospital; b) the child's home environment, including the age of home, presence of mold, carpeting, number of smokers in the home, presence of cats or dogs, and relatives who have asthma; and, c) number of school days missed by the child in 2004–2005 due to respiratory tract infections and/or asthma.

Based on the returned parent surveys ( $n = 3,424$  or 25% response rate), children were categorized into four health groups (Table 1). Of the 3,424 responders, 2,064 parents (61%) agreed to participate in a follow-up housing inspection, which included the collection and analysis of over 1,400 indoor and 500 outdoor air samples. A total of 715 homes were completely inspected. A detailed description of the design methodology and procedure used can be found in Polyzois and coauthors (2016).

## Results

### Self-Reported Visible Mold and Tested Airborne Mold

Tests of independence (Pearson's chi-squared test) for contingency tables were used to assess the associations between self-reported visible mold and airborne mold. A statistically significant association was found for the month of April between self-reported mold in the house and airborne mold (all species combined) for both the children's bedrooms and basements (Table 2).

*Cladosporium* was the most common mold found in Winnipeg homes (98.2% of children's bedrooms and 97.8% of basements), followed by *Alternaria* (82.4% of children's bedrooms and 77.0% of basements), and *Penicillium* (35.4% of children's bedrooms and 48.8% of basements).

### Self-Reported Visible Mold, Tested Airborne Mold, and Incidence of Asthma and/or Persistent Colds

Tests of independence (Pearson's chi-squared test) for contingency tables showed that the

child's respiratory health is significantly associated with self-reported visible mold in the basement of the child's home (Table 3). Generally, there are more healthy children (few or no colds/no asthma) when mold was not reported in the home and more children with compromised respiratory health when mold was reported in the home.

In order to link reported mold to tested airborne mold, a Kruskal-Wallis Nonparametric test of the distribution of *Cladosporium* spores (the most common genus type found) by area of the home (children's bedroom or basement) was performed (Table 4). Results showed a significant association between *Cladosporium* levels from air samples taken in April and children's asthma in combination with persistent colds. No statistically significant association between *Penicillium* or *Alternaria* and respiratory health was found.

#### School Absenteeism Rates due to Asthma and/or Persistent Colds

School absenteeism data were obtained during the initial contact survey involving 3,424 students in grades 3 and 4 in Winnipeg. In Manitoba, students attend between 194 and 196 days of school during any academic year. Parents were asked to respond to the following survey item: Over the past 12 months, how many days of school has your child missed due to a) upper respiratory tract infections (colds)? and b) asthma?

The total number of days absent from school was calculated as the sum of days absent due to colds and asthma (from survey items a and b, above). As parents reported absenteeism in a range of days, two analyses were run: one considered the minimum number of days absent due to colds and asthma (using the lowest value in the range) and the other considered the maximum number of days (using the highest value in the range). For the total minimum number for each child, the possible range of values is 0, 1, 2, 3, 4, 6, etc. For the total maximum number for each child, the possible range of values is 0, 2, 4, 5, 7, etc. Table 5 shows the mean number of days absent by group when using these two different approaches.

Children who had asthma in combination with persistent colds had the highest incidence of absenteeism. As shown in Figure 1, 30% of these children missed a maximum of 2–4 school days, 39% missed a maximum of

TABLE 2

#### Self-Reported Indoor Visible Mold (Yes/No) by Total Airborne Mold (Combined Genus Types) in CFU/m<sup>3</sup> (Data Collected in April)

Location	Self-Reported Mold (Presence/Absence)	Air Sample Results in CFU/m <sup>3</sup>			
		≥100 # (%)	≥200 # (%)	≥300 # (%)	≥400 # (%)
Children's bedroom	Yes (n = 143)	85 (59.4) <sup>a</sup>	46 (32.2) <sup>a</sup>	16 (11.2)	10 (7.0) <sup>a</sup>
	No (n = 145)	66 (45.5)	27 (18.6)	9 (6.2)	1 (0.7)
Basement	Yes (n = 139)	85 (61.2) <sup>a</sup>	46 (33.1) <sup>a</sup>	28 (20.1) <sup>a</sup>	18 (12.9)
	No (n = 142)	66 (46.5)	29 (20.4)	15 (10.6)	9 (6.3)

<sup>a</sup>p < .05.

TABLE 3

#### Association of Selected Aspects of the Home Environment and Children's Persistent Colds and/or Asthma

Mold in Basement	Few or No Colds/No Asthma (%)	Persistent Colds Only (%)	Asthma Only (%)	Asthma and Persistent Colds (%)	χ <sup>2</sup> (df) p-Value
Yes (n = 612)	47.4	29.9	5.9	16.8	29.11 (3) <.0001
No (n = 2,812)	59.3	23.4	4.8	12.5	

5–10 days, and an additional 12% missed a maximum of 12–42 days.

The absenteeism data are count versus continuous and because statistical methods such as least squares and ANOVA are designed for continuous dependent variables, therefore Poisson regressions were used to investigate the associations among asthma, persistent colds, and the total number of days missed. The two independent variables for the Poisson regressions were asthma (yes/no) and persistent colds (yes/few or no colds). Each independent variable has two levels indicating the presence or absence of the condition. The dependent variables were minimum and maximum total number of days missed. The likelihood ratio statistic was used to test the significance of the independent variables on the dependent variables (Cameron & Trivedi, 1998).

Results showed that the two independent variables (asthma and persistent colds) were significantly associated with both the minimum (asthma: p < .001; persistent colds: p < .001) and maximum total number

of days missed (asthma: p < .001; persistent colds: p < .001). As shown in Figure 2, children with persistent colds in combination with asthma miss significantly more school than children with only asthma or only persistent colds. For “healthy” children (i.e., with no asthma and no persistent colds) the mean total number of days missed was between 0.37 (using the minimum) and 0.68 (using the maximum) (Table 5). Children who have only asthma, however, miss from 2.4–2.6 times more days of school than healthy children. Similarly, children with only persistent colds miss from 3.7–4.2 times more days of school than healthy children. Children with both asthma and persistent colds miss 8.8–10.9 times more days than this same comparison group.

#### Children's Socioeconomic Status (SES) and Incidence of Asthma/Persistent Colds

In order to examine this relationship, we looked at the association of children's respira-

TABLE 4

**Median *Cladosporium* Levels (in CFU/m<sup>3</sup>) by Area in the Home (Children's Bedroom or Basement) by Respiratory Condition of Child (Data Collected in April)**

Median <i>Cladosporium</i> Levels (in CFU/m <sup>3</sup> ) by Area in the Home	Respiratory Condition of Child				
	Few or No Colds/ No Asthma	Persistent Colds Only	Asthma Only	Asthma and Persistent Colds	$\chi^2$ (df) p-Value
Bedroom median mold counts (25th percentile, 75th percentile)	97.0 (63, 125)	91.0 (59, 137)	97 (44, 190)	125 (91, 181)	9.82 (3) .020
Basement median mold counts (25th percentile, 75th percentile)	88 (63, 119)	75 (44, 125)	112 (69, 197)	131 (66, 187)	9.65 (3) .022

TABLE 5

**Mean Number of Days Absent (Minimum and Maximum) by Group**

	n Valid	Mean (95% CI)
Minimum number of days		
Few or no colds/no asthma	1,943	0.37 (0.33, 0.41)
Asthma only	170	0.95 (0.66, 1.25)
Persistent colds only	838	1.57 (1.40, 1.74)
Asthma and persistent colds	454	4.08 (3.56, 4.60)
Maximum number of days		
Few or no colds/no asthma	1,943	0.68 (0.61, 0.75)
Asthma only	170	1.67 (1.21, 2.13)
Persistent colds only	838	2.51 (2.28, 2.73)
Asthma and persistent colds	450	5.99 (5.40, 6.58)

CI = confidence interval.

Note. For the minimum number of days, 23 students had missing information. For the maximum number of days, 27 students had missing information.

tory health by the mean income of Winnipeg neighborhoods in which they lived. In the lowest income neighborhood clusters, one generally can find higher incidences of reported persistent colds. For example, the poorest district had a mean neighborhood income of \$33,523 and 56% of children in our study who lived in this area had persistent colds. In contrast, the most affluent district had a mean neighborhood income of \$106,617 and 30.5% of children in our study who lived in this area had persistent colds. Of the 23 neighborhood clusters examined, three out of the five clusters with the lowest average income were also in the top five clusters with the highest number of respondents with persistent colds.

In order to examine these associations on a finer scale, we used income data linked to children's individual postal codes (Manitoba Centre for Health Policy, 2016). The data are in the form of income quintile codes by postal code. An income quintile is a measure of SES that divides the population into five income groups (from lowest to highest) based on average household income, a population value (year specific), and an urban/rural indicator. Approximately 20% of the population falls in each income group.

The relationship between SES and respiratory health was examined only for the subgroup of urban children, as the vast majority of the children in our study (92%) fall

within that category. Tests of independence (Pearson's chi-squared test) for contingency tables were used to assess the associations between SES group and respiratory health. Table 6 shows that children from poorer families tend to have more persistent colds than children from high-income families ( $p = .003$ ). There was no statistically significant association, however, between SES and asthma (i.e., children with asthma were found at all SES levels).

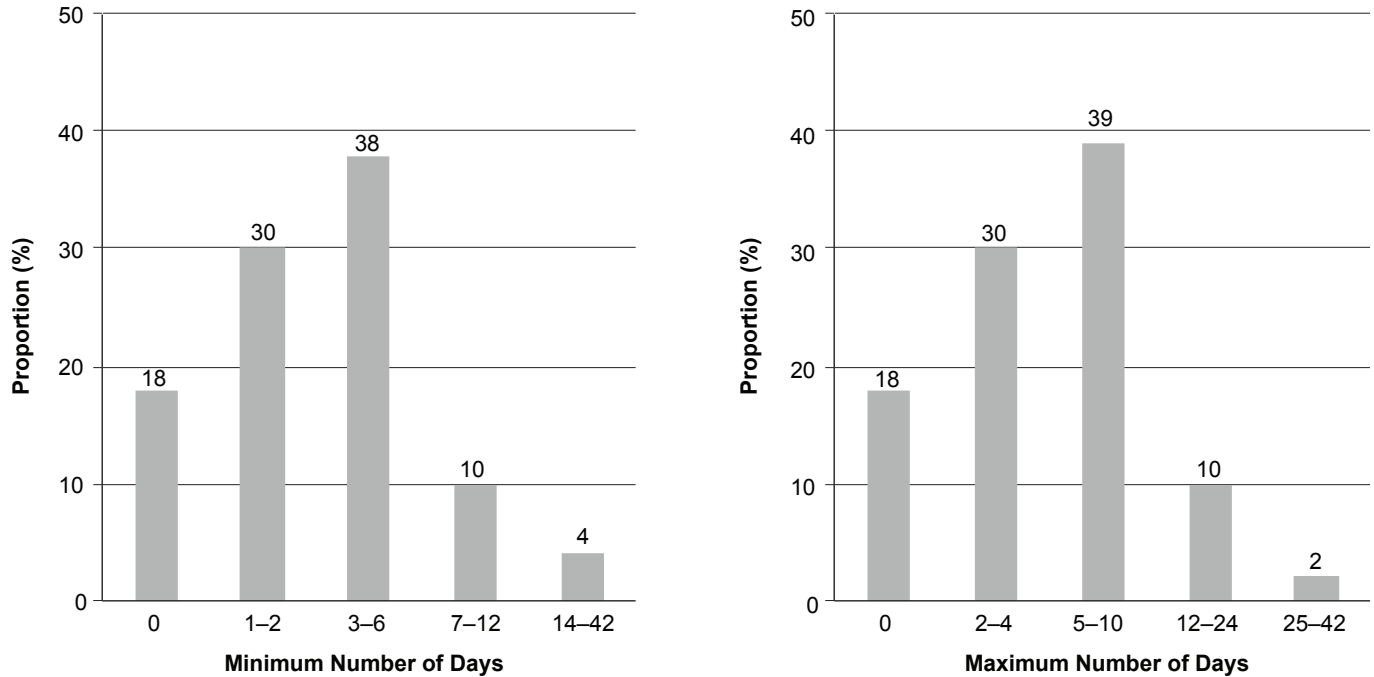
In order to determine the relationship between children's SES and school absenteeism, the Poisson regression analyses for the number of days missed conducted earlier were repeated by including SES group as an independent variable (in addition to the two independent variables, asthma and persistent colds). Two separate analyses were performed where the dependent variable was the number of days missed using the minimum and maximum values. In both cases, SES was not a significant factor for the number of days missed (minimum days:  $p = .147$ ; maximum days:  $p = .457$ ). In addition, when controlling for SES, persistent colds and asthma remained as significant factors for the number of days missed.

## Discussion

Results from this study indicate a significant association between self-reported visible mold and tested airborne mold. Additionally, a significant association was found between *Cladosporium* levels from air sample analyses (the most common genus type found) and children's asthma in combination with persistent colds. This same group also miss significantly more school

FIGURE 1

**Distribution of the Total Number of Days Absent for Students With Asthma in Combination With Persistent Colds**



days than children who have only asthma or only persistent colds. Children facing economic adversity are subject to more persistent colds than those from high-income level families—a finding that is supported by the literature. For example, Brownell and coauthors (2012) found that 32% of occurrences of hospital utilization (hospital episodes) for children in urban Manitoba were from the lowest income quintile, although this group only makes up 20% of the urban population—a clear overrepresentation by impoverished groups. In contrast, children with asthma in the current study were found in all income-level families. Finally, no link was found between SES and absenteeism; that is, students missed school because of asthma and colds, not because of SES.

Examining children's respiratory illness as related to household mold is important for a number of reasons. Children's persistent colds and/or diagnosed asthma condition not only affect their school attendance, they also result in parental lost work days. For example, among U.S. children and adolescents aged

5–17 years, asthma accounts for a yearly loss of 10 million school days and costs caretakers \$726.1 million/year because of lost wages (NCHS, 2015). According to Wang and coauthors (2005), this loss of productivity from asthma-related school absences amounts to approximately \$791/child with asthma per year. Additionally, children who are frequently absent from school not only disrupt their education, but are at a much greater risk of premature school dropout (Moonie, Sterling, Figgs, & Castro, 2006). Reducing absences could avoid compromising children's school performance (Haas & Fosse, 2008).

Healthcare professionals, educators, and housing authorities must share the responsibility to support and manage children's respiratory health and, by extension, encourage school attendance. Only in this way can we help buffer the negative effects of children's asthma and optimize their capacity for learning.

### Limitations

With a return rate of 25% in our survey, resulting in 3,424 children in grades 3 and 4

being represented in the survey, there is a possibility that results may be biased in favor of those parents with children who have known or suspected respiratory health conditions. It is noteworthy, however, that 57% of our study's respondents had no reported respiratory health problems. Furthermore, the reported proportion of asthma cases in our study sample (5%) was much lower than the reported percentage of asthmatic children of similar age within the broader Canadian population (9%).

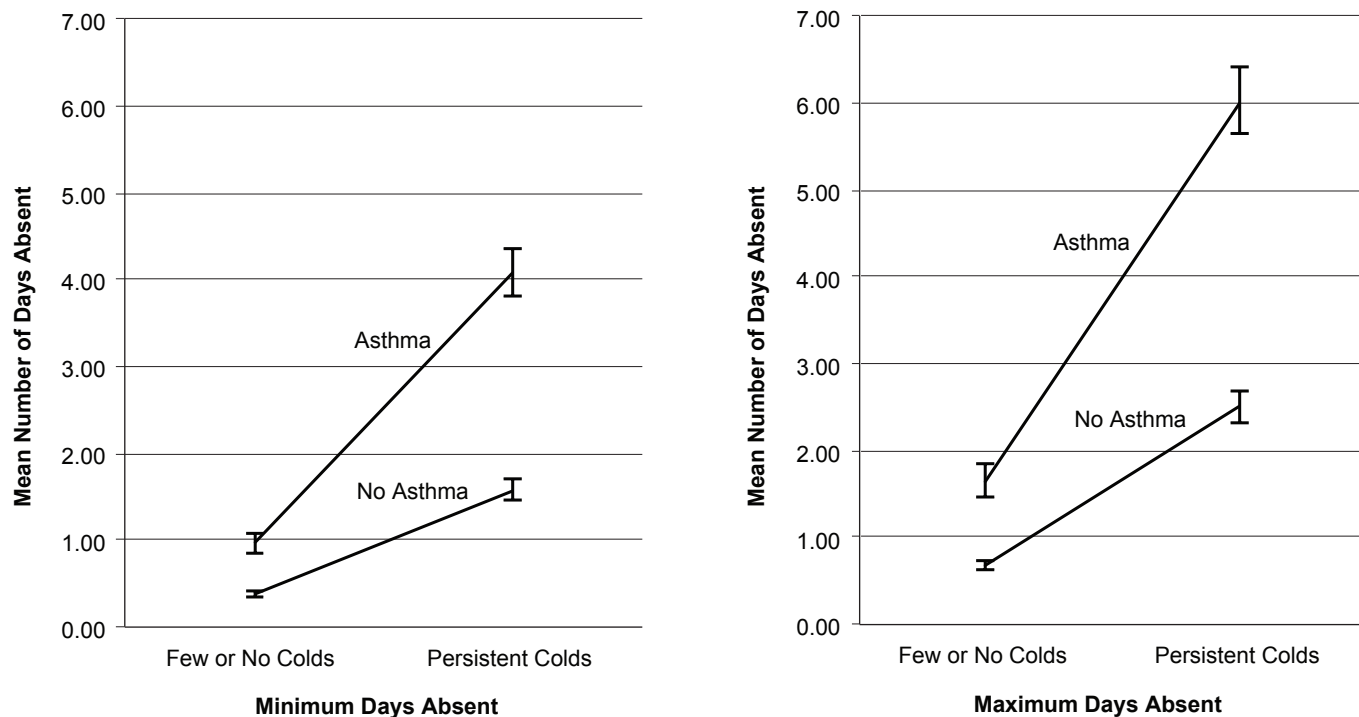
Second, simply asking parents about the presence of visible mold, as we did in our survey, might not be the same as actually identifying the mold in the homes. Results from our study suggest that the presence of self-reported mold was confirmed by the air sample counts for April for mold in both bedrooms and basements. We found a statistically significant association between self-reported visible mold and airborne mold through an analysis of over 1,500 indoor air samples.

Third, school absenteeism in the present study was based on retrospective data re-



FIGURE 2

**Mean Total Number of Days Absent for Students With Persistent Cold (Yes/Few or No Colds) and Asthma (Yes/No) for Minimum and Maximum Days**



Note. Error bars represent 95% confidence intervals.

called by parents regarding their children's missed days over the past academic year. A more accurate, yet labor-intensive approach would have been to directly examine each child's school record/report card for absent days. This alternate process would also have limitations, however, because schools typically do not record the reasons for absenteeism, including any asthma-related illnesses or persistent colds.

### Future Research

Future research could involve linking school absenteeism precipitated by upper respiratory tract infections or asthma to school performance. Research suggests that absenteeism is linked to lower academic performance, particularly among inner-city minority youth (Hsu et al., 2016). A further line of study could involve linking absenteeism to severity of asthma and/or upper respiratory tract infections based on fre-

quency of hospital/doctor visits and medications prescribed by a physician. Although in our study we found no association between asthma and SES, if severe instances of asthma were isolated, perhaps higher incidence levels among those who are impoverished might be more evident.

In Manitoba, such information can be obtained through the Manitoba Centre for Health Policy's unique data repository, which holds the Manitoba physician claim, hospital discharge abstracts, and prescription record health databases for all residents in the province, including children. Accessing these will permit an examination of such links to children's respiratory health, based on severity. We have secured formal consent from the parents to link the respiratory health condition of their children to these provincial health databases, enabling such an exploration to be undertaken in the near future. 🐼

**Acknowledgements:** This work was supported by grant 74307 from the Institute of Population and Public Health of the Canadian Institutes of Health Research (CIHR) and by grant 135495 from the CIHR Regional Partnership Program. In addition, funding support was received from the Province of Manitoba through the Manitoba Research and Innovation Fund.

We would like to thank all the families who participated in this study and who allowed us into their homes to conduct an extensive housing audit, including the collection of air samples.

We are indebted to Research Associate Dr. Dan Chateau, Biostatistics Consulting Unit of the Department of Community Health Sciences, Faculty of Medicine, for his initial assistance with the statistical analysis of the data. We would also like to thank Research Associate Scott McCullough and Research Assistant Adrian Werner from the Institute

of Urban Studies, University of Winnipeg, for the mapping analysis using ARC-GIS. Other members of the larger research team include Anita Kozyrskyj, Associate Professor, Department of Community Health Sciences, Faculty of Medicine and Faculty of Pharmacy, University of Manitoba, and Kimberly Thompson, Associate Professor of Risk Analysis and Decision Science, Harvard Medical School.

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TABLE 6

**Association Between Persistent Colds and Socioeconomic Status (SES) Group (Urban Only)**

	SES Group*					$\chi^2$ (df) p-Value
	1 (Poor) # (%)	2 # (%)	3 # (%)	4 # (%)	5 (Affluent) # (%)	
Persistent colds						
Yes	134 (44.7)	178 (38.9)	247 (39.7)	314 (41.5)	351 (34.2)	15.81 (4) .003
No	166 (55.3)	280 (61.1)	375 (60.3)	443 (58.5)	674 (65.8)	
Asthma						
Yes	53 (17.7)	84 (18.3)	117 (18.8)	164 (21.7)	171 (16.7)	7.38 (4) .117
No	247 (82.3)	374 (81.7)	505 (81.2)	593 (78.3)	854 (83.3)	
*SES groups correspond to the following income quintiles (as defined by Manitoba Centre for Health Policy, 2015): Group 1 (10%), \$14,640–\$42,340; Group 2 (14%), \$42,348–\$54,441; Group 3 (20%), \$54,455–\$67,696; Group 4 (24%), \$67,726–\$86,350; and Group 5 (32%), \$86,390–\$406,531.						

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## 2017 Joe Beck Educational Contribution Award

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

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

**Nomination deadline is March 15, 2017.**

To access the online application, visit  
[www.neha.org/joe-beck-educational-contribution-award](http://www.neha.org/joe-beck-educational-contribution-award).



## ► DIRECT FROM AEHAP



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DAAS  
Association of  
Environmental  
Health  
Academic  
Programs



Jason W.  
Marion, PhD  
Eastern  
Kentucky  
University

## Students Can Be an Important Link Between Academia and Practice

**Editor's Note:** In an effort to promote the growth of the environmental health profession and the academic programs that fuel that growth, NEHA has teamed up with the Association of Environmental Health Academic Programs (AEHAP) to publish two columns a year in the *Journal*. AEHAP's mission is to support environmental health education to ensure the optimal health of people and the environment. The organization works hand in hand with the National Environmental Health Science and Protection Accreditation Council (EHAC) to accredit, market, and promote EHAC-accredited environmental health degree programs. AEHAP focuses on increasing the environmental health workforce, supporting students and graduates of EHAC-accredited degree programs, increasing diversity in environmental health degree programs, and educating the next generation.

This column will provide AEHAP with the opportunity to share current trends within undergraduate and graduate environmental health programs, as well as their efforts to further the environmental health field and available resources and information. Furthermore, professors from different EHAC-accredited degree programs will share with the *Journal's* readership the successes of their programs and the work being done within academia to foster the growth of future environmental health leaders.

Chuck Treser is the interim executive director for AEHAP. He is also a principal lecturer emeritus in the Department of Environmental and Occupational Health Sciences at the University of Washington, Seattle. Jason Marion is an associate professor in the Department of Environmental Health at Eastern Kentucky University. He is the current president of AEHAP.

degree programs in environmental health, accredited by the National Environmental Health Science and Protection Accreditation Council (EHAC), are in high demand for entry-level positions with public and private sector employers.

First, these students have a rigorous background in the natural and physical sciences. Second, they have gained an understanding of practical experience in the field through their practice-based education and work done during their required internship. Many of these student internships are performed on site with local, state, and federal health agencies; environmental protection agencies; private sector manufacturing; and other businesses practicing industrial hygiene and safety, including engineering and consulting firms. Third, many of these students have gone beyond sitting in the classroom and participating in a practical internship and have actively engaged with research that confirms, expands, and/or challenges our knowledge of environmental factors and conditions that affect human health and well-being.

Since 2005, the Association of Environmental Health Academic Programs (AEHAP) has conducted a Student Research Competition, inviting both undergraduate and graduate students from EHAC-accredited institutions to submit a paper detailing a current research project in which they have played a significant role. Through funding provided by the Centers for Disease Control and Prevention/ National Center for Environmental Health (CDC/NCEH, award no. EH13-1304) and NSF International, AEHAP has been able to provide

If you have been following the concerns about the aging of the professional environmental health workforce, the importance of succession planning, and the drive to enhance the professional qualifications of en-

vironmental public health practitioners, then it should come as no surprise that students represent an important piece of the puzzle for solving this environmental health workforce issue. Students graduating from bachelor



a monetary award and travel support to bring outstanding students to the National Environmental Health Association's (NEHA) Annual Educational Conference (AEC) & Exhibition each year to present their research findings.

The recent recipients of the AEHAP Student Research Competition award are listed below.

## 2016

- **Scott Biebas**, Undergraduate Student, Baylor University  
Research: Residual Soil Lead in an Urban Residential Neighborhood in West Dallas Affected by Historic Lead Smelter Activities  
Faculty mentor: Dr. Trey Brown
- **Ethan Fuhrman**, Undergraduate Student, University of Wisconsin-Eau Claire  
Research: Airborne Particulates Around Frac Sand Plants Using EPA-Certified Instrument  
Faculty mentor: Dr. Crispin Pierce
- **Marissa Taylor**, Undergraduate Student, Western Carolina University  
Research: Identification of La Crosse, Dengue, Chikungunya, and Zika Vectors Collected From Sticky Traps Using Morphological and Molecular Methods  
Faculty mentor: Dr. Brian Byrd
- **Joshua Volkan**, Graduate Student, East Carolina University  
Research: Evaluation of Barrier Sprays for Mosquito Control in Eastern North Carolina  
Faculty mentors: Drs. Stephanie Richards and Jo Anne Balanay

## 2015

- **Amanda Bewley**, Undergraduate Student, West Chester University  
Research: GMO Corn and Incidence of Insecticide-Related Injuries  
Faculty mentor: Dr. Charles Shorten
- **Linzi Thompson**, Undergraduate Student, East Central University  
Research: UV Photoactivation of Titanium Dioxide Nanoparticles: Enhanced Photo-oxidation of Natural Organic Matter in Aqueous Systems  
Faculty mentor: Dr. Doug Weirick
- **Abigail Tompkins**, Undergraduate Student, Western Carolina University  
Research: Fog Machine Aerosol Nanoscale Characterization  
Faculty mentor: Dr. Burton Ogle

- **Adam Mannarino**, Graduate Student, East Carolina University  
Research: Noise Exposure Assessment Among Groundskeepers: A Pilot Study  
Faculty mentor: Dr. Jo Anne Balanay

Below is a list of the recent NSF International Scholars.

- **2016: Melanie Keil**, Undergraduate Student, Colorado State University  
Research: Examining Use of Third Party Standards in Municipal Drinking Water System Plumbing Component Regulations and Recommendations  
Faculty mentor: Dr. Judy Heiderscheidt
- **2015: Natasha Borgen**, Undergraduate Student, University of Washington  
Research: NSF International Survey: U.S. States Response to NSF/ANSI Standards 350 and 350-1 Standards for Onsite Water Reuse Treatment Systems  
Faculty mentor: Chuck Treser

These are just a few examples of the students who are better prepared to address traditional and emerging environmental health threats. These students are able and eager to tackle the challenges presented by emerging infectious diseases; legacy toxic chemicals and materials polluting the land and water; an international food supply with transportation issues, new processes, and ingredients; occupational health and safety problems as the economy transforms from manufacturing to service industries; and more.

Guiding and supporting these students is something we can all do. Environmental health students benefit when they engage with practitioners and the whole profession benefits from the enthusiasm many students bring to meetings and interactions. In both academic and nonacademic work, there are few greater rewards than mentoring and encouraging students who are capable of successful careers in our profession.

Custard (2016) wrote the following:

The professional legacy each of us leaves will not be in the programs we created or the awards we were honored with, but in the young professionals we trained, mentored, encouraged, and inspired (p. 7).

AEHAP fully agrees. Collectively, NEHA members can support students and career development in some way. First, we can all visit with students and be inquisitive during

student presentations at NEHA's AEC and at state or regional affiliate meetings. Second, students may need mentors for internships or practical projects that generate results warranting presentation. Mentorship is a highly rewarding experience and many practitioners are near an EHAC-accredited school that would welcome project ideas, mentors, and practical experience opportunities for their students. Third, we can continue to identify and implement better strategies for encouraging greater levels of student participation and engagement in our state affiliate conferences.

Reviews for the 2017 AEHAP and NSF International student competitions are underway for the NEHA 2017 AEC in Grand Rapids, MI, which will have a session spotlighting top student research. The benefits and excitement generated from these student research competitions are known fully by the folks who attend their presentations and help make these programs possible.

Please be sure to thank Dr. David Gilkey, Colorado State University, for championing these programs for the last several years through 2016. Please welcome Dr. Clint Pinion, Eastern Kentucky University, for taking over duties this year as chair of these competitions. In addition, the competition is greatly enhanced for the students through the support of CDR Jasen Kunz (CDC/NCEH), Stan Hazen (NSF International), and Dr. David Dyjack (NEHA) for increasing student visibility and engagement at NEHA's AEC.

On behalf of our students and member programs, we look forward to seeing you at the NEHA 2017 AEC in Grand Rapids! 🐾

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## Reference

Custard, B. (2016). Building the future environmental health workforce. *Journal of Environmental Health*, 78(6), 6–7.

## ► DIRECT FROM CDC ENVIRONMENTAL HEALTH SERVICES BRANCH



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## What Actions Are Health Departments Taking to Improve Safe Drinking Water Programs?

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

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

Vanessa Lamers is a project manager in the Performance Management and Quality Improvement Unit of the Public Health Foundation. Brian Hubbard is a health scientist and team lead for CDC's Safe Water for Community Health Program.

In September 2015, the Centers for Disease Control and Prevention (CDC) awarded cooperative agreements to 14 state and five local health departments (Figure 1). The goal of the cooperative agreement program, Safe Water for Community Health (Safe WATCH), is to improve efficiency and effectiveness of public health programs that address drinking water systems and sources (i.e., private wells, springs, cisterns) not covered by the U.S. Environmental Protection Agency's Safe Drinking Water Act. The expected outcome of the program is to reduce exposures to waterborne contaminants for the one in nine American residents who get their drinking water from a private well.

To accomplish these goals and outcomes, CDC asked the funded public health departments to take the following approach:

- assess safe drinking water programs using the Environmental Public Health Performance Standards,
- review assessment results and prioritize performance improvement areas to align with the 10 Essential Environmental Public Health Services (Table 1),
- develop work plans with specific actions needed to address the identified improvement areas, and
- take action to close programmatic gaps.

In addition to providing funding and grant management assistance, CDC partnered with the Public Health Foundation (PHF) to pro-

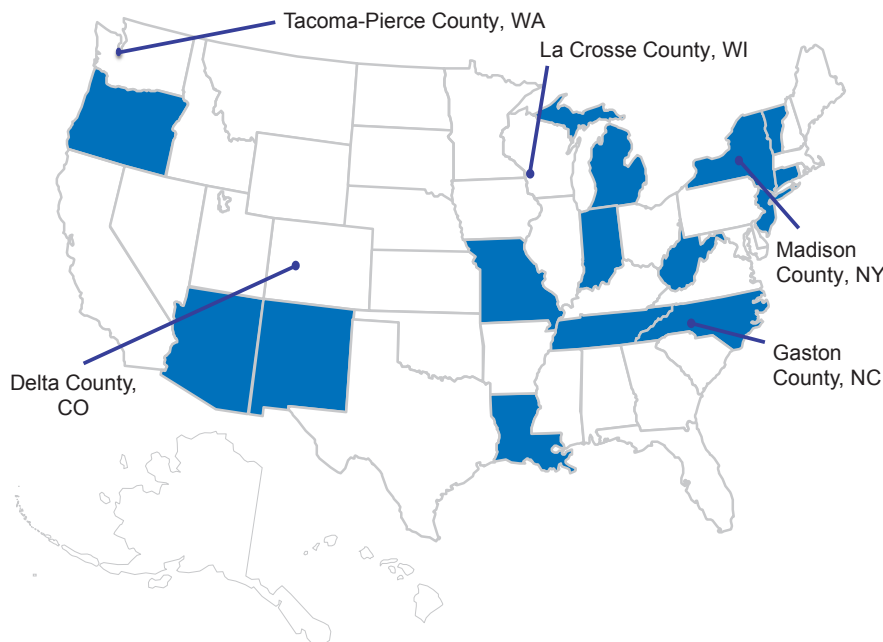
vide quality improvement (QI) training and technical assistance to state and local Safe WATCH partners as they began implementing their work plans and initiating improvement activities. PHF and CDC chose a QI approach for its emphasis on measurable, tangible targets and outcomes. QI in public health involves a continuous and ongoing effort to achieve improvements in the efficiency, effectiveness, and performance of services or processes, which improve the health of the community (Riley et al., 2010). QI has been used previously to address common drinking water challenges such as linking services (Cardenas, 2015), education (Souter, 2015), and patient satisfaction (Pierson, 2015).

Since November 2015, PHF's QI experts have assisted public health departments to plan and complete the prioritized performance improvement activities they identified as part of their cooperative agreements. This support builds upon an earlier collaborative performance improvement initiative between CDC and PHF to provide assistance to local health department vector control programs (Gerding et al., 2016). PHF has assisted more than 30 environmental health programs to move from reactive to proactive. Environmental health program managers with interest in performance improvement can learn more through PHF's performance improvement services.

PHF and CDC have helped Safe WATCH grantees to assess and establish metrics, create and improve drinking water evaluation plans, select community partners to build capacity, and develop and revise assessment tools for

FIGURE 1

### Safe Water for Community Health Grantee Map



Note. Available online at [www.cdc.gov/nceh/ehs/safe-watch/grantees.html](http://www.cdc.gov/nceh/ehs/safe-watch/grantees.html).

TABLE 1

### Ten Essential Environmental Public Health Services

ES1: <b>Monitor</b> environmental and health status to identify and solve community environmental public health problems.
ES2: <b>Diagnose and investigate</b> environmental public health problems and health hazards in the community.
ES3: <b>Inform, educate, and empower</b> people about environmental public health issues.
ES4: <b>Mobilize</b> community partnerships and actions to identify and solve environmental health problems.
ES5: <b>Develop</b> policies and plans that support individual and community environmental public health efforts.
ES6: <b>Enforce</b> laws and regulations that protect environmental public health and ensure safety.
ES7: <b>Link</b> people to needed environmental public health services and assure the provision of environmental public health services when otherwise unavailable.
ES8: <b>Assure</b> a competent environmental public health workforce.
ES9: <b>Evaluate</b> effectiveness, accessibility, and quality of personal and population-based environmental public health services.
ES10: <b>Research</b> for new insights and innovative solutions to environmental public health problems.

Note. Available online at [www.cdc.gov/nceh/ehs/10-essential-services/index.html](http://www.cdc.gov/nceh/ehs/10-essential-services/index.html).

customer satisfaction and service delivery. PHF also helped grantees refine their innovative and out-of-the-box ideas into clear, focused activities and objectives, as well as connect these ideas to health department strategic goals such as accreditation and health equity.

Drinking water grantees have been provided with tools such as PHF's *Public Health Quality Improvement Encyclopedia* (Moran & Duffy, 2012), along with training and facilitation to use these QI tools such as force field analysis (to evaluate a proposed change), aim statements (to create a measurable, time-bound goal), and Gantt charts (to plan project timelines).

Use of QI methods and tools has helped several health departments achieve early wins as part of this cooperative agreement:

- Indiana State Department of Health's Environmental Public Health Division created a Gantt chart that helped to decipher critical versus noncritical activities, track metrics, and conduct short-, medium-, and long-term planning.
- Tacoma-Pierce County (Washington) Health Department's Drinking Water Program is using a plan-do-check-act approach to document and assess their standard operating procedures. They have created over 40 flow charts and are soliciting feedback from staff and customers on these processes, including partnering with the health department's QI team to survey small water systems.
- Madison County (New York) Health Department recognized individual drinking water as a key priority and incorporated it into their community health improvement plan. They developed an aim statement and a plan to identify areas in the county where specific source contaminants may be present and secured resources to provide water quality sampling to more than 100 households per year.
- Tennessee Department of Health (TDH) is addressing spring water quality by offering spring water testing to residents in a county pilot program, along with statewide GIS mapping of drinking water sources. This program was strengthened by forging innovative partnerships with field-based organizations such as the TDH Family Health and Wellness Evidence Based Home Visiting Program, State Parks and Natural Area Program zoological staff, and Communities Unlimited, Inc., a part of the Rural Community Assistance Program.

Although the long-term outcome of the grantees' work is to reduce exposures to waterborne contaminants, they have prioritized other substantial outcomes including establishing water quality information systems, reviewing effectiveness of local regulations, and improving customer satisfaction. CDC and PHF will continue to celebrate grantee successes and stories and provide resources and tools for other drinking water programs that wish to improve their efficiency and effectiveness. 🐼

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Gerding, J., Kirshy, M., Moran, J.W., Bialek, R., Lamers, V., & Sarisky, J. (2016). A performance management initiative for local health department vector control programs. *Environmental Health Insights*, 10, 113–118.

## From the Centers for Disease Control and Prevention

- Environmental Public Health Performance Standards: [www.cdc.gov/nceh/ehs/envphps](http://www.cdc.gov/nceh/ehs/envphps)
- Performance improvement resources: [www.cdc.gov/nceh/ehs/activities/performance.html](http://www.cdc.gov/nceh/ehs/activities/performance.html)
- Safe Water for Community Health (Safe WATCH): [www.cdc.gov/nceh/ehs/safe-watch](http://www.cdc.gov/nceh/ehs/safe-watch)
- Safe WATCH grantee success stories: [www.cdc.gov/nceh/ehs/safe-watch/success-stories.html](http://www.cdc.gov/nceh/ehs/safe-watch/success-stories.html)
- Safe WATCH grantee tools and resources: [www.cdc.gov/nceh/ehs/safe-watch/tools.html](http://www.cdc.gov/nceh/ehs/safe-watch/tools.html)

## From the Public Health Foundation (PHF)

- About PHF: [www.phf.org/AboutUs](http://www.phf.org/AboutUs)
- Drinking water program improvement: [www.phf.org/drinkingwater](http://www.phf.org/drinkingwater)
- Performance improvement services: [www.phf.org/piservices](http://www.phf.org/piservices)
- Vector Control Program Performance Assessment and Improvement Initiative: [www.phf.org/vectorcontrol](http://www.phf.org/vectorcontrol)

Moran, J., & Duffy, G. (2012). *Public health quality improvement encyclopedia*. Washington, DC: Public Health Foundation.

Pierson, B. (2015). *Water quality and customer satisfaction*. Retrieved from Public Health Quality Improvement Exchange Web site: [www.phqix.org/content/water-quality-and-customer-satisfaction](http://www.phqix.org/content/water-quality-and-customer-satisfaction)

Riley, W.J., Moran, J.W., Corso, L.C., Beitsch, L.M., Bialek, R., & Cofsky, A. (2010).

Defining quality improvement in public health. *Journal of Public Health Management and Practice*, 16(1), 5–7.

Souter, S. (2015). *Washington County water testing*. (2015). Retrieved from Public Health Quality Improvement Exchange Web site: [www.phqix.org/content/washington-county-water-testing](http://www.phqix.org/content/washington-county-water-testing)

NATIONAL ENVIRONMENTAL HEALTH ASSOCIATION


# ADVANCE YOUR CAREER WITH A CREDENTIAL

Learn more at [neha.org/professional-development/credentials](http://neha.org/professional-development/credentials)



Environmental Health  
Specialist: REHS/RS



Food Safety:  
CP-FS and CCFS



Healthy Homes:  
HHS



Onsite Wastewater:  
CIOWTS





# 2017 Walter F. Snyder Award

## Call for Nominations

Nomination deadline is April 28, 2017.

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



Nominations for the 2017 *Walter F. Snyder Award* are being accepted for environmental health professionals achieving peer recognition for:

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



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

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

The 2017 Walter F. Snyder Award will be presented during NEHA's 81<sup>st</sup> Annual Educational Conference (AEC) & Exhibition to be held in Grand Rapids, MI July 10-13, 2017.



For more information or to download nomination forms, please visit  
[www.nsf.org](http://www.nsf.org) or [www.neha.org](http://www.neha.org) or contact Stan Hazan at NSF at 734-769-5105 or [hazan@nsf.org](mailto:hazan@nsf.org).



# DAVIS CALVIN WAGNER SANITARIAN AWARD



**The American Academy of Sanitarians (AAS) announces the annual Davis Calvin Wagner Award. The award will be presented by AAS during the National Environmental Health Association's (NEHA) 2017 Annual Educational Conference & Exhibition. The award consists of an individual plaque and a perpetual plaque that is displayed in NEHA's office lobby.**

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

1. Exhibit resourcefulness and dedication in promoting the improvement of the public's health through the application of environmental and public health practices.
2. Demonstrate professionalism, administrative and technical skill, 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, 2017.**

**Nomination packages should be sent electronically to [shep1578@gmail.com](mailto:shep1578@gmail.com). If desired, three hard copies of the nomination document may be submitted to**

American Academy of Sanitarians  
c/o Craig A. Shepherd  
1271 Statesville Road  
Watertown, TN 37184

For more information about the award nomination, eligibility, evaluation process, and previous recipients of the award, please visit [sanitarians.org/awards](http://sanitarians.org/awards).

# CAREER OPPORTUNITIES

## Food Safety Inspector

UL Everclean is a leader in retail inspections. We offer opportunities across the country. We currently have openings for trained professionals to conduct audits in restaurants and grocery stores. Past or current food safety inspection experience is required.

### United States

Albany, NY  
Alexandria, LA  
Atlanta, GA  
Bakersfield, CA  
Baton Rouge, LA  
Billings, MT  
Bismarck, ND  
Boise, ID  
Boston, MA

Buffalo, NY  
Butte, MT  
Charlotte, NC  
Des Moines, IA  
Grand Junction, CO  
Green Bay, WI  
Guam  
Honolulu, HI  
Iowa  
Jacksonville, FL

Kalamazoo, MI  
Kansas City, MO/KS  
Little Rock, AR  
Milwaukee, WI  
Minneapolis, MN  
Owatonna, MN  
Pensacola, FL  
Philadelphia, PA  
Phoenix, AZ  
Pocatello, ID

Raleigh, NC  
Rapid City, SD  
Rochester, NY  
San Antonio, TX  
San Diego, CA  
San Francisco, CA  
Shreveport, LA  
Sioux City, IA  
Sioux Falls, SD  
Spearfish, SD

Springfield, MO  
St. Louis, MO  
St. Paul, MN  
Syracuse, NY  
Tulsa, OK  
Wichita, KS  
Yuma, AZ

### Canada

British Columbia  
Toronto

If you are interested in an opportunity near you, please send your resume to: ATTN Bill Flynn at [LST.RAS.RESUMES@UL.COM](mailto:LST.RAS.RESUMES@UL.COM) or visit our Web site at [www.evercleanservices.com](http://www.evercleanservices.com). 🐾

# EH CALENDAR

## UPCOMING NEHA CONFERENCE

July 10–13, 2017: NEHA 2017 Annual Educational Conference & Exhibition, Grand Rapids, MI. For more information, visit [www.neha.org/aec](http://www.neha.org/aec).

## NEHA AFFILIATE AND REGIONAL LISTINGS

### Arizona

March 8–9, 2017: Spring Conference, hosted by the Arizona Environmental Health Association, Phoenix, AZ. For more information, visit [www.azeha.org](http://www.azeha.org).

### California

April 10–13, 2017: 66th Annual Education Symposium, hosted by the California Environmental Health Association's Citrus Chapter, Garden Grove, CA. For more information, visit [www.ceha.org](http://www.ceha.org).

### Florida

July 13–17, 2017: Annual Education Meeting, hosted by the Florida Environmental Health Association, Sarasota, FL. For more information, visit [www.feha.org](http://www.feha.org).

### Georgia

June 5–7, 2017: Annual Conference, hosted by the Georgia Environmental Health Association. For more information, visit [www.geha-online.org](http://www.geha-online.org).

### Idaho

March 15–16, 2017: Annual Education Conference, hosted by the Idaho Environmental Health and Solid Waste Associations, Boise, ID. For more information, visit [www.ieha.wildapricot.org](http://www.ieha.wildapricot.org).

### Michigan

March 15–16, 2017: Annual Education Conference, hosted by the Michigan Environmental Health Association, Big Rapids, MI. For more information, visit [www.meha.net/AEC](http://www.meha.net/AEC).

### Minnesota

May 10–12, 2017: Spring Conference, hosted by the Minnesota Environmental Health Association, Ruttger's Bay Lake, MN. For more information, visit [www.mehaonline.org](http://www.mehaonline.org).

### Nevada

April 11–12, 2017: Annual Joint Education Conference, hosted by the Nevada Environmental Health Association and the Nevada Food Safety Task Force, Reno, NV. For more information, visit [www.nveha.org](http://www.nveha.org).

### New Jersey

March 5–7, 2017: Educational Conference & Exhibition, hosted by the New Jersey Environmental Health Association, Atlantic City, NJ. For more information, visit [www.njeha.org](http://www.njeha.org).

### Utah

April 26–28, 2017: Spring Conference, hosted by the Utah Environmental Health Association, Bryce Canyon, UT. For more information, visit [www.ueha.org/events.html](http://www.ueha.org/events.html).

### Washington

May 1–3, 2017: Annual Education Conference, hosted by the Washington State Environmental Health Association, Wenatchee, WA. For more information, visit [www.wseha.org](http://www.wseha.org).

### West Virginia

May 9–11, 2017: Sanitarian's Mid Year Conference, hosted by the West Virginia Association of Sanitarians, Ripley, WV. For more information, visit [www.wvdhhr.org/wvas](http://www.wvdhhr.org/wvas).

## TOPICAL LISTINGS

### Public Health

April 11–12, 2017: Iowa Governor's Conference on Public Health, Des Moines, IA. For more information, visit [www.ieha.net/LGCPH](http://www.ieha.net/LGCPH).

April 25–27, 2017: Kansas Governor's Public Health Conference, Manhattan, KS. For more information, visit <http://webs.wichita.edu/?u=conferences&p=publichealth>. 🐾

# RESOURCE CORNER

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



## Certified Professional-Food Safety Manual (Third Edition)

National Environmental Health Association (2014)



The Certified Professional-Food Safety (CP-FS) credential is well respected throughout the environmental health and food safety field. This manual has been developed by experts from across the various food safety disciplines to help candidates prepare for NEHA's CP-FS exam. This book contains science-based, in depth information about causes and prevention of foodborne

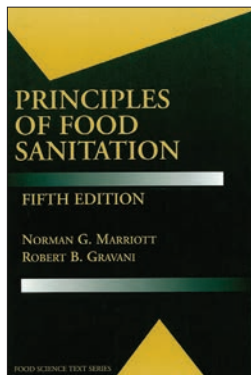
illness, HACCP plans and active managerial control, cleaning and sanitizing, conducting facility plan reviews, pest control, risk-based inspections, sampling food for laboratory analysis, food defense, responding to food emergencies and foodborne illness outbreaks, and legal aspects of food safety.

358 pages / Spiral-bound paperback

Member: \$179 / Nonmember: \$209

## Principles of Food Sanitation (Fifth Edition)

Norman G. Marriott and Robert B. Gravani (2006)



This book provides sanitation information needed to ensure hygienic practices and safe food for food industry and regulatory professionals. It addresses the principles related to contamination, cleaning compounds, sanitizing, and cleaning equipment. It also presents specific directions for applying these concepts to attain hygienic conditions in food processing or preparation operations. The book includes chapters that address biosecurity and allergens as they relate

to food sanitation, as well as chapters on the fundamentals of food sanitation, contamination sources and hygiene, HACCP, cleaning and sanitizing equipment, and waste handling disposal. Study reference for NEHA's REHS/RS and CP-FS exams.

413 pages / Hardback

Member: \$84 / Nonmember: \$89

## Professional Food Manager, 5th Edition

National Environmental Health Association (2016)



**NEW!** NEHA's *Professional Food Manager, 5th Edition* provides culinary and hospitality professionals and students with the knowledge they need to ensure successful execution of best food safety practices in the workplace. Updated to the 2015 Supplement to the 2013 Food and Drug Administration *Food Code*, this book provides vital information on the principles of food safety

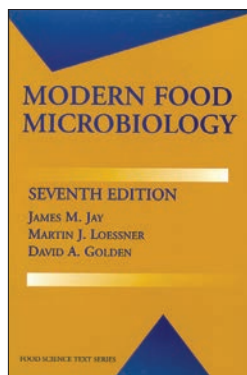
management and how to use those principles to create a food safety culture. Additionally, it contains streamlined, validated content by NEHA subject matter experts to support the education of food managers and provides the knowledge needed for culinary and hospitality professionals to pass accredited food manager certification exams.

166 pages / Paperback

Member: \$22 / Nonmember: \$26

## Modern Food Microbiology (Seventh Edition)

James M. Jay, Martin J. Loessner, and David A. Golden (2005)



This text explores the fundamental elements affecting the presence, activity, and control of microorganisms in food. It includes an overview of microorganisms in food and what allows them to grow; specific microorganisms in fresh, fermented, and processed meats, poultry, seafood, dairy products, fruits, vegetables, and other products; methods for finding and measuring microorganisms and their products in foods; methods for preserving foods; food safety and

quality controls; and foodborne diseases. Other section topics include biosensors, biocontrol, bottled water, *Enterobacter sakazakii*, food sanitizers, milk, probiotics, proteobacteria, quorum sensing, and sigma factors. Study reference for NEHA's CP-FS exam.

790 pages / Hardback

Member: \$84 / Nonmember: \$89

# JEH QUIZ

## FEATURED ARTICLE QUIZ #5

### Presence of Household Mold, Children's Respiratory Health, and School Absenteeism: Cause for Concern

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

1. Read the featured article carefully.
2. Select the correct answer to each *JEH* Quiz question.
3. a) Complete the online quiz found at [www.neha.org/publications/journal-environmental-health](http://www.neha.org/publications/journal-environmental-health),  
b) Fax the quiz to (303) 691-9490, or  
c) Mail the completed quiz to  
*JEH* Quiz, NEHA  
720 S. Colorado Blvd., Suite 1000-N  
Denver, CO 80246.  
Be sure to include your name and membership number!
4. One CE credit will be applied to your account with an effective date of March 1, 2017 (first day of issue).
5. Check your continuing education account online at [www.neha.org](http://www.neha.org).
6. You're on your way to earning CE hours!

#### Quiz Registration

Name \_\_\_\_\_

NEHA Member No. \_\_\_\_\_

E-mail \_\_\_\_\_

#### JEH Quiz #3 Answers December 2016

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

#### → Quiz deadline: June 1, 2017

1. In the U.S., approximately \_\_\_ of children are diagnosed with asthma.
  - a. 6%
  - b. 9%
  - c. 15%
  - d. 23%
2. In Canada, data show that \_\_\_ of children are currently affected by asthma.
  - a. 1%–4%
  - b. 5%–9%
  - c. 10%–15%
  - d. 16%–20%
3. Studies in the U.S. have indicated that asthma-related hospitalizations have risen disproportionately for \_\_\_ children.
  - a. inner-city
  - b. suburban
  - c. rural
4. A previous study found that children with asthma have \_\_\_ absenteeism rate than do nonasthmatic children.
  - a. a significantly lower
  - b. the same
  - c. a significantly higher
5. Evidence suggests that absenteeism rates due to asthma are lower for girls than for boys.
  - a. True.
  - b. False.
6. This study had a \_\_\_ response rate from parents who received a survey.
  - a. 25%
  - b. 35%
  - c. 45%
  - d. 55%
7. \_\_\_ was the most common mold found in study participant homes.
  - a. *Alternaria*
  - b. *Aspergillus*
  - c. *Cladosporium*
  - d. *Penicillium*
8. Children with both asthma and persistent colds miss \_\_\_ times more days than healthy children.
  - a. 2.4–2.6
  - b. 3.7–4.2
  - c. 5.8–7.9
  - d. 8.8–10.9
9. In this study, \_\_\_ of children residing in the poorest district had persistent colds compared to \_\_\_ of children residing in the most affluent district.
  - a. 30.5%; 56%
  - b. 30.5%; 12%
  - c. 56%; 30.5%
  - d. 56%; 40.5%
10. There was no statistically significant association between socioeconomic status and asthma.
  - a. True.
  - b. False.
11. There was \_\_\_ found between *Cladosporium* levels from air sample analyses and children's asthma in combination with persistent colds.
  - a. no significant association
  - b. a significant association
12. Among U.S. children and adolescents aged 5–17 years, asthma accounts for a yearly loss of \_\_\_ million school days.
  - a. 5
  - b. 10
  - c. 15
  - d. 20



# IN MEMORIAM

## Robert E. Harrington

We were saddened to learn that Bob Harrington passed away on November 4, 2016. His environmental health career spanned almost 40 years, making a positive difference in the communities and organizations he worked for and colleagues he worked with.

Harrington received his undergraduate and graduate degrees at Colorado State University and began his career in 1974 as a sanitarian at the El-Paso City-County Health Department in Colorado Springs. He moved up the ranks during his time there, leaving in 1980 as a senior supervisor. From there he worked for the Western Regional National Railroad Passenger Corporation (Amtrak) from 1980–1985, directing internal quality control sanitation programs for all Amtrak operations in 11 western states. From 1985–1997, Harrington served as the vice president of technical services for public health and safety for the National Restaurant Association (NRA). Through his work at NRA, he provided technical guidance on legislative and policy issues that impacted the foodservice industry.

Harrington's final career move brought to him to Wyoming in 1997, where he served as director for the City of Casper–Natrona County Health Department. He was responsible for all aspects of the department, including community public health nursing, disease prevention, and environmental health. He retired from the health department in 2013.

Along with his work in the field, Harrington was actively involved in numerous environmental public health organizations. He was a registered sanitarian through NEHA, as well as a long-time member. He was involved in NEHA's industry affiliate, serving as president from 1996–1997, and was a member of NEHA's Wyoming affiliate. He was also a diplomate of the American Academy of Sanitarians. Other associations he was involved in included the Wyoming Public Health Association, Western Association of Food and Drug Officials, Wyoming Governor's Food Safety Council, National Automatic Merchandising Association, and Conference for Food Protection.

Harrington is survived by his wife, two children, and one grandchild. His hobbies included horseback riding, model railroads, and a broad love of music. He was an extremely talented musician, being able to play the guitar, banjo, mountain dulcimer, mandolin, accordion, tin whistle, and Highland bagpipe.

While Harrington had a strong impact on the environmental health profession and the communities and organizations he served, he also made an equally strong impact on his colleagues. Chuck Higgins, retired captain from the U.S. Public Health Service, spoke of Harrington's impact on his career, "I met Bob early in my career and our paths seemed to cross at critical junctions. His seriousness about the profession had a great impact on me. In our private conversations he always emphasized the importance

of our obligation to the public. I used that advice to guide many decisions over my career."

Long-time friend Bob Powitz remembered the first time he met Harrington, "I met Bob Harrington at a NEHA conference. We hit it off immediately. We both enjoyed and were proud of what we were doing. We both blatantly identified ourselves as 'sanitarians,' and we were both committed to continuing education and innovations in our practice. In other words, we were cut out of the same bolt of cloth, or two identical dial thermometers in the tool bag." Powitz went on to say, "We called each other when we needed advice or a sounding board. We exchanged ideas, lit new fires, put out old ones, criticized everything we knew, and always came away with the answers we needed. Bob was a traditionalist, but with a twist. He always found a novel approach to some old and hackneyed environmental health concept or method. His approach to problems did much to change my way of thinking and his ideas changed the classic meme of our industry and profession. Damn, he is missed."

Michèle Samarya-Timm recalls that Harrington was "a true old-school sanitarian with a long-standing dedication to the field of environmental health. Bob was always armed with an informative and entertaining public health anecdote, usually accented with an infectious laugh. In addition to sharing, he was always willing to expand his expertise by exploring new ideas, topics, and innovations—and despite some theatrical protests, he even embraced the new-fangled world of computer literacy! Perhaps my favorite quote from Bob is, 'Environmental health is the voice of reason that can overcome the silliness of those who only think they're in the know.' We will certainly miss him and his dedication to our profession."

"I knew Bob for years. He was always the consummate professional and 'whip smart' about knowledge of the profession. He was also willing to share that knowledge with others," commented CAPT Gary Noonan. "I appreciated his rather quirky and wry sense of humor. He was always fun to be around and I will miss him a great deal. It is still hard to believe he is gone."

NEHA wishes to express its deepest sympathies to Harrington's family, friends, and colleagues. He was a memorable and outstanding figure in our profession, and he touched the hearts and minds of many of us. He will be greatly missed. 🌹

Editor's Note: The *Journal* would like to thank Patricia Taliaferro for providing us with information about her father's career. We also appreciate the quote contributions from Harrington's friends and colleagues. 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](mailto:kruby@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 one 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/about-neha/donate](http://www.neha.org/about-neha/donate).

*Thank you.*

### DELEGATE CLUB (\$25–\$99)

*Name in the Journal for one year and endowment pin.*

**Richard W. Mitzelfelt**  
Edgewood, NM

### HONORARY MEMBERS CLUB

(\$100–\$499)

*Letter from the NEHA president, name in the Journal for one year, and endowment pin.*

**Tim Hatch, MPA, REHS**  
Montgomery, AL

**Adam E. London, RS, MPA**  
Grand Rapids, MI

**Larry Ramdin, REHS, CP-FS, HHS**  
Salem, MA

**Ned Therien, MPH**  
Olympia, WA

### 21st CENTURY CLUB

(\$500–\$999)

*Name submitted in drawing for a free one-year NEHA membership, name in the Journal for one year, and endowment pin.*

**Bob Custard, REHS, CP-FS**  
Lovettsville, VA

**David T. Dyjack, DrPH, CIH**  
Denver, CO

**Peter M. Schmitt**  
Shakopee, MN

**LCDR James Speckhart, MS**  
Silver Spring, MD

**Leon Vinci, DHL, RS**  
Roanoke, VA

### SUSTAINING MEMBERS CLUB

(\$1,000–\$2,499)

*Name submitted in drawing for a free two-year NEHA membership, name in the Journal for one year, and endowment pin.*

**James J. Balsamo, Jr., MS, MPH, MHA, RS, CP-FS**  
Metairie, LA

**Gavin F. Burdge**  
Lemoyne, PA

**George A. Morris, RS**  
Dousman, WI

### AFFILIATES CLUB

(\$2,500–\$4,999)

*Name submitted in drawing for a free AEC registration, name in the Journal for one year, and endowment pin.*

**Vince Radke, MPH, REHS, CP-FS, DAAS, CPH**  
Atlanta, GA

### EXECUTIVE CLUB AND ABOVE

(\$5,000–\$100,000)

*Special invitation to the AEC President's Reception, name in the Journal for one year, and endowment pin.*

## NEHA ENDOWMENT FOUNDATION PLEDGE CARD

**I pledge to be a NEHA Endowment Foundation Contributor in the following category:**

- |   |  |  |
|---|--|--|
| <input type="radio"/> Delegate Club (\$25)              | <input type="radio"/> Affiliates Club (\$2,500)            | <input type="radio"/> Visionary Society (\$50,000)   |
| <input type="radio"/> Honorary Members Club (\$100)     | <input type="radio"/> Executive Club (\$5,000)             | <input type="radio"/> Futurists Society (\$100,000)  |
| <input type="radio"/> 21st Century Club (\$500)         | <input type="radio"/> President's Club (\$10,000)          | <input type="radio"/> <b>You have my permission to disclose the fact and amount (by category) of my contribution and pledge.</b> |
| <input type="radio"/> Sustaining Members Club (\$1,000) | <input type="radio"/> Endowment Trustee Society (\$25,000) |  |

I plan to make annual contributions to attain the club level of \_\_\_\_\_ over the next \_\_\_\_\_ years.

Signature \_\_\_\_\_ Print Name \_\_\_\_\_

Organization \_\_\_\_\_ Phone \_\_\_\_\_

Street Address \_\_\_\_\_ City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

☐ Enclosed is my check in the amount of \$\_\_\_\_\_ payable to **NEHA Endowment Foundation**.

☐ Please bill my: MasterCard/Visa/American Express # \_\_\_\_\_ Exp. Date \_\_\_\_\_ CVV \_\_\_\_\_

Signature \_\_\_\_\_

**MAIL TO: NEHA, 720 S. Colorado Blvd., Suite 1000-N, Denver, CO 80246, or FAX to: 303.691.9490.**

1703JEHEND

# NEHA ORGANIZATIONAL MEMBERS

## Sustaining Members

### Accela

[www.accela.com](http://www.accela.com)

### Advanced Fresh Concepts Corp.

[www.afcsushi.com](http://www.afcsushi.com)

### Albuquerque Environmental Health Department

[www.cabq.gov/environmentalhealth](http://www.cabq.gov/environmentalhealth)

### Allegheny County Health Department

[www.achd.net](http://www.achd.net)

### American Chemistry Council

[www.americanchemistry.com](http://www.americanchemistry.com)

### Arlington County Public Health Division

[www.arlingtonva.us](http://www.arlingtonva.us)

### Association of Environmental Health Academic Programs

[www.aehap.org](http://www.aehap.org)

### Black Hawk County Health Department

[www.co.black-hawk.ia.us/258/Health-Department](http://www.co.black-hawk.ia.us/258/Health-Department)

### Cabell-Huntington Health Department

[www.cabellhealth.org](http://www.cabellhealth.org)

### Chemstar Corporation

[www.chemstarcorp.com](http://www.chemstarcorp.com)

### Chesapeake Health Department

<http://chesapeake.vdh.virginia.gov>

### City of Bloomington

[www.bloomingtonmn.gov](http://www.bloomingtonmn.gov)

### City of Milwaukee Health Department, Consumer Environmental Health

<http://city.milwaukee.gov/Health>

### City of St. Louis Department of Health

[www.stlouis-mo.gov/government/departments/health](http://www.stlouis-mo.gov/government/departments/health)

### Coconino County Public Health

[www.coconino.az.gov](http://www.coconino.az.gov)

### Colorado Department of Public Health & Environment, Division of Environmental Health and Sustainability, DPU

[www.colorado.gov/pacific/cdphe/dehs](http://www.colorado.gov/pacific/cdphe/dehs)

### Denver Department of Environmental Health

[www.denvergov.org/DEH](http://www.denvergov.org/DEH)

### Digital Health Department, Inc.

[www.dhdinspections.com](http://www.dhdinspections.com)

### Diversey, Inc.

[www.diversey.com](http://www.diversey.com)

### Douglas County Health Department

[www.douglascountyhealth.com](http://www.douglascountyhealth.com)

### DuPage County Health Department

[www.dupagehealth.org](http://www.dupagehealth.org)

### Eastern Idaho Public Health District

[www.phd7.idaho.gov](http://www.phd7.idaho.gov)

### Ecobond Lead Defender

[www.ecobondlbp.com](http://www.ecobondlbp.com)

### Ecolab

[www.ecolab.com](http://www.ecolab.com)

### EcoSure

[gail.wiley@ecolab.com](mailto:gail.wiley@ecolab.com)

### Elite Food Safety Training

[www.elitefoodsafety.com](http://www.elitefoodsafety.com)

### Florida Department of Health in Sarasota County

<http://sarasota.floridahealth.gov>

### Georgia Department of Public Health, Environmental Health Section

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

### Gila River Indian Community: Environmental Health Service

[www.gilariver.org](http://www.gilariver.org)

### GLO GERM/Food Safety First

[www.glogerm.com](http://www.glogerm.com)

### Hawkeye Area Community Action

[www.hacap.org](http://www.hacap.org)

### Health Department of Northwest Michigan

[www.nwhealth.org](http://www.nwhealth.org)

### Hedgerow Software Ltd.

[www.hedgerowsoftware.com](http://www.hedgerowsoftware.com)

### Heuresis Corporation

[www.heuresistech.com](http://www.heuresistech.com)

### Hoot Systems, LLC

<http://hootsystems.com>

### Inspect2GO Health Inspection Software

[www.inspect2go.com/ehs](http://www.inspect2go.com/ehs)

### InspekPro, LLC

[www.inspekpro.com](http://www.inspekpro.com)

### Kanawha-Charleston Health Department

[www.kchdhw.org](http://www.kchdhw.org)

### Kenosha County Division of Health

[www.co.kenosha.wi.us/index.aspx?NID=297](http://www.co.kenosha.wi.us/index.aspx?NID=297)

### LaMotte Company

[www.lamotte.com](http://www.lamotte.com)

### Lenawee County Health Department

[www.lenaweehealthdepartment.org](http://www.lenaweehealthdepartment.org)

### Linn County Public Health

[www.linncounty.org/health](http://www.linncounty.org/health)

### Macomb County Environmental Health Association

[jarrod.murphy@macombgov.org](mailto:jarrod.murphy@macombgov.org)

### Maricopa County Environmental Services

[www.maricopa.gov/envsvc](http://www.maricopa.gov/envsvc)

### Micro Essential Lab

[www.microessentiallab.com](http://www.microessentiallab.com)

### Mid-Iowa Community Health

[www.micaonline.org](http://www.micaonline.org)

### Multnomah County Environmental Health

[www.multco.us/health](http://www.multco.us/health)

### National Center for Healthy Housing

[www.nchh.org](http://www.nchh.org)

### National Environmental Health Science and Protection Accreditation Council

[www.ehacoffice.org](http://www.ehacoffice.org)

### National Swimming Pool Foundation

[www.nspf.org](http://www.nspf.org)

### New York City Department of Health & Mental Hygiene

[www.nyc.gov/health](http://www.nyc.gov/health)

### North Bay Parry Sound District Health Unit

[www.myhealthunit.ca/en/index.asp](http://www.myhealthunit.ca/en/index.asp)

### Nova Scotia

Truro, NS, Canada

### NSF International

[www.nsf.org](http://www.nsf.org)

### Omaha Healthy Kids Alliance

[www.omahahealthykids.org](http://www.omahahealthykids.org)

### Otter Tail County Public Health

[www.co.ottertail.mn.us/494/Public-Health](http://www.co.ottertail.mn.us/494/Public-Health)

### Ozark River Hygienic Hand-Wash Station

[www.ozarkriver.com](http://www.ozarkriver.com)

### Polk County Public Works

[www.polkcountyiaowa.gov/publicworks](http://www.polkcountyiaowa.gov/publicworks)

### Pride Community Services

[www.prideinlogan.com](http://www.prideinlogan.com)

### Professional Laboratories, Inc.

[www.prolabinc.com](http://www.prolabinc.com)

### Prometric

[www.prometric.com](http://www.prometric.com)

### QuanTEM Food Safety Laboratories

[www.quantemfood.com](http://www.quantemfood.com)

### Seattle & King County Public Health

[www.kingcounty.gov/healthservices/health.aspx](http://www.kingcounty.gov/healthservices/health.aspx)

### Seminole Tribe of Florida

[www.semtribe.com](http://www.semtribe.com)

### Skogen's Festival Foods

[www.festfoods.com](http://www.festfoods.com)

### Sonoma County Permit and Resource Management Department, Wells and Septic Section

[www.sonoma-county.org/prmd](http://www.sonoma-county.org/prmd)

### Southwest District Health Department

[www.swdh.org](http://www.swdh.org)

### Southwest Utah Health Department

[www.swuhealth.org](http://www.swuhealth.org)

### Starbucks Coffee Company

[www.starbucks.com](http://www.starbucks.com)

### StateFoodSafety.com

[www.statefoodsafety.com](http://www.statefoodsafety.com)

### Stater Brothers Market

[www.staterbros.com](http://www.staterbros.com)

### Steritech Group, Inc.

[www.steritech.com](http://www.steritech.com)

### Sweeps Software, Inc.

[www.sweepssoftware.com](http://www.sweepssoftware.com)

### Texas Roadhouse

[www.texasroadhouse.com](http://www.texasroadhouse.com)

### Tri-County Health Department

[www.tchd.org](http://www.tchd.org)

### UL

[www.ul.com](http://www.ul.com)

### Washington County Environmental Health (Oregon)

[www.co.washington.or.us/HHS/EnvironmentalHealth](http://www.co.washington.or.us/HHS/EnvironmentalHealth)

### Waukesha County Environmental Health Division

[www.waukeshacounty.gov/environmental\\_health](http://www.waukeshacounty.gov/environmental_health)

### Wegmans Food & Pharmacy, Inc.

[www.wegmans.com](http://www.wegmans.com)

## Educational Members

### Baylor University

[www.baylor.edu](http://www.baylor.edu)

### East Carolina University

[www.ecu.edu/cs-hhp/hlth](http://www.ecu.edu/cs-hhp/hlth)

### East Tennessee State University, DEH

[www.etsu.edu](http://www.etsu.edu)

### Eastern Kentucky University

<http://ehs.eku.edu>

### Michigan State University, Online

Master of Science in Food Safety  
[www.online.foodsafety.msu.edu](http://www.online.foodsafety.msu.edu)

### The University of Findlay

[www.findlay.edu](http://www.findlay.edu)

### University of Wisconsin-Oshkosh, Lifelong Learning & Community Engagement

[www.uwosh.edu/llce](http://www.uwosh.edu/llce)

### University of Wisconsin-Stout,

College of Science, Technology, Engineering, and Mathematics  
[www.uwstout.edu](http://www.uwstout.edu)

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## NEHA SECOND VICE-PRESIDENTIAL CANDIDATE PROFILES

*NEHA elects its leaders through a ballot that goes to all active and life members prior to the annual conference. Among other things, the ballot features the election for the position of NEHA second vice-president. The person elected to this position begins a five-year commitment to NEHA that involves advancing each year to a different national office, eventually to become NEHA's president.*

*Election policy specifies that candidate profiles for the second vice-president be limited to 800 words in total length. If a candidate's profile exceeds that limit, the policy requires that the profile is terminated at the last sentence before the 800-word limit is exceeded. In addition, the submitted profiles have not been grammatically edited, but presented as submitted and within the 800-word limitation. This year, NEHA presents two candidates for the office of second vice-president. The candidates are listed in alphabetical order as they will appear on the ballot.*



### **Stan Hazan, BSc, MPH, MBA**

Stan Hazan has worked in environmental health for over 35 years, collaborating with industry, academia, federal and state agencies, legislative bodies and organizations to help promote public health and safety initiatives.

Stan began his career as an analytical chemist in Canada, conducting drug screens on racehorses and Olympic athletes. He performed forensic analyses in drug, arson and scuba accident cases. Stan co-led a Canadian Defense Department study looking at the pharmacokinetic profiles of marijuana administration to human subjects to determine dose and timing of exposure, and tracking the concentrations of the active ingredients and major metabolites. He also led a study of emissions from a Hamilton, Ontario landfill site. He performed chemical analyses on water, soil, fish and infant formula, including drug residues in poultry. He developed unique high yield extraction/concentration methods for dioxins and PCBs from soils and fish. He developed new analytical methods using APCI/Triple Quad Mass Spectrometry using SCIEX's cutting-edge technology. His work was important in determining environmental and occupational exposures from Superfund sites, factories and products. Stan achieved dioxin laboratory qualification under the EPA's Contract Laboratory Program.

In 1988 he was hired to be the first Program Manager at NSF for certification of drinking water additives according to NSF/ANSI 60 and 61. He grew the program to more than 1,200 clients in 10 years. Working closely with water utilities and federal/state regulators, this program, now the largest at NSF, serves as a model third-party certification program to assist regulators. In 2000, he created the NSF Nonfood Compounds Registration Program based on the USDA White Book. Again, working with multiple stakeholders, the program has hundreds of clients and the NSF White Book ended up replacing that of the USDA.

From 1996 to 1999, Stan served as Sr. Director of Marketing, Communications and Business Development for all NSF International programs. He led the team that developed the first NSF presence on the internet, and transitioned NSF listings from printed Blue Books to online searchable listings updated daily. He was charged with gaining acceptance for the NSF HACCP-9000 Food Safety Management System program, the first to combine safety and quality aspects of food production.

From 1999 to 2003, Stan managed NSF International's Training, Education and Conferences Program. He provided training in NSF standards, Food Manager Certification, HACCP Manager Certification, and training in ISO 9000 and ISO 14000. He helped to develop the popular NSF HealthGuard Food Manager and HACCP Manager training books. He produced multiple conferences, including a successful conference in Geneva, Switzerland, in conjunction with WHO, on heterotrophs in drinking water. He won two USDA contracts to develop and manage food safety education conferences in 2006 and 2010, resulting in Stan receiving a USDA Secretary for Food Safety Award.

In his current role as Sr. Director of Science and Regulatory Affairs, Stan represents NSF International on a multitude of issues ranging from third-party certification, accreditation and consensus standards to regulations and legislation. He has played central roles at NSF as a resource on FSMA (Food Safety Modernization Act) and to Flint and the Michigan DEQ during the water crisis.

In 2008 Stan graduated from the University of Michigan, School of Public Health (UM SPH) with an MPH in environmental health sciences, which combined with his MBA, helped prepare him to contribute to making environmental health a strong focal point for NSF. He also earned a certificate in International Food Law and Regulation from Michigan State University. Stan has worked closely with, and been mentored by, NSF staff who have previously served as NEHA presidents. He also earned the NEHA Past President's Award in 2016 "in recognition of long-standing service and contributions to NEHA and to the Environmental Health Profession."

Stan currently serves as Secretary to the NSF Council of Public Health Consultants that ensures NSF standards are protective of public health. Stan is also coordinator for the NSF/PAHO/WHO Collaborating Centers for Food Safety, Water Quality and Indoor Environments. Additionally, he is the NSF representative to the Codex Alimentarius Commission. For the last 13 years, he has served as coordinator of the Walter F. Snyder Award that NSF and NEHA present jointly. He serves on several boards including the Partnership for Food Safety Education and the UM SPH Dean's Advisory Board.

Stan's chemistry, environmental health, business and regulatory backgrounds position him to contribute to the success of NEHA as an organization. The missions of NSF International and NEHA are intertwined, with NSF working closely with NEHA over the decades. He looks forward to carrying on that tradition as well as

## NEHA SECOND VICE-PRESIDENTIAL CANDIDATE PROFILES

working with NEHA officers, staff and its Executive Director to help strengthen and grow NEHA to the benefit of EH professionals and protection of the general public.



### **Sandra Long, REHS, RS, CP-FS**

Sandra Long believes it is important to realize and recognize all the fields of work, disciplines of study and areas of involvement Environmental Health encompasses and reach out to these groups and individuals.

To pique the interest of new members and professionals in the field it is important to keep the momentum of the new direction National Environmental Health Association (NEHA). To embraced involvement, moving the profession out of the shadows and being the voice of environmental health. This is a mission all Environmental Health professionals can contribute towards.

In her career Sandra has worked in a variety of areas of Environmental Health which include wastewater, water, food inspection, code enforcement, animal services, foodborne illness investigations, rental home inspections, child care inspections, and swimming pool inspections. She realizes that “boots on the ground” is important.

Sandra Long is a Registered Environmental Health Specialist/Registered Sanitarian and the Environmental Health Supervisor for the City of Plano Environmental Health and Sustainability Department in Plano, Texas. She graduated from the Texas Woman's University where key areas of study were general biology and microbiology.

She is a dedicated professional who is passionate about environmental health. It is not just a profession, but a way of life. She understands the significance of our profession and tries to help others understand as well. She believes that NEHA has a unique ability to further the cause at the national, and even international, level.

Sandra has served as the Regional Vice President for Region Five representing New Mexico, Texas, Oklahoma, Louisiana, Arkansas, Missouri and Kansas. If elected as your next 2nd Vice President,

she intends to work to increase member involvement and to make the association more attractive to the next generation of EH professionals. She believes that NEHA's future relies on the education and participation of the next generation of professionals.

Sandra has also served as the presiding officer of the Texas Sanitarian Advisory Committee where she was instrumental in bringing Sanitarians in Texas to a professional level, providing measures in the State Statutes allowing a National Environmental Health Association (NEHA) Registered Environmental Health Specialist (REHS) to become a Texas Register Sanitarian without examination. Continuing education hours from NEHA are accepted by Texas Department of State Health Services to be applied for continuing education for the Texas Registered Sanitarian. And having Texas Governors Bush and Perry sign Governors Proclamations recognizing Environmental Health Specialist and Professional Registered Sanitarians in the state of Texas.

Sandra is a past president of the Texas Environmental Health Association (TEHA) and has been recognized by TEHA with the prestigious TEHA I.E. Scott Award for career outstanding contributions to the Environmental Health Profession.

She has been an active member of the National Environmental Health Science & Protection Accreditation Council (EHAC) since 2011 serving as a practitioner with a focused interest developing students in the field of Environmental Health. With the idea that the field of Environmental Health will continue to grow it is vital to encourage and provide the education and guidance for the future. For the past two years Sandra has served at the EHAC Nominations Chair.

She is published in Food Protection Trends, is active with her church, Immaculate Conception Catholic Church, Denton, TX and her community with the Boy Scouts of America in The Colony, TX.

Additional awards and recognitions include four TEHA President's Meritorious Service Awards, TEHA Honorary Life membership, TEHA Fellow, TEHA North Texas Chapter Willy Acuna Meritorious Service Award, two NEHA Presidential Citations, NEHA Certificate of Merit and two recognitions as employee of the year. 🐼

NATIONAL ENVIRONMENTAL HEALTH ASSOCIATION



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## NEHA NEWS

**Join the UNCOVER EH Effort!**

Understanding the Needs, Challenges, Opportunities, Vision, and Emerging Roles in Environmental Health (UNCOVER EH) is a national initiative between NEHA, the Centers for Disease Control and Prevention, and Baylor University to learn more about the environmental health profession.

The study, scheduled to begin this year, will consist of an online survey and in-person workshops of environmental health professionals working at health departments. Its purpose is to describe the environmental health workforce, understand the challenges environmental health professionals face to ensure healthy communities, and learn more about the resources and training needed to address current and emerging environmental health issues.

"We are pleased to lead a study that exclusively examines the single largest segment of the public health workforce—environmental health. While many other workforce studies have been conducted over the years, this comprehensive study is the first to be conducted by the environmental health profession for the environmental health profession," said Dr. David Dyjack, NEHA executive director.

Efforts of environmental health professionals are critical for protecting public health and the environment, yet these efforts often

go unnoticed until problems occur (e.g., foodborne outbreaks, vectorborne diseases, contaminated water supplies, disasters).

A national-level report will provide a foundation for leaders and decision makers to formulate evidence-based decisions regarding workforce capacity and public health safety for their communities. Additionally, this information can serve as a tool to plan future environmental health training needs and to better understand emerging environmental health issues.

Here are five ways in which you can help.

1. Register to receive the e-mail survey that will be launched later this year.
2. Sign up for UNCOVER EH e-mail updates.
3. Give an UNCOVER EH presentation at your staff meeting. Find slides available on our Web site at [www.neha.org/uncover-eh](http://www.neha.org/uncover-eh).
4. Invite us to present information on UNCOVER EH at your affiliate meeting or training.
5. Spread the word to your colleagues and local communities through newsletters, e-mails, Web site links, etc.

Visit [www.neha.org/uncover-eh](http://www.neha.org/uncover-eh) to learn more about UNCOVER EH and help spread the word to ensure that we capture information from as many environmental health professionals as possible. 🐼

## Did You Know?

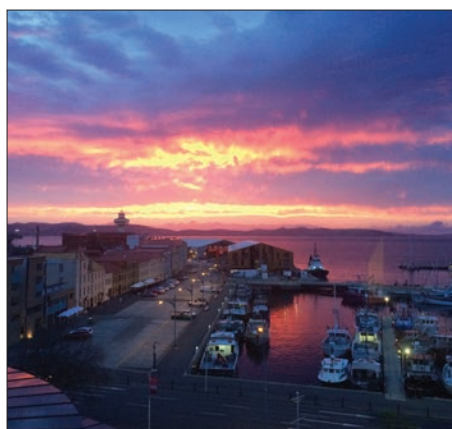
A new training from the Centers for Disease Control and Prevention and partners emphasizes the use of integrated pest management to address public health pests and vectors that spread diseases, including Zika virus and others. Get started today at <http://lms.southcentralpartnership.org/vcehp.php>!

**DirectTalk**

*continued from page 54*

In the process, they seem to have effectively stitch the health professions together to create a web of health.

We're not Australia. I'm simply saying that over time we should scan the landscape to identify opportunities to build systems approaches with clinicians in our local, federally-qualified health centers, public hospitals, and health departments. The Practical Playbook ([www.practicalplaybook.org](http://www.practicalplaybook.org)) highlights approaches for doing just that. Encourage your staff to familiarize themselves with its Web site content and share it with their colleagues. Hey, if you are inspired, why not attend a local healthcare executive dinner meeting and listen to their challenges? Get yourself a grand rounds lecture invitation or speak at a local nursing meeting. You'll be delighted by the reception you receive.



*Dawn on Hobart's Derwent River. Photo courtesy of David Dyjack.*

I contend that we need to row upstream. Let's commit to identifying the root causes of environmental health challenges and not limit ourselves to simply measuring and monitoring because they are easier paths. At

the same time, let's discover the next-generation adrenaline rush by delivering value to society through meaningful engagement with the clinical health professions.

The hub of social life in Hobart, Tasmania, is the Derwent River. Its headwaters are found in the center of Tasmania. Regretfully, I won't make it there. You know the drill—there are competing demands, meetings, and phone calls back home. One of those meetings will be to strategize with the Practical Playbook Team on how to strengthen our profession and advance the health of the nation through an environmental health—primary care partnership. This conversation is long overdue.

Best from Down Under. 🐼

*Dave*

[ddyjack@neha.org](mailto:ddyjack@neha.org)  
Twitter: @DTDyjack





# JULY 10-13, 2017 Annual Educational Conference & Exhibition

## Local Solutions. National Influence.

*We are building a great conference in "Beer City," also named the #1 travel destination by Lonely Planet, Groupon, and Huffington Post! We are gathering local perspectives, as well as national experts, to bring you the latest and greatest in environmental health.*

### Conference Highlights

- **Invited Keynote:** Debbie Stabenow, U.S. Senator (MI), Ranking Member of the U.S. Senate Committee on Agriculture, Nutrition, and Forestry
- **Opening Session:** Aiming for Equity, an environmental justice panel facilitated by Dr. Renée Branch Canady, Chief Executive Officer of the Michigan Public Health Institute
- **Special Panel on Antibiotic Resistance,** Sponsored by NSF International with Dr. Richard Raymond, former U.S. Department of Agriculture's Undersecretary for Food Safety
- **Closing Session on Sustainability,** sponsored by NEHA's Business Industry Affiliate and moderated by Josh Jacobs, Technical Information and Public Affairs Manager for UL

- **UL Event: Tuesday, July 11, 6–9:30 pm**



The Grand Rapids Public Museum with NEHA mascot "Lex."

This special evening at the Grand Rapids Public Museum, sponsored by UL, has something for everyone and includes appetizers, cash bar, an elegant gallery with dance floor, the "Streets of Old Grand Rapids" exhibition where docents provide living history accounts, a carousel, two free planetarium shows (limited number on first come, first serve basis), and various exhibits. Purchase tickets in advance as this event typically sells out. Cost is \$45 per person.

- **Brews, Blues & BBQ: Wednesday, July 12, 6:30–8:30 pm**

Join our conference networking social event dubbed Brews, Blues & BBQ! The event will be held on the Gillett Bridge, overlooking the river next to the Amway Grand Plaza hotel, and will feature local foods and brews, as well as a live local band that will set a festive tone for the evening. This event is included in all full conference registrations. Additional tickets are \$65 per person.



### Hotel Reservations

Book your room at the AEC designated hotel, Amway Grand Plaza, Curio Collection by Hilton. Reserve early to receive the NEHA AEC room block special rate at [neha.org/aec/hotel](http://neha.org/aec/hotel).



Photos courtesy of Experience Grand Rapids.

### Registration

**Early pricing ends April 15!**

Register today at [neha.org/aec/register](http://neha.org/aec/register).

	Member	Nonmember
<b>Early Registration: Full Conference</b>	\$595	\$770
<b>Early Registration: Full Conference + 1-year NEHA Membership</b>	\$690	
<b>Single Day Registration</b>	\$310	\$365



Find details on sessions and events at [neha.org/aec](http://neha.org/aec).

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

David Dyjack, DrPH, CIH

## The Journey Into the Future Points Upstream

The story unfolds like many: a conference call with professional colleagues who wonder out loud, “Where is the environmental health profession?” In this case, it was a team from Duke University that explained that recent studies on colorectal cancer and stroke had ruled out the usual causal suspects—poverty-driven poor diet and lifestyle choices. It seemed there might be environmental factors at play. As other health professionals grappled with the significance of the study’s findings, reportedly no one from the environmental health profession was in the room to weigh in.

The Department of Community and Family Medicine in the Duke University School of Medicine has been contributing to an important initiative that works to improve the health of the nation through collaboration between primary care and public health. The Practical Playbook Team represents a classic academic incubator in that it has struggled to solve one of the most profound issues of our time: how to grease the rails between two stationary locomotives, public health and primary care. The outcome is the Practical Playbook, a web-based resource that provides expert insights, actionable advice, and tools to help individuals and groups work together to improve population health.

Many may feel this work is a noble, but challenging cause. With slashed budgets and overflowing portfolios, many readers may be left wondering how they can be expected to entertain yet another responsibility, particularly something as abstract as working with

*Working with  
healthcare  
providers is  
essential.*

healthcare providers. My advice? Remember why you got into this business.

Many of us love the adrenaline rush associated with solving environmental health mysteries. What was the source of the *Cryptosporidium*? The kiddie pool or the tri-tip? How do you effectively disinfect personal protective equipment? Is there lead in the community garden soil? How do we efficiently drain *Aedes aegypti* breeding areas? But more important than the oxytocin-mediated rush, we do this job because we genuinely cherish the health, safety, and security of our families, neighborhoods, and communities. That’s why working with healthcare providers is essential.

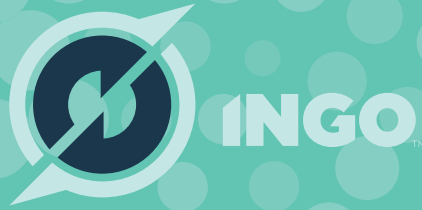
We can’t solve today’s challenges with the same thinking and approaches we used yesterday. Working with healthcare providers, policy makers, and elected officials is critical to the future of our profession. Let me share a few examples.

- This morning I opened the Centers for Disease Control and Prevention’s *Morbidity and Mortality Weekly Report* Express app and the leading article discussed *Candida auris*. This pathogenic fungus is largely resistant to the

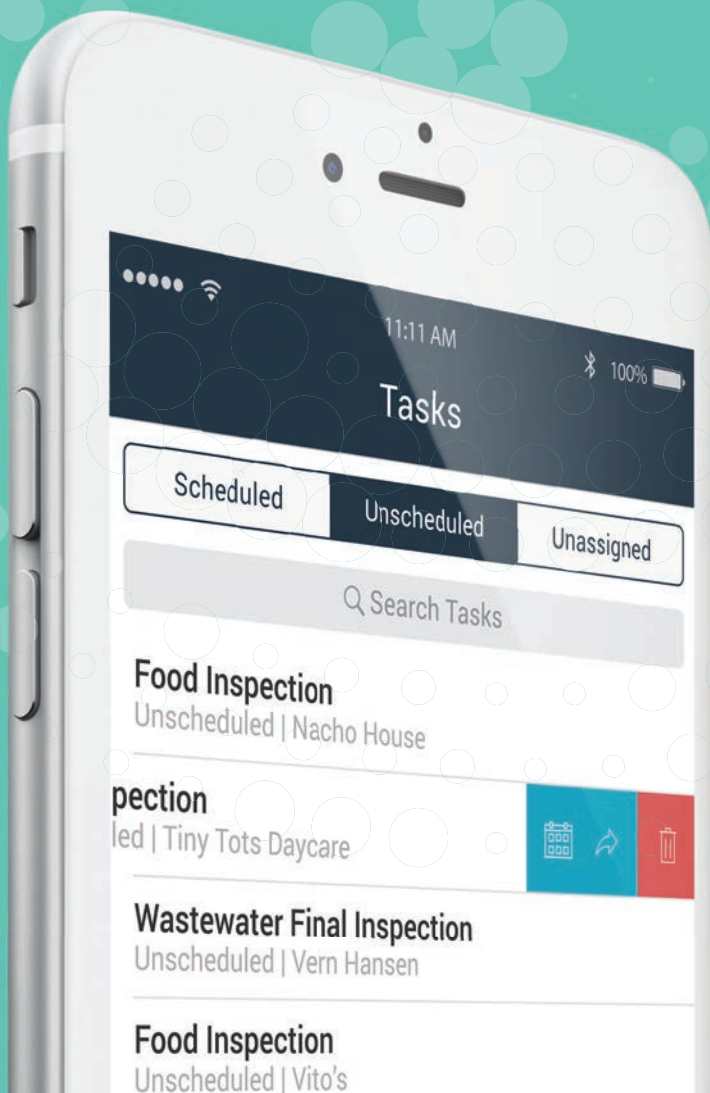
three most effective classes of antifungal medication. It also appears to be acquired by a visit to the hospital. Healthcare would benefit from our infection control expertise. Environmental health is profoundly local, and your local emergency room or hospital is increasingly becoming a hot bed of infection.

- I also read this week that sick employees cause approximately 45% of all food-borne infections in the U.S. In addition, the national turnover rate in retail food is 94%. That’s astounding! We are not going to train, inspect, or digitize our way out of this mess. We need to partner with elected officials in Washington, DC, to promote reasonable paid sick leave policies and a health insurance safety net for part-time and casual laborers. We would benefit from working together with the healthcare industry to address this issue with our elected officials. Together we are stronger.
- This week I was one of the keynote speakers at Environmental Health Australia’s ([www.eh.org.au](http://www.eh.org.au)) national conference in Tasmania, where the Tasmania Minister of Health, the Honorable Michael Ferguson, MP, did a fabulous job articulating how he valued our profession. Tasmanian veterinarians, pediatricians, and political appointees came together to listen to presentations on immunizations and a transmissible cancer that plagues the Tasmanian devil. Our southern hemisphere counterparts appear intent on being weavers, threading together the health of their respective states, and less intent on being framed as content experts.

*continued on page 52*



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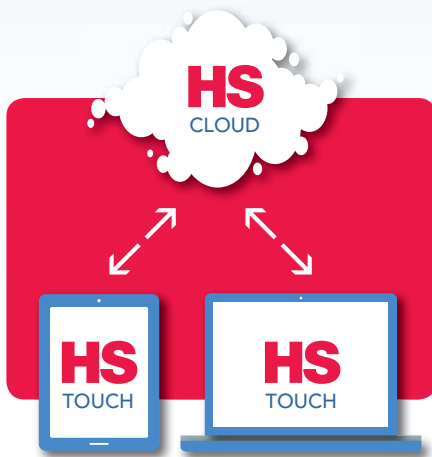
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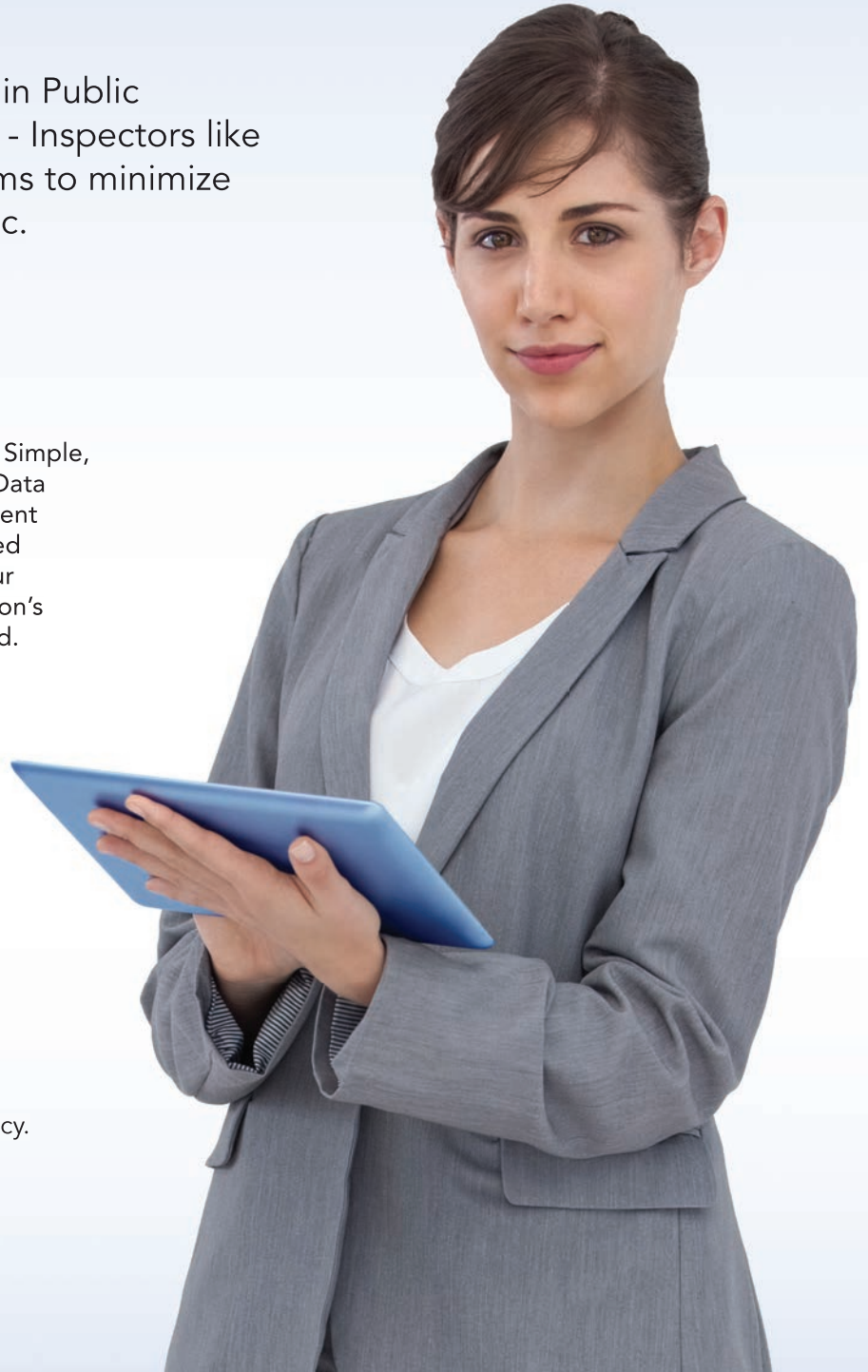
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## ► INTERNATIONAL PERSPECTIVES

# A Study of Parents' Perception of Air Pollution and Its Effect on Their Children's Respiratory Health in Nanchang, China

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**Abstract** This cross-sectional survey was conducted to understand parents' perceptions regarding air pollution and its effect on children's respiratory health in Nanchang, China, to offer baseline information useful to the government of the People's Republic of China. Data collected from 1,056 residents (response rate = 93.7%) was analyzed using descriptive analysis, chi-square test, nonparametric rank-sum test, Spearman rank correlation coefficient, and linear trend test. The results showed that most parents would worry more about their children's health if air quality became worse, especially in families with high education and income. The top three respiratory conditions associated with poor air quality among children were cough (90.5%), upper respiratory infection (72.9%), and bronchitis (47.2%). Parents believed motor vehicle emissions (95.9%), secondhand smoke (95.4%), and dust (92.9%) to be the risk factors largely responsible for respiratory illnesses among children. Furthermore, most respondents supported government intervention to improve air quality with several suggestions: controlling industrial pollution (69.9%), increasing public transportation and reducing private cars (51.0%), and controlling and reducing waste incineration (45.6%).

## Introduction

People in China are becoming more aware of the quality of their life, opting to live in a comfortable environment and to lead a healthy lifestyle. This shift is due to the rapidly developing economy, progress of science and technology, and the improvement of people's living standards (Zhang, Yuan, & Zhao, 2011). The rapid urbanization and population density surge in parts of China, however, have released large amounts of harmful pollutants into the atmosphere, seriously threatening people's health. Particulate matter less than 10

micrometers in diameter ( $PM_{10}$ ), sulfur dioxide ( $SO_2$ ), and nitrogen oxides ( $NO_x$ ) are the main air pollutants caused by the manufacturing industry and transportation. Emission of  $SO_2$  is primarily from industry and daily activities such as coal burning by residents (Ministry of Environmental Protection of the People's Republic of China [MEP], 2013). Coal burning has been reduced to 20.4 million tons, a 3.5% reduction compared with 2012. In China in 2013,  $NO_x$  emissions, which are released primarily by industrial and motor vehicle exhaust, were reduced to 22.3 million tons,

representing a 4.7% reduction compared with 2012 (MEP, 2013).

These improvements notwithstanding, the city's ambient air quality status is still not cause to be optimistic. Air quality remains a health risk in most of the major cities (World Health Organization [WHO], 2016). According to the Ministry of Environmental Protection of the People's Republic of China (MEP), a surveillance study was conducted in 2013 among 74 cities in China, including Beijing, Tianjin, and cities along the Yangtze River and Pearl River regions. MEP assessed the effects of the implementation of new ambient air quality standards with modified indication values of  $SO_2$ ,  $NO_2$ ,  $PM_{10}$ ,  $PM_{2.5}$ , carbon monoxide (CO), and ozone ( $O_3$ ) (MEP, 2012). MEP reported that only three cities—Haikou, Zhoushan, and Lhasa—met the air quality standards, accounting for 4.1% of cities assessed, while the other 71 cities (95.9%) were above recommended pollutant levels (MEP, 2013).

Nanchang, the capital of Jiangxi province and the 25th largest city in China, is adjacent to the three most dynamic economic developmental regions: the Yangtze River delta, the Pearl River delta, and MinDongNan triangle. Nanchang's economy relies mainly on industry, particularly construction, making it subject to air pollution with particulate matter and other pollutants (National Bureau of Statistics of the People's Republic of China, 2014).

One study found that the higher concentration of  $PM_{10}$  was largely due to city construction dust and vehicle exhaust emission, which was a result of increased motor vehicles and more construction sites for city buildings, as well as subway development in

TABLE 1

**General Demographic Characteristics of Interviewees (N = 989)**

Characteristic	#	%
Gender		
Male	373	37.7
Female	616	62.3
Educational level		
≤Junior high school	267	27.0
High school	207	20.9
≥College	515	52.1
Place of residence		
City	660	66.7
Countryside	329	33.3
Average annual household income (yuan)		
<25,000	379	38.3
25,000–75,000	402	40.6
>75,000	208	21.0
Parents' age (years)*		
20–30	305	30.8
31–40	604	61.1
>40	76	7.7
Travel experience		
Yes	919	92.9
Domestic travel	817	82.6
Overseas travel	102	10.3
No	70	7.1
Health status of child		
Healthy	496	50.2
Sick (selected in hospital)	493	49.8
*Mean age = 33.2; Standard deviation = 5.1.		

the past years (Zou et al., 2015). In Nanchang, 7 of 40 days (<18%) measured between April and May 2014 did not meet the ambient air quality standards (Nanchang City Environmental Protection Bureau, 2014).

Air quality is closely related to the overall competitiveness of a city, directly affecting residents' health and quality of life, which impacts the investment environment. The World Health Organization (WHO) reported that outdoor air pollution in both urban and rural areas caused approximately 3.7 million premature deaths worldwide in 2012; furthermore, 88% of deaths occurred in low- and middle-income level countries, primarily located in the western Pacific and Southeast Asia (WHO, 2016).

Indoor air pollution is a problem, too. Approximately 4.3 million people die each year

from indoor air pollution from causes such as inefficient cooking and heating practices (cooking and heating their homes with solid fuels such as wood, charcoal, coal, dung, crop wastes) and smoking in and around the home (WHO, 2014).

Other reports have indicated air pollution is associated with a broad range of health risks (Collins, Parsons, & Zinyemba, 2014) and might potentially play a role in elevated incidence rates of breast cancer in urban areas (Garcia et al., 2014). This issue has attracted close attention from the government and residents of the People's Republic of China.

The serious effects of poor air quality on the sensitive respiratory systems of children are much more apparent than in adults. A study by Liu and Zhang (2009) found major effects of air pollution on children's lung function.

The levels of total suspended particles and SO<sub>2</sub> in ambient air correlated with damage to the big airway function of children, while NO<sub>x</sub> mainly affected the small airway function. Another study revealed a positive correlation of the exposure to PM<sub>2.5</sub> and PM<sub>10</sub> with the incidence of childhood respiratory illnesses (Liu, Li, Hu & Sun, 2014). Studies on the effects of air pollution on respiratory health have frequently been conducted in many parts of the world (Beatty & Shimshack, 2014; Kong, He, Xu, Xu, & Guo, 2001).

Additionally, there have been several studies on air quality including environmental air quality standards and management policies, the air pollution index variation characteristics and influence factors, and the effects of air quality on health (Liao, Xu, & Zhang, 2010; Liu et al., 2005; Wang et al., 2013).

Little investigation, however, has been conducted to examine the public's perceptions regarding air pollution and its effect on children's respiratory health in China. This study, through interviews with Nanchang parents of both healthy and sick children, aimed to understand parents' perceptions of Nanchang air quality and the potential effects of air pollution on their children's respiratory health. In addition, this study was designed to obtain baseline information useful to the Nanchang government in its attempt to improve air quality and protect children's respiratory health in the future.

## Materials and Methods

Participants selected for this study were parents, including caregivers and caretakers, who had at least one child between the ages of 2–10 years. Parents were interviewed through a face-to-face method with trained interviewers. A total of 1,056 survey questionnaires were collected. Among these participants, 526 were parents with healthy children from a Nanchang city kindergarten, a primary school of Nanchang, and the Nanchang Center for Disease Control and Prevention (NCDC). The other 530 participants were parents who had sick children waiting to see medical doctors in Jiangxi Children's Hospital in Nanchang. The number of valid responses was 989 (response rate = 93.7%) and the basic demographic information about these respondents is summarized in Table 1.

To ensure the reliability and validity of this survey, the questionnaires used were de-

TABLE 2

## Parents' Perceptions of Children's General Health Conditions

Parent Characteristic	Perceived General Health Condition						$\chi^2$	p-Value
	Good		Fair		Poor			
	#	%	#	%	#	%		
Gender							2.857	.240
Male	269	72.1	86	23.1	18	4.8		
Female	415	67.4	160	26.0	41	6.7		
Educational level							7.704	.103
≤Junior high school	179	67.0	67	25.1	21	7.9		
High school	132	63.8	61	29.5	14	6.8		
≥College	373	72.4	118	22.9	24	4.7		
Place of residence <sup>a</sup>							11.181	.004
City	474	71.8	157	23.8	29	4.4		
Countryside	210	63.8	89	27.1	30	9.1		
Average annual household income (yuan)							2.128	.712
<25,000	260	68.6	96	25.3	23	6.1		
25,000–75,000	273	67.9	102	25.4	27	6.7		
>75,000	151	72.6	48	23.1	9	4.3		
Parents' age (years) <sup>b</sup>							36.639	<.001
20–30	180	59.0	91	29.8	34	11.1		
31–40	448	74.2	134	22.2	22	3.6		
>40	53	69.7	21	27.6	2	2.6		
Travel experience							48.469	<.001
Yes	659	71.7	215	23.4	45	4.9		
Domestic travel	581	71.1	194	23.7	42	5.1		
Overseas travel	78	76.5	21	20.6	3	2.9		
No	25	35.7	31	44.3	14	20.0		
Health status of child <sup>c</sup>								
Healthy	437	88.1	57	11.5	2	0.4		
Sick	247	50.1	189	38.3	57	11.6		

°Orderly rank and inspection:  $Z = -2.846$ ,  $p = .004$ .  
°Spearman rank correlation coefficient =  $-0.141$ ,  $p = .000$ ; Linear trend value =  $22.253$ ,  $p = .000$ .  
°Orderly rank and inspection:  $Z = -13.191$ ,  $p = .000$ .

<sup>a</sup>Orderly rank and inspection:  $Z = -2.846$ ,  $p = .004$ .

<sup>b</sup>Spearman rank correlation coefficient =  $-0.141$ ,  $p = .000$ ; Linear trend value =  $22.253$ ,  $p = .000$ .

<sup>c</sup>Orderly rank and inspection:  $Z = -13.191$ ,  $p = .000$ .

signed by public health experts and refined based on our 2013 study (Zhang et al., 2014). Our 2013 study was carried out in four sites, including two NCDC locations, Jiangxi Children's Hospital, and a local kindergarten. Additionally, the study team members received training on questionnaire details and survey techniques. Pilot presurvey tests were performed before the survey was conducted.

The questionnaires covered five major aspects: 1) general demographic characteristics of the interviewees (age, gender, educational level, place of residence, travel experiences, and annual household income); 2) children's health conditions (age, overall health, respiratory diseases, symptoms in children when

air quality was poor); 3) parents' concerns about the air quality in Nanchang; 4) parents' understanding of the linkage between air quality and children's health problems (impact on children's respiratory system, factors aggravating symptoms in children, how worried parents were about respiratory health problems caused by air pollution); and 5) parents' attitudes towards the government's policies. All participants were assessed through confidential face-to-face interviews.

All data were analyzed with SPSS version 17.0. General demographic characteristics of the interviewees and health condition of the children were described with descriptive statistics. Chi-square tests compared the differ-

ences of parents' perception of air quality and the cognitive relationship of air quality with parents' perception about children's health according to general demographic characteristics of the interviewees. The general chi-square analysis was run on frequency distribution data. A nonparametric rank-sum test was used to order classification data values status. Linear trend tests and Spearman rank correlation coefficients were used to analyze the bidirectional orderly and different properties contingency table data. The level of  $\alpha$  was set at 0.05.

## Results

Health conditions of healthy children from a Nanchang city kindergarten, a primary school of Nanchang, and NCDC locations were much better than sick children from Jiangxi Children's Hospital ( $p < .001$ ), matching assumptions that children selected from the kindergarten would be much healthier than those from the hospital site. Most participants generally believed that their child's overall health was good (69.2%) (Table 2). Data indicated that parents' perception of their children's health was significantly affected by location of their residence, showing that parents from Nanchang city considered their children to be healthier than those from the countryside ( $p = .004$ ). Parents' age was shown to be a significant factor affecting their perception of children's health. Older parents had higher rates of believing their children to be in good health ( $p < .001$ ). Our data showed that travel experience nationally and/or internationally was also a significant factor affecting parents' perception of their children's health (Table 2).

Based on parent recall, cough, upper respiratory tract infection, and bronchitis were the top three common respiratory conditions among children in Nanchang (Table 3). The rates of coughing in children significantly increased, 90.5% versus 82.8%, when compared with 2013 ( $\chi^2 = 113.786$ ,  $p < .001$ ). Although 72.9% of children suffered from upper respiratory tract infection, a decrease is shown when compared with the 2013 study result of 89.5% ( $\chi^2 = 138.106$ ,  $p < .001$ ). The frequency of bronchitis, however, was 47.2%, which was significantly greater than the results of our 2013 study of 29.3% ( $\chi^2 = 98.889$ ,  $p < .001$ ) (Zhang et al., 2014). The data in Table 4 show the Spearman rank cor-

TABLE 3

## Frequency of Respiratory Conditions in Children

Date	Disease	Never # (%)	≤1/yr # (%)	1–2/yr # (%)	≥3/yr # (%)	Chronic Illness # (%)
April 2014 (n = 989)	Asthma	898 (90.8)	47 (4.8)	20 (2.0)	21 (2.1)	3 (0.3)
	Allergies*	716 (72.4)	152 (15.4)	65 (6.6)	48 (4.9)	8 (0.8)
	Bronchitis*	522 (52.8)	188 (19.0)	175 (17.7)	98 (9.9)	6 (0.6)
	URI*	268 (27.1)	163 (16.5)	321 (32.5)	228 (23.1)	9 (0.9)
	Coughing*	94 (9.5)	177 (17.9)	370 (37.4)	335 (33.9)	13 (1.3)
	Wheezing*	876 (88.6)	53 (5.4)	28 (2.8)	29 (2.9)	3 (0.3)
May 2013 (n = 721)	Asthma	660 (91.5)	39 (5.4)	11 (1.5)	6 (0.8)	3 (0.7)
	Allergies	546 (75.7)	103 (14.3)	36 (5.0)	15 (2.1)	21 (2.9)
	Bronchitis	510 (70.7)	112 (15.5)	47 (6.5)	30 (4.2)	22 (3.1)
	URI	76 (10.5)	176 (24.4)	216 (30.0)	186 (25.8)	67 (9.3)
	Coughing	124 (17.2)	168 (23.0)	191 (26.5)	171 (23.7)	69 (9.6)
	Wheezing	661 (91.7)	37 (5.1)	7 (1.0)	10 (1.4)	6 (0.8)

URI = upper respiratory infection.

\*Compared with 2013,  $p < .001$ .

TABLE 4

## Correlations Between Parents' Perception of Their Child's Health and Respiratory Conditions in Children\*

Disease	General Health Conditions	p-Value
Asthma	0.037	.244
Allergies	0.095	.003
Bronchitis	0.173	<.001
URI	0.218	<.001
Coughing	0.204	<.001
Wheezing	0.047	.141

URI = upper respiratory infection.

\*The Spearman rank correlation coefficients between perceptions of general health conditions and respiratory diseases in children.

relation coefficient ( $r_s$ ) between perceptions and respiratory diseases in children; that is, parents' perception about the general health condition of their child was in accordance with rates of allergies ( $r_s = 0.095$ ,  $p = .003$ ), bronchitis ( $r_s = 0.173$ ,  $p < .001$ ), upper respiratory infection ( $r_s = 0.218$ ,  $p < .001$ ), and coughing ( $r_s = 0.204$ ,  $p < .001$ ) (Table 4).

As shown in Table 5, the data revealed a positive correlation between concerns regarding children's health and parents' education level, place of residence, annual household income, and travel experience. Parents

with a higher educational level (a college degree or higher) and/or higher annual income ( $\geq 75,000$  Chinese yuan) worried more about their children's health ( $r_s = 0.182$ ,  $p < .001$ ), ( $r_s = 0.123$ ,  $p < .001$ ), respectively. Parents who live in the city or have previous travel experience were also more likely to be more concerned about their children's health (Table 5).

When air quality was poor, the top three common symptoms reported by parents with affected children included dry throat pain (60.1%), sneezing (49.5%), and coughing

(37.7%) (Figure 1). As shown in Figure 2, the majority of parents believed that their children's respiratory health was affected by polluted air, mainly from motor vehicle emissions (95.9%), secondhand smoking (95.4%), and dust (92.9%). As indicated in Table 6, bronchitis was associated with high levels of dust, vehicle exhaust emissions, and secondhand smoking, which were some of the factors parents considered as worsening their children's respiratory symptoms. While upper respiratory tract infections were associated with dust and motor vehicle exhaust emissions, coughs were associated only with dust.

In view of the current air quality in Nanchang and parents' perceived impact of air quality on children's health, most parents expressed their strong support to local government to improve air quality. Participants were also asked to give their suggestions on measures to improve air quality. The top three suggestions were to control and reduce air pollution from industrial facilities (69.9%), increase public transportation and reduce private cars (51.0%), and control and reduce waste incineration (45.6%). Other suggestions for local governments to consider included reducing cigarette smoke (30.3%), implementing a nationwide effort to control air pollution (29.7%), increasing solar and green energy options (25.9%), and improving urban housing construction (25.6%).

## Discussion

With the rapid growth of the Chinese economy, many cities in China are facing a concerning situation of multiple pollutant emissions and poor air quality. Due to elevated energy consumption, electricity generation, and motor vehicle use, increased pollutants are severely and adversely affecting the quality of life of residents (Wang & Hao, 2012). Recent studies on air quality and pollution types have indicated that the pollution in the atmosphere in Nanchang is complex, with several main pollutants including  $PM_{10}$ ,  $SO_2$ , and  $NO_x$  attributed to motor vehicle exhaust emissions (Zhuang et al., 2014).

The air pollution issue has caught the attention of local government and residents. Risk perception means individuals' feeling and understanding of different objective risk outside (Slovic, 1987). Humans perceive and act on risk in two fundamental ways. Risk as feelings refers to individuals' instinctive and



TABLE 5

## Parent Concerns About Child's Respiratory Health When Air Quality Worsened

Parent Characteristic	Very Worried		Somewhat Worried		Not Considered		Not Worried		$\chi^2$	p-Value
	#	%	#	%	#	%	#	%		
Gender									6.322	.097
Male	164	44.0	178	47.7	21	5.6	10	2.7		
Female	318	51.6	260	42.2	23	3.7	15	2.4		
Educational level <sup>a</sup>									38.591	<.001
≤Junior high school	100	37.5	133	49.8	20	7.5	14	5.2		
High school	94	45.4	97	46.9	11	5.3	5	2.4		
≥College	288	55.9	208	40.4	13	2.5	6	1.2		
Place of residence <sup>b</sup>									28.803	<.001
City	349	52.9	156	47.4	28	8.5	12	3.6		
Countryside	133	40.4	282	42.7	16	2.4	13	2.0		
Annual household income (yuan) <sup>c</sup>									17.707	.007
<25,000	161	42.5	185	48.8	19	5.0	14	3.7		
25,000–75,000	201	50.0	171	42.5	20	5.0	10	2.5		
>75,000	120	57.7	82	39.4	5	2.4	1	0.5		
Parents' age (years)									5.966	.743
20–30	148	48.5	136	44.6	14	4.6	7	2.3		
31–40	297	49.2	269	44.5	23	3.8	15	2.5		
>40	35	46.1	31	40.8	7	9.2	3	3.9		
Travel experience									8.402	.038
Yes	453	49.3	407	44.3	39	4.2	20	2.2		
Domestic travel	390	47.7	369	45.2	38	4.7	20	2.4	10.278	.016
Overseas travel	63	61.8	38	37.3	1	1.0	0	0.0		
No	29	41.4	31	44.3	5	7.1	5	7.1		

<sup>a</sup>Nonparametric rank and inspection:  $\chi^2 = 32.797$ ,  $p = .000$ ; Spearman rank correlation coefficient = 0.182,  $p = .000$ ; Linear trend value = 37.456,  $p = .000$ .

<sup>b</sup>Nonparametric rank and inspection:  $Z = -4.449$ ,  $p = .000$ .

<sup>c</sup>Nonparametric rank and inspection:  $\chi^2 = 15.182$ ,  $p = .000$ ; Spearman rank correlation coefficient = 0.123,  $p = .000$ ; Linear trend value = 16.338,  $p = .000$ .

intuitive reactions to danger. Risk as analysis brings logic, reason, and scientific deliberation to bear on risk management (Slovic & Peters, 2006). The public's perception of risk guides their behavior to a large degree, impacting effectiveness of the risk management policy and implementation. Air pollution risk management has become one of the key tasks for the government. Residents' understanding and cooperation (i.e., risk perception) benefit risk management of air pollution (Zhu & Xu, 2014).

Studies on the public's air risk perception started in the 1950s and 1960s in the U.S. with quantitative methods (Johnson et al., 1972; Smith, Schueneman, & Zeidberg, 1964); then in the 1990s, researchers started using qualitative methods on air pollution-related perceptions (Saksena, 2011). More re-

cent studies on air pollution perception have focused on improvement of risk communication (Egondi et al., 2013; Nikolopoulou, Kleissl, Linden, & Lykoudis, 2011) and on factors that can influence perceptions (Johnson, 2012). Part of the aim of these studies was to bridge the gap between scientific research and public awareness.

Our study showed that, as expected, the general health status of children from the Nanchang city kindergarten, the Nanchang primary school, and NCDC sites was better than the health status of children enrolled from Jiangxi Children's Hospital. Researchers expected that children selected from the kindergarten would be much healthier than those from the hospital site. Almost all parents believed that their children's overall health was good, especially those parents liv-

ing in the city ( $p = .004$ ). The health status of children in rural areas of Nanchang was reported to be worse than children in the city because rural children were more likely to be subjected to several risk factors, including direct or indirect contact with dust, infectious bacteria, and disease-carrying insects (Pluhar, Piko, Kovacs, & Uzzoli, 2009).

Among the respondents, older parents considered their children to be in better health, with a linear trend value of 22.253 ( $p < .001$ ). One explanation for this observation is that older parents have greater access to child care, which has been shown keep children healthier. As stated previously, we uncovered a positive correlation between children's health status and parents' travel experience. As travel experience is closely related to household income status, parents

FIGURE 1

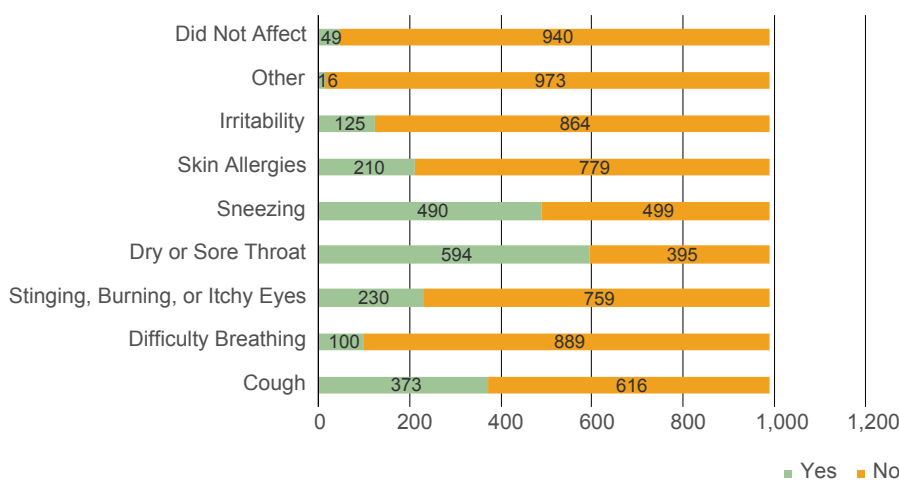
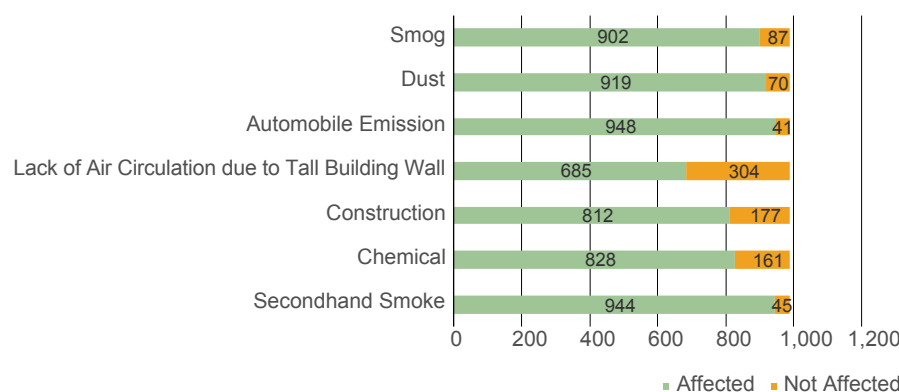
**Exhibited Symptoms as a Result of Worsened Air Quality**

FIGURE 2

**Factors That Worsened Children's Symptoms**

with higher income have more means to travel. Those with more resources might also be able to focus more on leading a healthier lifestyle. Our results suggest that families' socioeconomic status has much to do with health status. Thus, findings from this study suggest that education and healthy habits should be promoted, especially in the rural areas, specifically targeting parents ages 20–40 (Neidell, 2004).

The top three respiratory conditions found in children in Nanchang, China, were cough, upper respiratory tract infection, and bronchitis. Cough and bronchitis were particularly

prevalent, reaching 90.5% and 47.2%, respectively, indicating that children are suffering more from cough or bronchitis as compared with previous years (Zhang et al., 2014). This alarming increase might be a serious risk to children from long-term cumulative exposure to polluted air in Nanchang. The consistency of parents' perception about general health status and respiratory conditions (allergies, bronchitis, upper respiratory infection, and coughing) in children indicated that parents' perceptions seemed to be credible.

Parents have different levels of concern about the effects of worsening air pollution

on their children's respiratory health. Such differences depend on educational levels, place of residence, household income levels, and travel experience. In particular, education and household income levels were positively correlated with the degree of parental concern.

This result is in agreement with a study showing that parents with higher educational levels and higher household income pay more attention to air quality, seek a better quality of life, and worry more about their children's health (Zhang et al., 2014). Another study revealed that the health effects of air pollution could also vary depending on socioeconomic status and the age of a population (Neidell, 2004). Our results are consistent with these findings. Parents who had national and/or international travel experience and resided in urban areas showed more concern about their children's health. Motor vehicle exhaust and dust caused by construction exacerbated parental concern about their children's health.

Our study has shown that parents perceive poor air quality to be linked with cough, dry throat pain (60.1%), and sneezing (49.5%) among exposed children. The majority of parents believed that motor vehicle emissions, secondhand smoke, and dust are the major influencing factors for adverse effects on their children's respiratory health. Our qualitative finding is in agreement with a report that used logistic regression to examine the effect of secondhand smoke exposure on public workers in Shanghai and suggested secondhand smoke was responsible for several respiratory health problems, including lung cancer and tracheitis (Li et al., 2009).

Aurrekoetxea and coauthors' (2016) study on secondhand smoke exposure on 4-year-old children in Spain showed 21.6% of the children were exposed to secondhand smoke at home and 47.1% elsewhere. The odds of quantifiable urinary cotinine in children dropped after the smoking ban took effect in public places. Quantifiable urinary cotinine was more likely in children whose parents smoked at home in their presence (Aurrekoetxea et al., 2016). It is important to prevent children from indoor exposure to lung irritants in order to promote their respiratory health. In particular, parents should be reminded that their activities, including smoking or using coal for cooking, can affect their children's health.

TABLE 6

**Analysis of Risk Factors (Parents' Perception) Related to Children's Respiratory Conditions**

Factors*		Bronchitis <sup>a</sup>		Upper Respiratory Infection <sup>b</sup>		Coughing <sup>c</sup>	
		Yes	No	Yes	No	Yes	No
Dust	Did not affect	23	47	38	32	57	13
	Affected a little	130	176	216	90	276	30
	Affected strongly	314	299	467	146	562	51
Automobile emission	Did not affect	12	29	21	20	33	8
	Affected a little	102	135	162	75	212	25
	Affected strongly	353	358	538	173	650	61
Second-hand smoke	Did not affect	23	22	34	11	37	8
	Affected a little	94	140	164	70	214	20
	Affected strongly	350	360	523	187	644	66

\*The effect rank of factors that parents believed worsen child respiratory symptoms.

<sup>a</sup>Dust (bronchitis):  $\chi^2 = 12.491$ ,  $p = .002$ ;  $r_s = 0.109$ ,  $p = .031$ . Automobile emission (bronchitis):  $\chi^2 = 8.647$ ,  $p = .013$ ;  $r_s = 0.083$ ,  $p = .009$ . Secondhand smoke (bronchitis):  $\chi^2 = 6.166$ ,  $p = .046$ ;  $r_s = 0.061$ ,  $p = .032$ .

<sup>b</sup>Dust (upper respiratory infection):  $\chi^2 = 16.449$ ,  $p = .000$ ;  $r_s = 0.109$ ,  $p = .001$ . Automobile emission (upper respiratory infection):  $\chi^2 = 14.992$ ,  $p = .001$ ;  $r_s = 0.107$ ,  $p = .001$ .

<sup>c</sup>Dust (coughing):  $\chi^2 = 7.723$ ,  $p = .021$ ;  $r_s = 0.064$ ,  $p = .044$ .

Based on the children's health risk factors associated with poor air quality, the government should take all possible measurements to improve air quality in Nanchang. Parents believe that the top three approaches for the government to improve air quality in Nanchang are to control and reduce pollution from industrial facilities, to increase public transportation and reduce use of private cars, and to control and reduce waste incineration. These findings were consistent with reports from other studies (Lee et al., 2014; Zhang et al., 2014), which is useful information to Nanchang government officials in their effort to control air pollution and improve air quality in Nanchang in the future.

This study was more complete than the 2013 survey study (Zhang et al., 2014) because it contained a larger sample size from both rural and urban areas, and included both healthy and sick children. Limitations, however, are present.

One limitation in this study is possible recall bias when parents answered questions on their children's respiratory status. Plus, the questionnaire didn't include parent's own contribution to air quality and the health of their children. The main limitation of this study is due to the focus on a narrowed target population: parents

with children ages 2–10 years. Therefore, it is unclear if the perception about air quality and its effects on children's respiratory health is the same or different from parents who have children younger than 2 or older than 10 years.

Also, people living in cities usually believe their health is better than people living in the countryside, which might be a cognitive bias. Finally, the rating scale used in this survey is subjective to parental perception. More quantitative research should be conducted in order to obtain a more complete assessment about the effects of poor air quality on children's respiratory health in Nanchang, China.

### Conclusion

Most parents who participated in this study reported believing that their children were in good health (69%). Parents' concern regarding their children's health, however, was quite different depending on their socioeconomic status and level of education. Promoting health education about how air quality affects children's health might be an effective measure to improve public knowledge and understanding of the effects of poor air quality, especially for low-socioeconomic status parents in the countryside who reported more worry about their children's health.

While it is true that air pollution is not a problem localized to any one city or country and it can be a serious health issue affecting many countries and regions of the world, the majority of parents who participated in this study believe that the government should place more control on industrial facilities, private cars, and waste incineration to improve the air quality and respiratory health conditions of children in Nanchang.

In addition to posing great risks to children's respiratory health, air pollution is an issue that ideally should be addressed by the government, as air pollution is a far-reaching problem that affects all people exposed. Therefore, when making any economic development plan or policy for a city, proper management for air quality should be an essential consideration. The public's perception could provide a constructive frame of reference for the government to consider when shaping policies.

The government is not the only entity with a duty to improve the air quality and respiratory health of children—the public also has to assume some responsibility. Based on the populace's knowledge and misgivings, the public should consider stopping unhealthy behaviors (such as to stop smoking both indoors and outdoors), stopping indoor cooking with coal and using more cleaner fuels, and limiting their use of private cars in favor of using public transportation (buses) or personal bicycle more often. 🚲

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