Florida Journal of Environmental Health

The Official Publication of the Florida Environmental Health Association

Issue #217 Summer 2018

70th AEM Anniversary Edition

In This Issue...

Dear FEHA Members,

On behalf of the entire FEHA Board of Directors, President Gary Frank, President Elect Latoya Backtus and Executive Director Michael Crea would like to thank you for an amazing 2017-2018 FEHA Year. We made some huge strides forward for the association and we hope to continue the momentum through the next year and beyond. We could not have done it without all of you and we thank each and every one of you. We would like to specifically thank all of the members serving on the Board of Directors and on a District Board. Without your help, none of this would be possible. Please continue to serve the association with honor and distinction as you have been doing for so many years.

We look forward to the many years to come!

THANK YOU!

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Incoming Presidents Message

Every day is a challenge in the field of environmental health and science. I hope my contribution as President will continue to bring awareness to what changes that we, as a society, need to make in order to better serve and protect our environment. The core environmental vision of reducing, reusing, and recycling is what can preserve & protect where we call home. I hope as President of the Florida Environmental Health Association I can carry on the legacy of community service and increase membership so that we reach our goals of environmental awareness, education, and communication.

A little bit about me: I Received my Bachelor's of Science in Environmental Science & Policy from USF and my Master's of Public Health in Toxicology & Risk Assessment from USF. I am currently employed by the Florida Department of Health-Pinellas as a Environmental Supervisor. In additon to serving as FEHA President Elect last year and now serving as FEHA President, I am also the Chairperson of the Tampa Bay District of FEHA. We are working to revitalize the FEHA Tampa Bay District by providing trainings to earn CEUs and to continue to increase members. We know the only way to be successful is through a joint effort of members of the local chapter working together.

I look forward to working with all of you this year as FEHA President and as Chairperson of the Tampa Bay District.

Outgoing Presidents Message

Per the Bylaws, "The mission of the Association is to enhance the professional integrity, knowledge, and working conditions of the environmental health professional, as well as to promote the social and economic conditions of the members". Many of the districts have held meetings this past year and have promoted our mission by inviting speakers on many environmental subjects. These meetings were also beneficial to the attendees as CEU's were received for attending.

We have encountered a significant increase in membership the past year. Free memberships were offered to new members – hopefully these new members have found FEHA beneficial and will renew their memberships. The increase was also a result of our executive director visiting the districts and assisting them organizing meetings – thanks Michael.

The Annual Education Meeting (AEM) is a great event for all to enjoy – educational speakers, vendor displays, and socializing at breaks and during the evening activities. AEM 2017 was well attended at Innisbrook – check the website for pictures and the agenda. The 2018 AEM promises to be another great meeting – July 24th to July 27th at the Cape Canaveral Radisson. Check the website for details - the Director of the Kennedy Space Center is the Keynote Speaker at the awards luncheon. A tour of the space center is scheduled for Friday the 27th (thanks to Garry our 1st VP for arranging this). The Mission Inn near Orlando has been selected for the 2019 AEM – a relaxing 1,100 acre venue with two golf courses, a full service spa, quality accommodations including several restaurants, and even skeet shooting.

I am pleased to report our financial situation is in good order (thanks Scott for serving as treasure for years). Speaking of finances, I have requested the Board to have a salary survey performed by our executive director. Many counties have experienced a large turnover of environmental specialists which is due in large part to the salary rates. The Board will be discussing this during the AEM.

I urge you to consider serving FEHA in your districts as officers are needed to make the districts successful. Officers are also needed for the Board to carry out its' duties. All the best to our President-elect LaToya – I'm sure she will do a great job. All our Board members have contributed to the success of our organization – thanks to all of you.

Thanks for the support of my office and family during my term as President. Finally, thanks for the opportunity to serve our organization as it has been a rewarding experience.

Sincerely,

Gary Frank
President FEHA 2017-2018

Executive Directors Message

It has been my pleasure to serve as your Executive Director this past year. During the awards lunch at last years AEM, I promised to revitalize the districts,increase awareness of FEHA in the environmental health community, increase association membership within both the government and private industries, print the first issue of the Florida Journal of Environmental Health in the past 4 years and plan an amazing 2018 AEM that will be both educational and fun for all those attending. I have worked tirelessly to acheive these goals. I have traveled the state visiting districts, colleges and statewide meetings. We have revitalized the Tampa Bay District, Treasure Coast District, Gulf Coast District and Central District. I have educated people about the association and on how they can be a part of a great organization that has been around since 1947. Association membership has just about doubled in the past 2 years and we are getting new members every month. FEHA is promoting membership not only to state employees but also to environmental health professionals working in private industries such as OSTDS, Food Safety, Body Art, Indoor Air Quality, Bio Medical Waste and Infection Control.

I have had the pleaseure of representing FEHA at the National Environmental Health Association (NEHA) Annual Educational Conference (AEC) and participating in the Affiliate Educational Sessions in 2017 and 2018. I gave a presentation in 2017 at the NEHA AEC on the successes of the association and the methods we use to acheive our goals. In 2017 and 2018 I was selected to give presentations at the NEHA AEC on the topic of body art that was geared toward inspectors and environmental health supervisors. I have had the pleasure of representing FEHA on the NEHA Body Art Model Code Committee and on the AFDO Body Art Sub-Committee. I was invited to speak at the State College of Florida about the association and it had such a positive impact on the students that we gained over 30 members in one day. We were even asked to provide science fair judges to Fruitville Elementary School in Sarasota, which Myself and FEHA Member Fatima Conteh happily provided.

In additon to the above mentioned achievements, FEHA has made some great strides forward within the environmental health industry. We have appointed a representitave to the Interagency Arbovirus Task Force (Trisha Dall) and to the OSTDS Technical Review and Advisory Panel, TRAP Committee (Elias Christ). We have updated and added new features to the FEHA website including digital membership cards, member only forums and updates to most of the website pages.

This coming year I promise to continue the work that I have been doing within the association including continueing to increase membership, revitalize the districts and maintain the districts that have been revitalized in the past year.

I hope you all have a fun and educational 2018 AEM and I look forward to working with all of you this year and seeing you at a district meeting and at the 2019 AEM.

FEATURED ARTICLE

Vibriosis on the Half Shell: Analysis of Florida Vibriosis, 2004-2016

Authors: Laura P. Matthias, MPH and Jamie DeMent, MNS, CPM

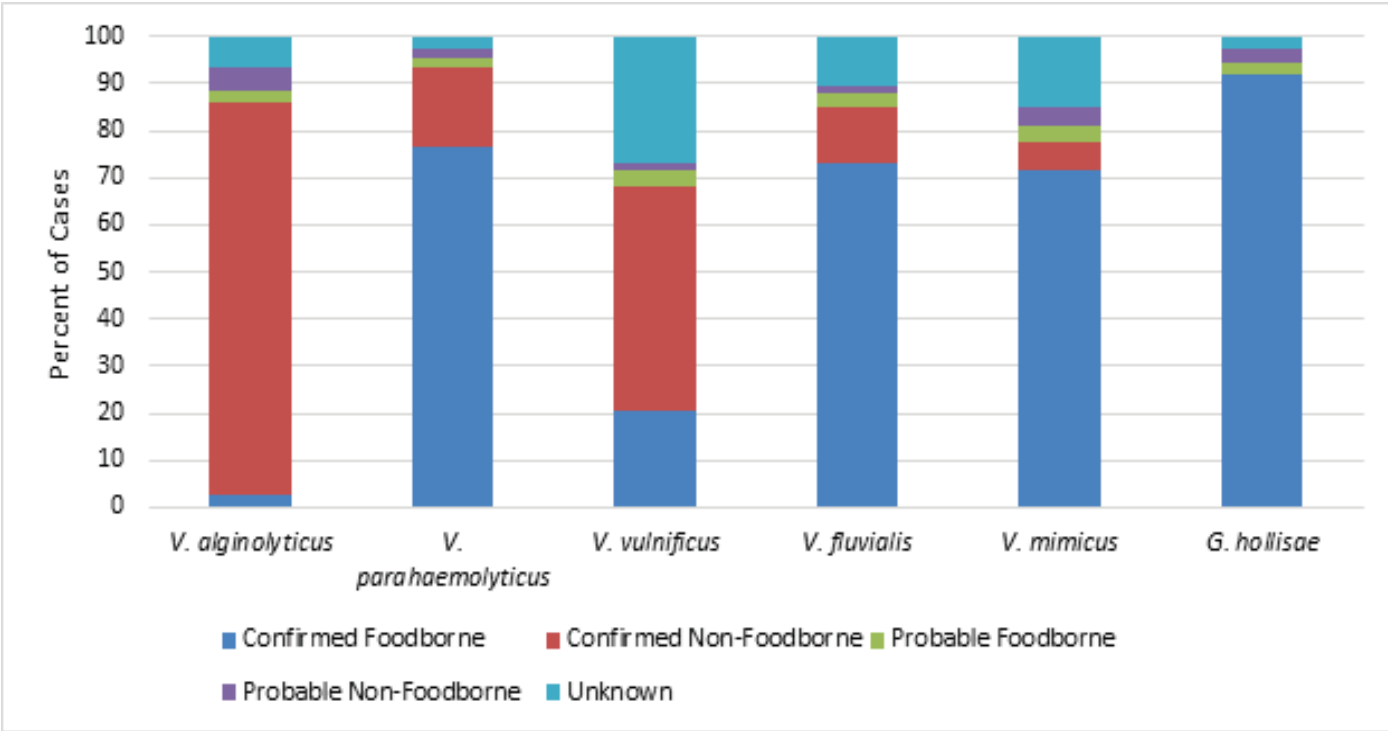
Vibrio are gram-negative bacteria found naturally in warm marine and estuarine environments. The bacteria can be found free swimming or attached to underwater surfaces.1 In addition, the bacteria are frequently found in shellfish that have been harvested from warm coastal waters. The optimal growth temperature for Vibrio is between 68-95˚F (20-35˚C).2 In cooler months, in places where water temperatures are lower, Vibrio species may be undetectable. In locations where the water temperature remains above 59˚F (15˚C), Vibrio species may be detected throughout the year with the number of organisms detected increasing with water temperature. Other factors, such as water salinity, can affect the number of organisms present.3 Oysters and other shellfish are filter feeders and may have concentrations of Vibrio bacteria up to 100-fold higher than the surrounding water.[1] Vibrio vulnificus has been found in oyster meat harvested from the Gulf Coast year-round with higher concentrations of organisms in the meat in the summer and a reduction in months November through mid-March. During warmer months, the median concentration of organisms is 2,300 per gram of oyster meat (most probable number) with counts falling to ≤10 organisms per gram in cooler months.3 It is estimated that a dose of 1,000 V. vulnificus organisms can cause illness in humans.[2] Appropriate cooking will kill Vibrio bacteria; however, humans can become infected with the bacteria when they consume raw or undercooked shellfish. Cuts sustained while handling uncooked shellfish can also result in infection.
All humans are at risk of infection. However, people who are immunocompromised or have a pre-existing health condition, such as liver or kidney disease, are at greater risk of severe infection by the bacteria when they are exposed. In a healthy person, symptoms typically associated with infection due to consumption of raw shellfish include nausea, vomiting, diarrhea, fever, and abdominal cramps. In those with weakened immune systems, the bacteria can spread to the blood and cause serious systemic infections.[2,4]

Nationally, the Centers for Disease Control and Prevention (CDC) estimates that there are about 80,000 illnesses, 500 hospitalizations, and 100 deaths each year due to pathogenic Vibrio species.[4] The CDC estimates that about 45,000 illnesses from V. parahaemolyticus occur each year in the U.S. and about 86% of them are foodborne. For V. vulnificus, the number is much lower, with an estimate of 96 cases of foodborne illness each year with death occurring in about 35% of people who develop sepsis.[2] For other non-cholera Vibrio species, there is a mean incidence of 17,564 cases per year of domestically acquired foodborne illness.[5]

The Cholera and Other Vibrio Illness Surveillance Report (COVIS) annual summaries

from 2010-2012 analyzed national data based on domestically acquired cases of different Vibrio species for confirmed and probable foodborne exposures, confirmed and probable non-foodborne exposures, and unknown exposures (Figure 1). Foodborne exposures accounted for the majority of four different species, while non-foodborne exposures accounted for most of the V. alginolyticus cases. All non-foodborne exposures accounted for 49.06% of V. vulnificus cases. Of all the cases with foodborne exposure who reported eating a single seafood item in the week before illness onset, oysters consistently accounted for >50% of the single food item eaten. Other seafood items consumed were clams, mussels, crab, shrimp, lobster, crayfish, finfish, and scallops.[6]

Figure 1. Vibriosis Cases by Transmission Route and Species in the United States, 2010-2012



In Florida, vibriosis exposures are classified in four ways:

1. Foodborne: the only reported exposure was seafood
2. Wound: incurring a wound before or during exposure to marine water or wild life
3. Multiple: seafood consumption as well as exposure to seawater with or without presence of a wound
4. Other/unknown: reported only exposure to seawater, specimen was cultured from the ear or other body site, had a wound but no documented exposure, or exposure is unknown.

Based on the above exposure criteria, reported Florida confirmed and probable cases of vibriosis were analyzed from 2004-2016 to determine exposures. Florida data are consistent with national data in that cases follow a seasonal trend. Out of 1,784 cases

reported, 407 (22.8%) had a foodborne exposure, 702 (39.3%) were due to wounds, 71 (4%) had multiple exposures, and 604 (33.9%) had other/unknown exposures (Figure 2). *Vibrio alginolyticus* cases were primarily wound-related (43.5%) and other/unknown exposures (53.7%). Many cases in the unknown category were ear infections with or without documented seawater exposure. In keeping with national trends, over half (52%) of *V. vulnificus* were wound-related. *Vibrio parahaemolyticus* cases in Florida were due to foodborne and wound exposures, 35.2% and 38.4% respectively. This differs from national data which indicate that over half of reported exposures were foodborne. Foodborne exposures accounted for over half of the *V. mimicus* and *G. hollisae* cases in Florida and this is consistent with national trends. For *V. fluvialis*, foodborne exposures accounted for 38.7% of cases, while 40.8% had other/unknown exposures. Over half (52.8%) of cases reported as *V.* other were wound infections and only 7.4% were attributed to foodborne exposures (Figure 3).

Figure 2. *Vibriosis* Cases by Transmission Route in Florida, 2004-2016 (n=1,784)

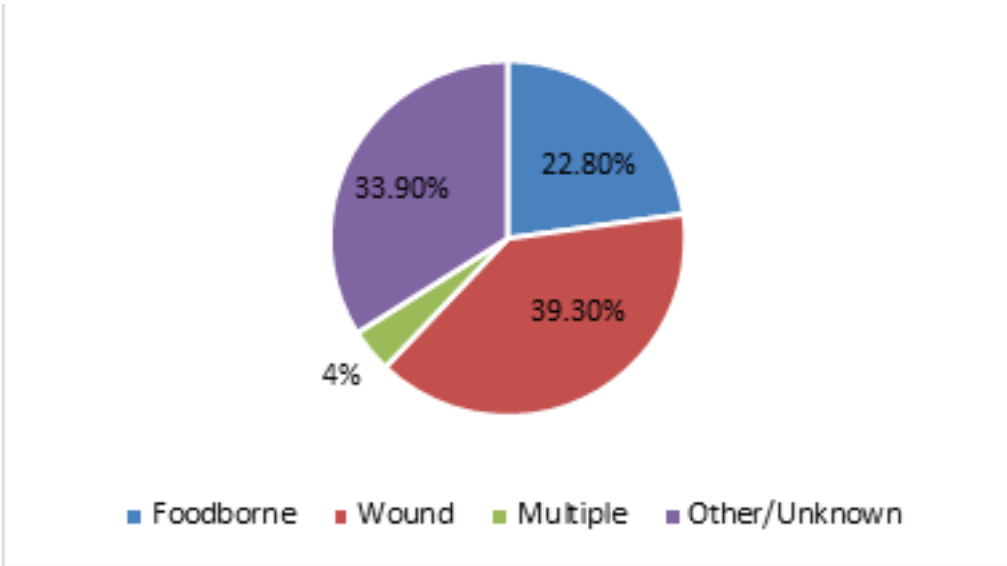
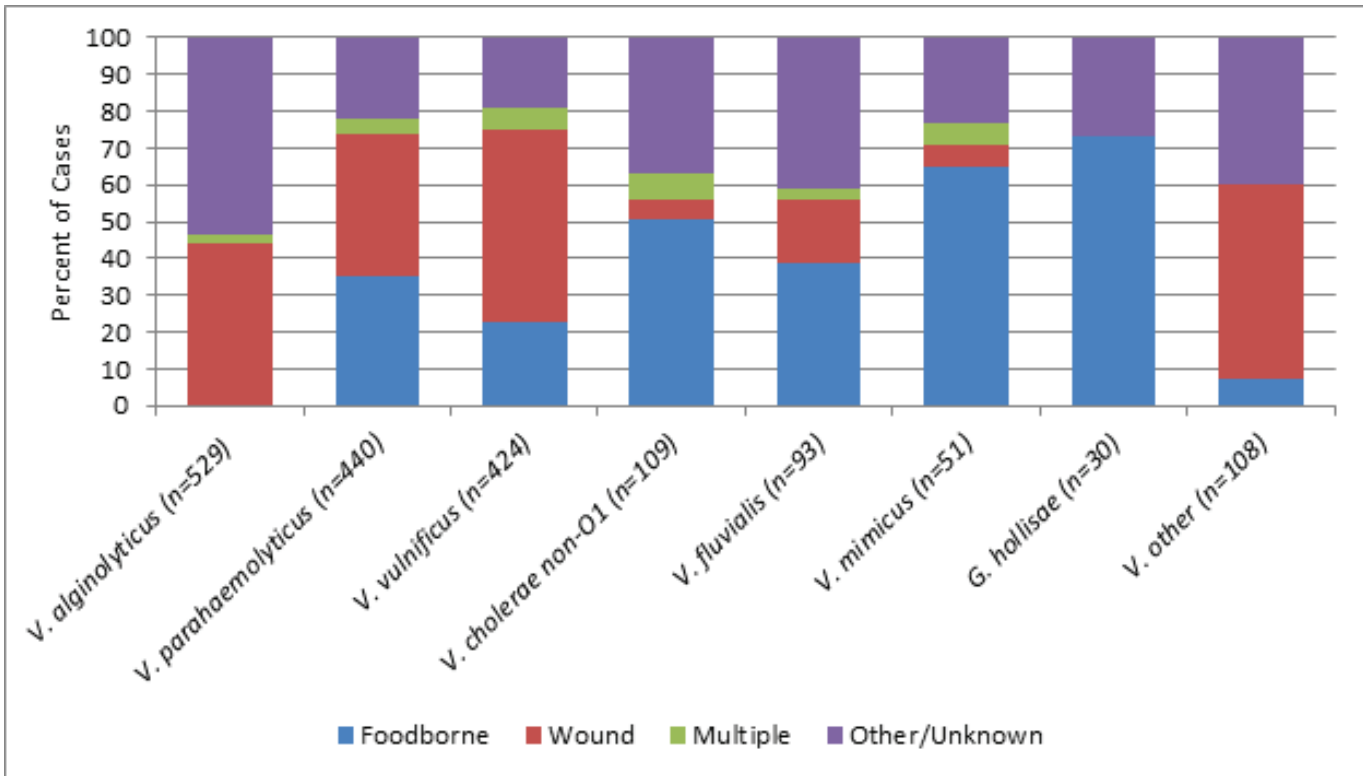
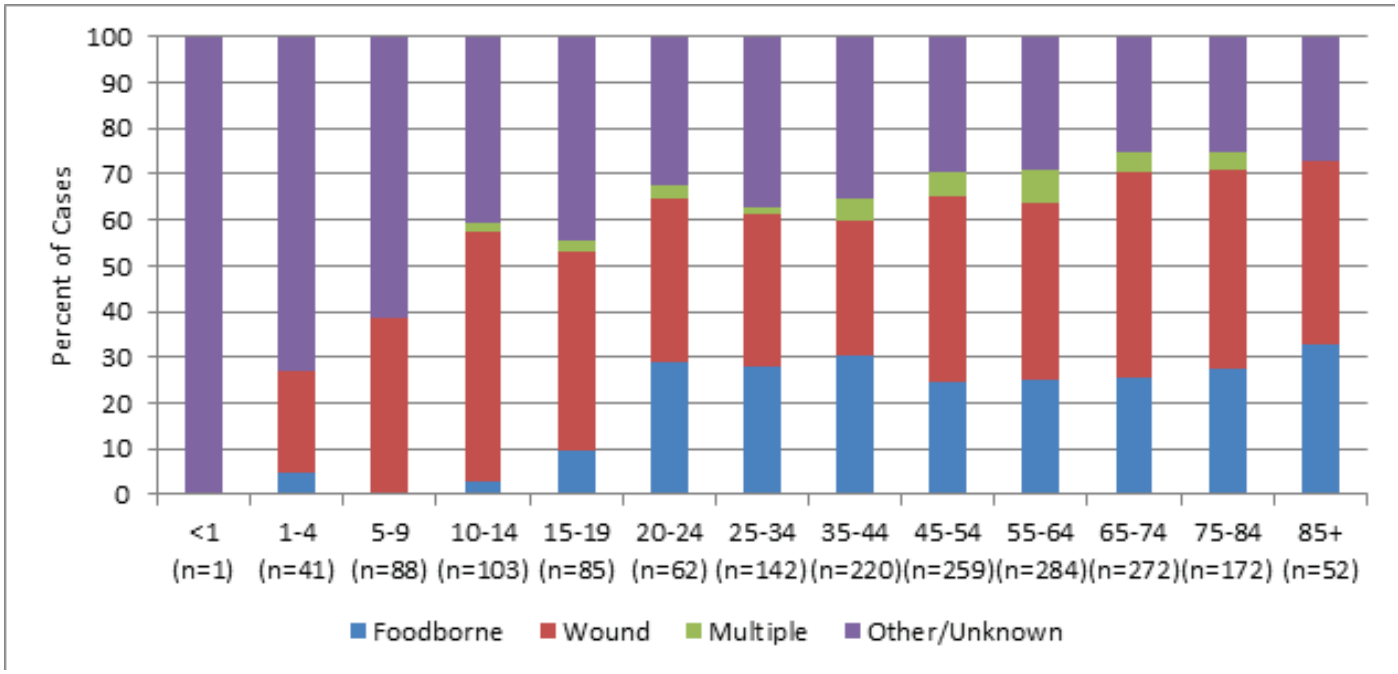


Figure 3. Vibriosis Cases by Transmission Route and Species in Florida, 2004-2016 (n=1,784)



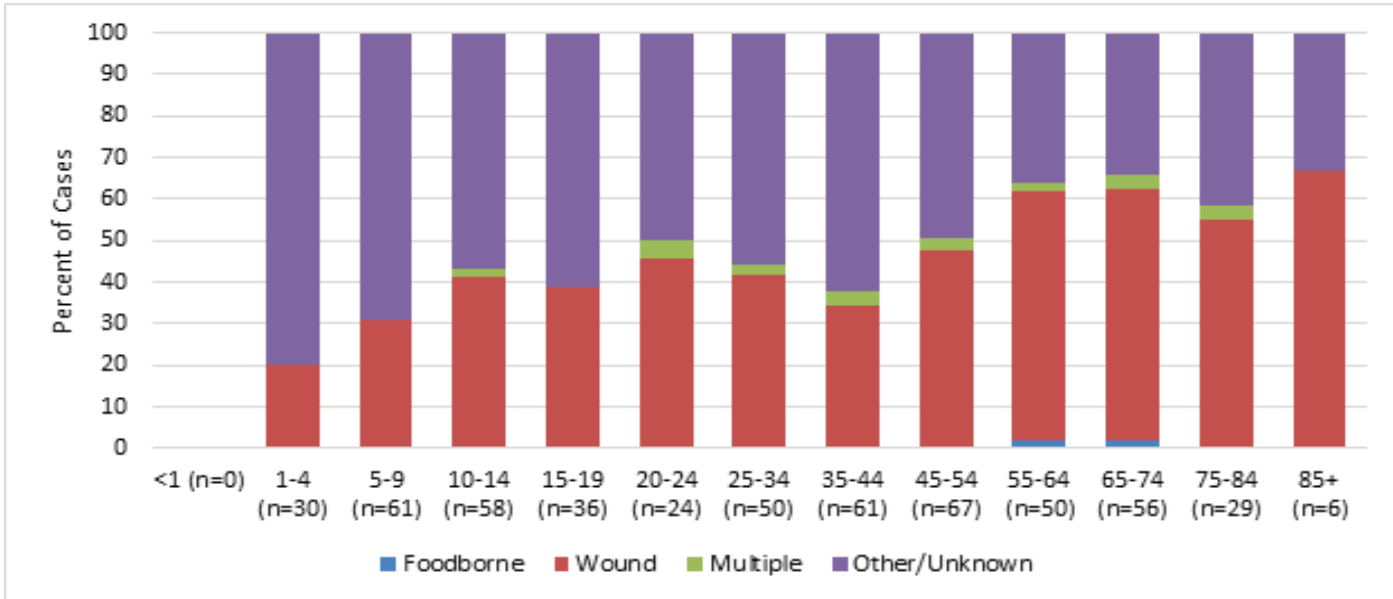
Analysis of age groups based on transmission route indicated that children were less likely to acquire an infection due to a foodborne exposure. Children were more likely to acquire V.alginolyticus via other/unknown or wound routes whereas older adults were more likely to acquire V. parahaemolyticus or V. vulnificus via foodborne or wound routes (Figures 4-7). Gender and race analysis indicated that 72% of cases were male and 81% of cases were Caucasian.

Figure 4. Vibriosis Cases by Age Group and Transmission Route in Florida, 2004-2016 (n=1,781*)



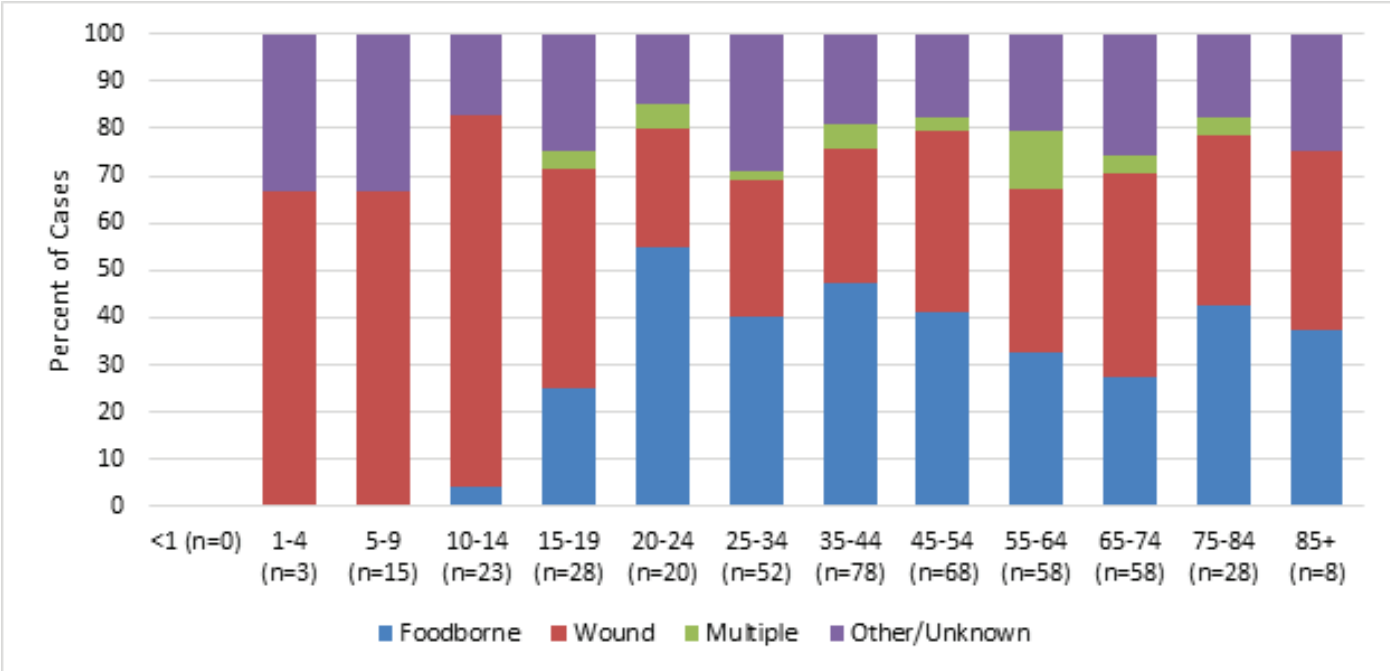
*Age unknown for three cases

Figure 5. V. alginolyticus Cases by Age Group and Transmission Route in Florida, 2004-2016 (n=528*)



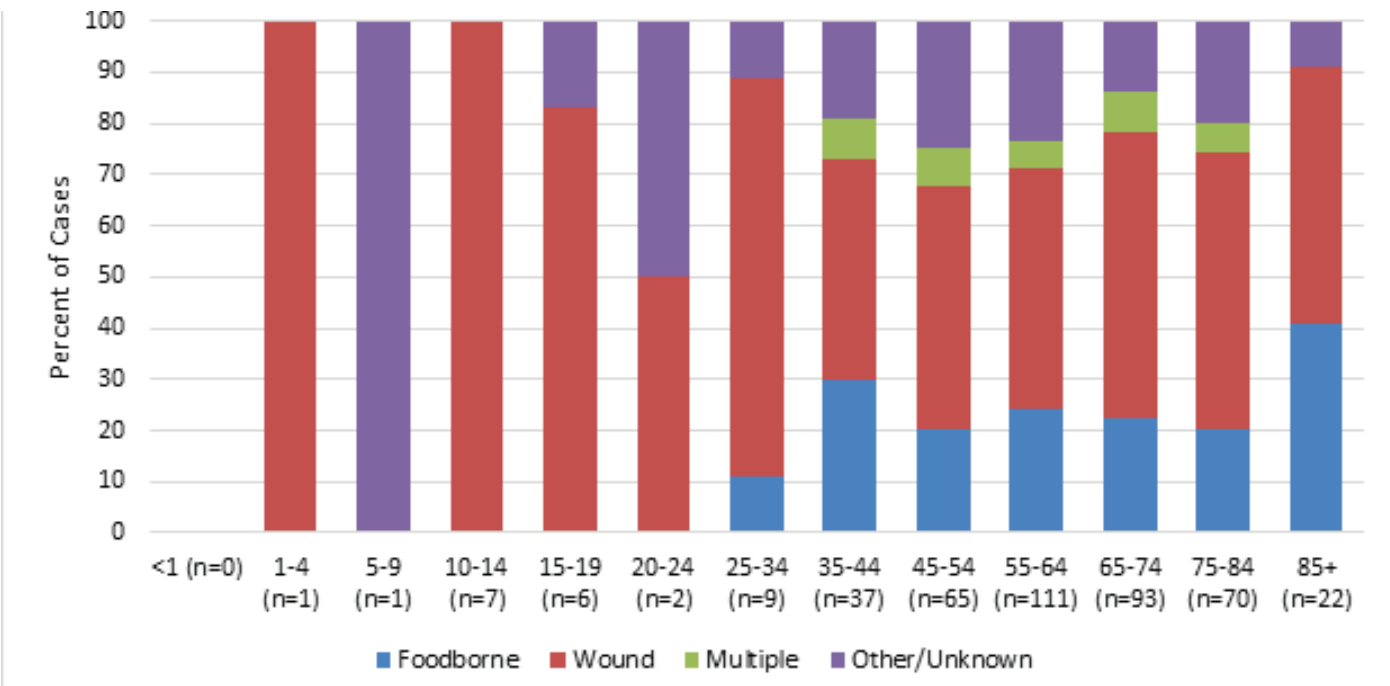
*Age unknown for one case

Figure 6. *V. parahaemolyticus* Cases by Age Group and Transmission Route in Florida, 2004-2016 (n=439*)



*Age unknown for one case

Figure 7. *V. vulnificus* Cases by Age Group and Transmission Route in Florida, 2004-2016 (n=424)



There were 142 deaths associated with vibriosis. Mortality rate was highest for cases of V. vulnificus at 28% followed by V. cholerae non-O1 at 5.5% and V. parahaemolyticus at 1.8%. Overall, foodborne exposures contributed to 32% of the deaths followed by wound exposures with 22%, multiple exposures with 10% and other/ unknown exposures with 36%. For deaths associated with V. vulnificus, 35.4% were related to foodborne exposures and 22.7% were wound exposures. A complete analysis of underlying medical conditions could not be completed for the entire data set (2004-2007 underlying medical condition information) was not available. From 2008-2016 (n=313), the analysis of underlying medical conditions in those with foodborne exposures indicated that diabetes was reported in 22% of cases, followed by heart disease 20%, liver disease 17%, alcoholism 13%, malignancies 12%, and renal disease in 11% of cases. Additional analysis of the 407 foodborne-related cases was conducted to determine if cases were associated with consuming multiple seafood items or a single seafood item in the seven days before illness onset. Analysis revealed 140 cases reported consuming more than one seafood item in the seven days before illness onset. Of the 267 cases reporting consumption of a single seafood item before illness onset, 73.4% consumed oysters. Of those who consumed only oysters, 177 had a known cooking status and 169 reported consuming raw oysters (Figure 8).

Figure 8. Seafood Exposures Among Cases With Foodborne Vibriosis Who Reported Eating a Single Seafood Item in the Week Before Illness Onset, 2004-2016

	Mollusks		Crustaceans			Other	
	Oysters	Clams	Shrimp	Lobster	Crab	Other Shellfish*	Finfish†
Cases who ate a single seafood item n (% of 267)	196 (73.4)	12 (4.5)	8 (3)	2 (0.7)	29 (10.9)	9 (3.4)	11 (4.1)
Cases who ate a single seafood item raw n (% of n in row above with known cooking status)	169 (95.5)	10 (90.9)	0 (0)	0 (0)	1 (4.5)	1 (16.7)	0 (0)

*Other shellfish reported: conch, crayfish, mussels, scallops, unknown (2)
†Finfish reported: perch, pompano, grouper, snapper, tilapia, cod, unknown (5)

In Florida, it appears that the foodborne transmission route, although an important transmission, accounts for a small proportion of vibriosis cases. When compared with national data, a smaller proportion of Florida V. parahaemolyticus infections (35.2%) are attributed to foodborne transmissions. Infections due to V. mimicus, G. hollisae, and V. cholerae non-O1 are more likely to be associated with foodborne transmission versus other transmission categories.
The findings in this report are subject to two limitations. First, this evaluation only focuses on Florida residents, not specifically where an individual was exposed, and does not account for out-of-state residents exposed in Florida. Second, underlying medical

condition information was either not collected or missing for cases from 2004-2007. This analysis suggests that host factors, such as age and immune status, play a role in the exposure and transmission type for cases of vibriosis in Florida. Foodborne illness associated with raw shellfish exposure is still a source of illness in Florida but is more frequently associated with species that have been reported to cause less severe illness. Efforts should be maintained to educate Floridians and visitors of all coastal states on the potential illnesses associated with marine exposure and consuming raw seafood. To lower the risk of acquiring vibriosis via a foodborne exposure, shellfish should be cooked to an internal temperature of 145°F for 15 seconds.2 To help prevent wound infections, cover open areas with a waterproof bandage, wash wounds with soap and water after exposure, and wear protective shoes when walking along the beach to help prevent cuts from shells or other marine debris. Providers should consider V. alginolyticus in cases of ear infections in people who have had recent marine water exposures.

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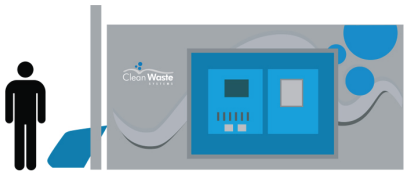
About the Authors

Laura Matthias is a regional environmental epidemiologist (REE) with the Florida Department of Health's Food and Waterborne Disease Program. She graduated with Bachelor's degrees in Environmental Health and Biology and obtained her Masters of Public Health from the University of Georgia. She works with 18 county health departments to investigate food and waterborne disease outbreak investigations. She provides training to the counties on various topics such as how to conduct outbreak investigations and how to collect environmental samples. Her experience includes sampling turtle tanks at souvenir shops for a Salmonella outbreak, assessing potential exposure to palytoxin, collecting water samples for legionellosis investigations, and assisting with tracebacks for various food products. Mrs. Matthias is also the case reviewer for all reported cases of vibriosis, ciguatera fish poisoning, and cryptosporidiosis in Florida. She assesses the exposures and works with counties when additional information, such as harvest tags, are needed and provides technical guidance and assistance to field staff investigating these reportable conditions.

Ms. Jamie DeMent is the Food and Waterborne Disease Program (FWDP) Coordinator for the Florida Department of Health (FDOH), located in Tallahassee, Florida. She earned both an undergrad and master's degree in Natural Science from Southeast Missouri State University in Cape Girardeau, Missouri. Ms. DeMent has served as the primary epidemiologist responsible for carrying out a full range of complex epidemiologic and surveillance activities related to foodborne and waterborne illnesses. She has identified and analyzed foodborne and waterborne-related issues and their impact on public policies, studies, or surveys. She has authored or coauthored comprehensive statistical and analytic reports from outbreaks and disseminated results in a wide-range of venues. In her current role at FDOH she has provided guidance for the Florida Integrated Food Safety Center of Excellence and participated in the Florida Integrated Rapid Response Team and other food safety workgroups.



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FEATURED ARTICLE

CAPILLARY WATER AND ITS INFLUENCE ON COMMON SOILS IN FLORIDA

Author: Kevin M. Sherman

I. Capillary Forces

The movement and retention of water in the capillary fringe above a groundwater table is similar in many respects to the rise and retention of water in a capillary tube, although there are also important differences between the two cases. Probably the most commonly observed demonstration of capillary forces is that of placing one end of a small diameter hollow tube in a water-filled petri dish. It is worthwhile to begin studying the physics of this simple phenomenon to gain insight to the more complex analog of soil pores.

II. Surface tension

The surface tension of a liquid is caused by the fact that molecular attractions between molecules at the surface of the liquid differ from the molecular attractions between molecules in the interior of the mass of liquid. In the center of a beaker of liquid, molecules have symmetric attractions with the identical molecules around them. At the liquid-gas interface, two different kinds of molecules are in close proximity. Because liquid and gas molecules have less affinity for each other, the attraction along the surface of the interface is stronger. Surface tension is a measure of how closely molecules are attracted to each other (cohesion) versus how well they bond to a solid material (adhesion). Surface tension allows liquids to behave as though they were covered with a tightly stretched membrane or skin. This property allows one to define surface tension as a tensile stress in a hypothetical membrane.

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III. Level of liquids in capillary tubes

When a circular glass tube is inserted vertically into a beaker of water which is open to the atmosphere, water will rise in the tube and come to rest at some definite height above the free water surface as shown in Figure 1. Because this is an equilibrium condition (the height remains stable over time) the weight of the column of water should just balance the force that holds the water up in the tube. Because a curved surface forms at the glass wall I water interface, the surface tension acts at an angle a from the vertical glass wall.

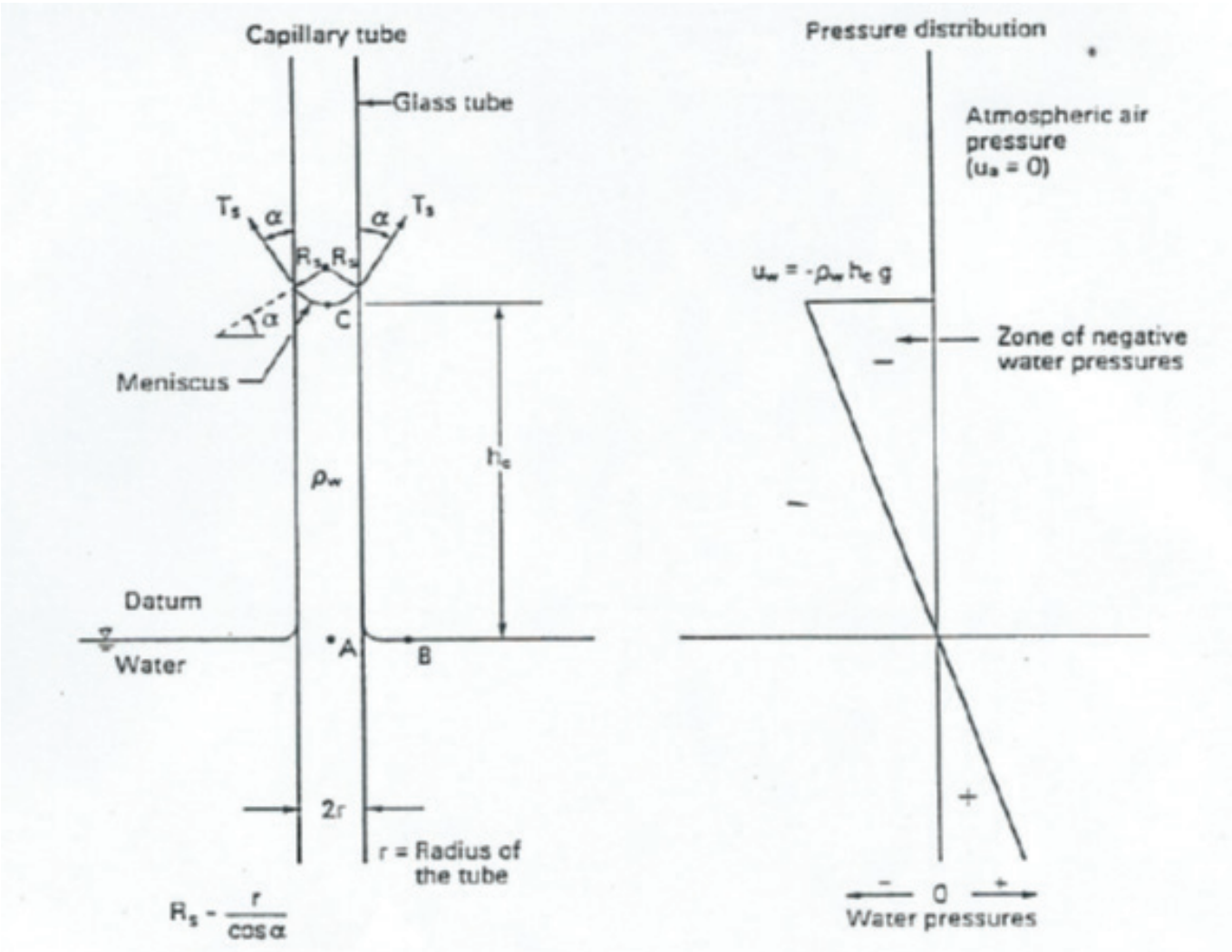

Figure 1. (a) Capillary rise of water; (b) pressure vs. depth in the water (Source, Fredlund and Raharardjo, 1994)

The upward force can then be calculated as the circumference of the water surface multiplied times the portion of the surface tension acting vertically upwards, or

$$2\pi r T_s \cos\alpha$$

The weight of the water column of height hc is the volume of the cylinder multiplied times the unit weight of water. or

$$\pi r^2 h_c \gamma_{H2O}$$

Equating both sides and solving for hc gives

$$h_c = \frac{2T_s \cos\alpha}{r\gamma_{H2O}} \quad [1]$$

Note that had the surface tension acted perpendicular to the glass wall the water would not rise within the capillary tube. With mercury, the surface tension acts at a greater than 90° angle with the glass walls, producing a convex upward liquid surface and depression of the liquid within the capillary tube (Figure 2).

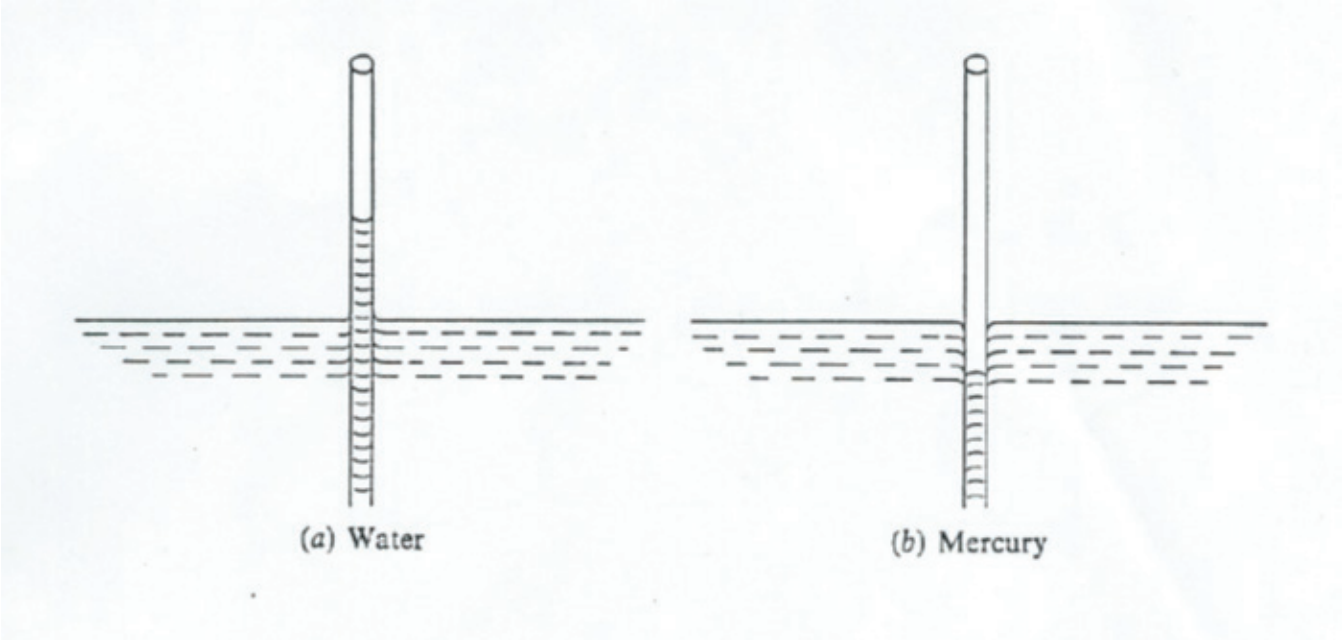

Figure 2. Capillarity in water and mercury
(Source, Evett and Liu, 1987)

Soils usually contain particles of various sizes. Consequently, the soil pores vary in diameter. Each pore can be modeled as its own capillary tube and corresponding hc . The height of the zone of capillary saturation is dictated by the maximum pore size, and the height of the capillary fringe is dictated by the minimum pore size.

IV. Attraction of soil for water

Capillary water in soil seeks to adjust itself to a state of pressure equilibrium. By virtue of this fact, the soil is said to have an attraction for water. This capillary attraction of the soil for water is exerted in all directions. When water rises above an observed water table, the capillary attraction draws it up in opposition to the pull of gravity. When water soaks into the ground and migrates downward toward a water table, gravity and capillarity combine to cause the downward flow. Capillary water may also move horizontally in soil. This movement is not influenced by gravity, however, because the force of gravity does not have a horizontal component.

V. Matric Potential

The attraction that soil has for capillary water may be expressed quantitatively by a stress property called capillary potential, matric potential, or soil suction. It is defined as the work required to pull a unit mass of water away from a unit mass of soil exclusive of osmotic and other influences, and represents the security or tenacity with which the soil holds capillary water. The term "matric potential" is now preferred for soils because of the role of clay-water bonds, which can generate negative pressures of many atmospheres - far greater than can be attributed to capillary phenomena alone.

Matric potential is always a negative quantity and can never have a value greater than zero, since the pressure in capillary water is always less than atmospheric pressure. Moisture flow is toward drier soil, other factors being the same, because the potential is low, that is, more negative. In a wet soil the matric potential is high, and in a saturated soil or soil below the water table, the matric potential is zero, this being the highest possible value of that property.

VI. Capillarity in sandy soils and silt

Valle-Rodas (1944) conducted experiments with uniform sands and silts. These data set the upper limit on the capillary fringe for the types of soil material examined. Similar results are expressed in Table 1.

Soil Material	Capillary Rise h_c (in.)
Coarse Sand	4.92
Medium Sand	9.84
Fine Sand	15.75
Silt	39.37

Source: Heath, 1982

Table 1. Approximate extent of the capillary fringe in various soil materials

The zone of capillary saturation is, conversely, a function of the largest pores in the soil. Table 2 provides the extent of the region Freeze and Cherry (1989) refer to as the "tension-saturated zone" (taken from Valle-Rodas, 1944).

Soil Material	Capillary Saturated Zone (in.)
Coarse Sand	0.00
Medium Sand	1.18
Fine Sand	1.97
Silt	5.91

Source: Valle-Rodas, 1944 in Fredlund and Raharardjo, 1994

Table 2. Extent of the capillary saturated zone in various soil materials

Particle shape, tortuosity of the channel between the particles and continuity of the pores will have some impact on the extent of capillary rise. When a large pore exists beneath finer pores, the capillary rise is 'broken' in the channel. This is the reason why soil pore filling follows a different path than soil pore emptying (hysteresis).

VII. Implications for Onsite Wastewater Treatment and Disposal Systems

Onsite wastewater systems rely on unsaturated soil for wastewater renovation. Capillary water works against this goal. However, in Florida, the seasonal high water table is not estimated based on an observed water depth in a piezometer or pit, but rather on redoximorphic features such as soil mottling, low chroma matrices and similar soil morphological features. These features can form in both the tension-saturated zone and in the free water surface below it.

In mounded systems with wet season high water tables at or above ground surface, however, capillary water could have a detrimental effect on the vertical extent of the unsaturated zone beneath the drainfield. Table 2 gives a conservative estimate of how much of the anticipated unsaturated zone is drawn up into fill when soil material of various textures are placed on such soils. Designs of systems should, in the future, take this factor into consideration to achieve proper unsaturated zone depth and ultimately minimize environmental impacts from system installations.

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FEATURED ARTICLE

Measuring Mercury Exposure among Residents of Martin County, Florida, 2016-2017

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BACKGROUND Mercury (Hg) is a ubiquitous environmental toxin that can lead to significant health risks in humans, causing particularly serious neurological damage in the developing fetus. Coastal areas in South Florida have some of the highest levels of mercury deposition in the country. Therefore, we conducted a cross-sectional study in a medium-sized coastal county to evaluate fish consumption patterns of women of child-bearing age in relationship to hair mercury levels. Secondary objectives included to determine awareness of annual fish advisories and to compare results with a baseline study conducted in the same county in 2010.

METHODS The data were collected from 232 non-random volunteer women aged 18 to 50 years, who had resided in Martin County, Florida for at least one year prior to the study. Hair samples were analyzed for total Hg concentration. Interviews collected data on sociodemographic characteristics, fish consumption, pregnancy status, and awareness of fish advisories. Geometric and arithmetic Hg concentrations were calculated and potential associations assessed using basic descriptive and analytic statistical tests.

RESULTS The geometric and arithmetic means of Hg concentration were 0.21 and 0.47µg/g of hair, respectively. Thirty-eight (16%) women had concentrations >1µg/g. Higher Hg concentrations were associated with non-Hispanic ethnicity, White race, and income >$75,000. The most important contributors to fish consumption in this population were fish meals at restaurants (2.46 meals/month) and shellfish meals (2.37 meals/month), and patterns varied by age, race/ethnicity, and income. Tuna and grouper were the most commonly consumed fish. While the majority of women (63.7%) reported having received information on safe fish consumption, far fewer were aware of limiting fish because of mercury contamination (46.6%) or familiar with fish consumption advisories (32.8%). Awareness was higher among pregnant participants.

CONCLUSION The geometric and arithmetic mean hair mercury levels identified in this study were similar to those obtained from the National Health and Nutrition Examination Survey (0.20 and 0.47µg/g) but less than those obtained in the baseline study (0.37 and 0.68µg/g). These results demonstrate an overall improvement in average mercury concentrations in women of child-bearing age in Martin County, Florida; however, additional education and promotion of fish consumption advisories is needed in this target population.

Introduction

Mercury (Hg) is a naturally existing element that can appear in several forms and can be found in rock and coal. Mercury is released into the environment through natural processes (e.g., volcanic releases, wildland fires), but more commonly through industrial processes (e.g., burning of fossil fuels). Through bioconversion, mercury is converted to methylmercury, a toxic organic compound, by aquatic bacteria and then accumulates in the food chain. Exposure through fish consumption is the most common pathway putting humans at risk. Developing fetuses are most at risk for neurological and developmental complications from methylmercury exposure, though chronically-exposed adults may also experience neurological and cardiovascular system effects.[1,2]

According to the Mercury Deposition Network of the National Atmospheric Deposition Program, the Southeast US has some of the highest concentrations of total Hg and wet deposition each year. Coastal areas in Florida consistently lead this region as having some of the highest wet deposition and total Hg concentrations in the US.[3] Because of the risk of exposure to methylmercury from bioaccumulation in the food chain, mercury-related advisories have been issued in Florida since 1989,[4] and the Florida Fish Advisories Program produces an annual brochure that provides eating guidelines for women of childbearing age and all other individuals by water body for fresh and marine waters.[5] Additionally, the Florida Department of Health (DOH) has made a variety of educational materials related to safe fish consumption available for many years including a wallet card and cookbook.[5]

The Florida Department of Health in Martin County (DOH-Martin) and the Environmental Public Health Tracking (EPHT) Program conducted a mercury biomonitoring project in Martin County, Florida in 2016 and 2017. The purpose of this project was to assess fish consumption patterns among women of child-bearing age in relationship to hair Hg levels. Additionally, this study updated a similar biomonitoring project conducted in this population in 2010.

Methods

The study was submitted to and approved by the DOH Institutional Review Board in September 2016. From December 2016 through June 2017, DOH-Martin and EPHT conducted a cross-sectional study consisting of interviews and laboratory analysis of hair samples for total Hg concentration. We used convenience sampling methods to enroll volunteer women ages 18-50 years who were residents of Martin County for at least one year prior to the study. Field staff attempted to include as many women as possible who had participated in the 2010 study, and conducted additional recruitment by posting announcements in newspapers, physician offices, health clubs, health department clinics and websites; by advertising on local public television stations; and at local events.

Use of hair samples to assess mercury exposure is simple and non-invasive, and hair concentrations of mercury have been shown to correlate well with dietary intake. For most populations, total hair Hg concentration can be considered a good marker for

methylmercury exposure.2,6 Hair samples were obtained using standard collection and analysis procedures. Specifically, staff collected a sample of approximately 100 strands of hair from an inconspicuous area close to the occipital region of the scalp. The DOH Bureau of Public Health Laboratories analyzed samples for total Hg concentration using combustion-gold amalgamation-atomic absorption spectroscopy with the MA-2000 mercury analyzer (Nippon Instruments Corporation; Tokyo, Japan). The calibration linear dynamic range was modified (2- to 60-ng of Hg) to achieve lower detection limits.

Surveys were conducted to assess participants usual fish consumption patterns, awareness of fish consumption advisories and safe fish options, and other factors. We obtained additional data from the US Census Bureau, specifically the American Community Survey 5-year estimates for 2016,7 to compare our study sample with the overall characteristics of Martin County residents.

Field staff entered survey data and hair Hg concentrations into a secure Access database, and study investigators analyzed the data using SAS v9.4 software (SAS Institute; Cary, NC). All analyses were conducted using an alpha (Type I error) of 0.05 to test for significance. We conducted a variety of descriptive and analytic statistical tests. Descriptive statistics include arithmetic and geometric mean Hg concentrations, means and standard deviations, medians and ranges, and 95% confidence intervals (CI), where appropriate. T-tests and analysis of variance (ANOVA) tests were conducted to compare mean Hg hair concentrations across sociodemographic characteristics. Limited significance testing was used and logistic regression analyses were not included in the present study results due to small sample size and low power issues. Additionally, formal statistical comparisons were not done comparing the 2010 study to the present study results because of the disparities in participant characteristics and sample size between the study samples.

Results

Sociodemographic Characteristics. We targeted a final enrollment of 400, but only achieved a study sample size of 232 (58.0%) due to lower than expected participation rates. Additionally, while every attempt was made to contact individuals who participated in the 2010 biomonitoring project, only 17 (4.2%) of the 408 participants in the previous study were recruited into the 2016 study.

Participant sociodemographic characteristics and other potential non-seafood exposures to mercury are shown in Table 1. Characteristics are also provided for Martin County population overall and for females. The median age of study participants was 37 years (range: 18-50), with 59.9% of participants between the ages of 35 and 50 years. Most participants were non-Hispanic (76.3%), White (73.7%), with a household income of $50,000 or higher (56.0%) and a college or post-college degree (65.5%). The sociodemographic characteristics of respondents differed from the overall county population on age, race/ethnicity, and education, but there was no difference in terms of household income. Study participants were more likely to be 25 years and older, report other race or Hispanic ethnicity, and to report being college grads or more education than

the overall Martin County population (Table 1).

Mercury Concentrations. Overall, the arithmetic and geometric mean Hg concentrations among study participants were 0.47 µg/g and 0.22 µg/g of hair, respectively (Table 2). Arithmetic mean concentrations differed significantly by race, ethnicity, and income (all p-values < 0.05). Those with higher mean Hg concentrations were more likely to be non-Hispanic (0.53 µg/g), White (0.53 µg/g), and have incomes of $50,000-74,999 (0.55 µg/g) and $75,000 or higher (0.65 µg/g).

Fish Consumption Patterns. Among study participants, 205 (88.4%) reported including fish or shellfish in their diets. Among these individuals, 96 (46.8%) reported that their fish consumption varies throughout the year, and an average of 10.6 (SD = 8.7) total fish meals per month consumed. The most frequent sources of fish consumption (Table 3) among participants were fish meals at restaurants, fish meals cooked at home, and shellfish (all means = 2.6 meals/month). No significant differences in total fish meals were noted by age, race, ethnicity, or household income (Table 4), though some minor differences can be seen when examining type of fish meals per month. The most common high Hg fish consumed in the past 60 days included tuna (79, 78.2%), mackerel (15, 14.9%), and Chilean sea bass (12, 11.9%). The most common locally-caught fish consumed in the past 60 days included grouper (57, 77.0%), snook (24, 32.4%), and wahoo (22, 29.7%).

Mercury Awareness. Among the 205 participants who reported including fish or shellfish in their diets, 131 (63.9%) had heard about limiting fish consumption because of mercury contamination, 97 (47.3%) had received information on safe fish consumption, and 66 (32.2%) were familiar with fish consumption advisories (results not shown). The most common sources of information on mercury contamination and safe fish consumption were doctors/nurses (34, 16.6%), internet/social media (29, 14.1%), and DOH (14, 6.8%). Other sources listed included food vendors/restaurants; Women, Infant, and Children (WIC) program offices; and other organizations. There were 17 pregnant women included in the survey who reported consumption of fish/shellfish. A greater proportion of pregnant women were likely to report mercury awareness than non-pregnant women, respectively: limiting fish consumption due to Hg contamination (68.7% vs. 63.5%), receiving information about safe fish consumption (56.3% vs. 46.6%), and being familiar with fish consumption advisories (56.3% vs. 30.7%).

Women with High Mercury Consumption and Concentrations. We examined characteristics of women who reported consuming fish higher in mercury or locally-caught fish in the previous 60 days (Table 5). Women between the ages of 35 and 50 years, non-Hispanic, White, with household incomes of $50,000 or more and college or post-college degrees were more likely to report consuming fish higher in mercury or local caught. We also examined characteristics of women with a hair mercury concentration ≥ 1 µg/g of hair and had reported consumption of fish higher in mercury or locally caught in the previous 60 days (results not shown). Similar characteristics were noted.

Comparisons with 2010 Study. We compared results from the current study (2016-2017) with results obtained in the baseline study (2010),8 but did not employ significance

testing for reasons previously mentioned. Participants in the current study were older, less likely to be White or Black and more likely to report Other race, and more likely to report having a college or post-college degree than participants in the baseline study. The arithmetic mean hair Hg concentration was lower in the current study than that reported in the baseline study, 0.47 vs. 0.68 µg/g of hair. More participants in the current study had hair Hg concentrations less than 0.5 µg/g of hair, whereas more participants in the baseline study had concentrations ≥ 0.5 µg/g of hair (Figure 1). However, the current study reported similar participant characteristics for those with higher mercury concentrations (White, non-Hispanic, higher incomes) as the baseline study. Fish consumption patterns did not differ notably from those reported in the baseline study. Overall, mercury awareness appeared lower in the current study compared to baseline – 75.3% were aware of limiting fish consumption because of Hg contamination and 41.5% were aware of local fish advisories in the baseline study compared to 63.9% and 32.2%, respectively, in the current study. Finally, characteristics of women who had recently consumed fish high in mercury or locally-caught fish or had higher hair mercury concentrations were similar between studies.

Discussion

The mean hair mercury levels in women of childbearing age found in the current study were similar to those reported in the 1999-2000 National Health and Nutrition Examination Survey (NHANES). This is the most recent NHANES to assess total hair mercury concentrations among participants. The current study found a geometric mean of 0.22 µg/g and arithmetic mean of 0.47 µg/g, compared to 0.20 and 0.47 µg/g, respectively, in NHANES 1999-2000.9 The current study also reported lower mean hair mercury levels than the baseline study in the same reference population (Martin County, FL) from 2010 (0.37 and 0.68 µg/g, respectively).8 Additionally, this 2016-2017 Martin County biomonitoring study found concentrations similar to or less than studies conducted in other Florida populations.10-13

The majority (63.9%) of participants in the current study had heard about limiting fish consumption due to possible mercury contamination, though less than half reported receiving information on safe fish consumption (47.3%) or were familiar with local fish consumption advisories (32.2%). These results are similar to the baseline study, in that over half of participants in 2010 were unaware of local fish advisories.8 Other Florida studies have reported even lower rates of awareness of advisories.10,13 Even with local and statewide educational efforts, including local environmental health podcasts, safe fish wallet cards, and a cookbook, more efforts are needed to educate women of childbearing age in this population to prevent neurodevelopmental complications in utero.

Similar sociodemographic characteristics for higher mercury concentrations were noted in the current study and previous studies conducted in Florida populations. The current study demonstrated higher hair mercury concentrations associated with higher income and educational attainment, higher age, and being White, non-Hispanic. Nair et al. (2014)8 also noted similar associations with race and education. Traynor et al. (2013)13 demonstrated higher hair mercury concentrations with increasing age, non-Hispanic individuals, and those with greater income or education levels.

This study is subject to several limitations. Due to the lower than expected participation rates in the current study, the power to detect significant associations is limited. Therefore, we limited our analyses to simple bivariate associations. Because the study population in the current study differed in many ways from the overall population of Martin County, we are limited in our ability to generalize the results outside of the study population. Finally, because few participants from the baseline study participated in the current study and for other reasons (e.g., limited information on educational activities, limited webpage tracking information, disparities in participant characteristics between studies), our conclusions regarding the effectiveness of previous educational efforts in this county are limited.

However, the results of this study clearly demonstrate the specific sub-populations in Martin County that need to be targeted, potentially with regionally-focused advisories and information, including women in higher income groups or with greater education levels. Increased educational efforts at events and other public locations frequented by these sub-populations are needed.

Table 1. Participant demographic characteristics and non-seafood exposures, Martin County, Florida (N = 232).

			Martin County, FL (total population = 153,592)[1]		Martin County, FL (female population = 77,755)[1]	
Variable	**N**	**%**	**N**	**%**	**N**	**%**
Age (continuous)	mean: 36.72 median: 37	SD: 7.73 range: 18-50	N/A median: 51.1		N/A median: 52.8	
Age (years)[2]						
18-24	16	6.90	9,830	20.45	4,588	20.14
25-34	77	33.19	13,823	28.75	6,065	26.62
35-50	139	59.91	24,421	50.80	12,130	53.24
Ethnicity						
Hispanic	55	23.71	19,777	12.88	9,037	11.62
Non-Hispanic	177	76.29	133,815	87.12	68,718	88.38
Race						
White	171	73.71	133,754	87.08	68,682	88.33
Black	9	3.88	8,583	5.59	3,663	4.71
Other	49	21.12	11,255	7.33	5,410	6.96
No Answer	3	1.29				
Household Income[3]					N/A	
<$25,000	45	19.40	14,045	22.30		
$25,000-34,999	26	11.21	6,739	10.70		
$35,000-49,999	21	9.05	9,069	14.40		
$50,000-74,999	52	22.41	11,147	17.70		
$75,000 or more	78	33.62	21,791	34.60		
No Answer	10	4.31				
Education[4]						
Elementary/Middle School	10	4.31	13,671	10.71	5,716	8.80
High School/GED	21	9.05	33,903	26.57	17,365	26.75
Some College/Tech School	44	18.97	42,130	33.02	23,793	36.65
College Grad/Post College	152	65.52	37,899	29.70	18,054	27.81
No Answer	5	2.16				

Years in Martin County	mean: 12.65 median: 10	SD: 10.31 range: 1-49	N/A		N/A	
City of Residence[5]						
Hobe Sound	18	7.76	65,657	42.75	33,320	42.85
Indiantown	26	11.21	19,922	12.97	9,221	11.86
Jensen Beach	36	15.52	-		-	
Palm City	43	18.53	-		-	
Stuart	107	46.12	68,013	44.28	35,214	45.29
Other	2	0.86	-		-	
Pregnant	19	8.19	N/A		N/A	
Silver Dental Fillings	77	33.19	N/A		N/A	
Other Recent Exposure to Hg[6]	6	2.59	N/A		N/A	
Recreational Fishing License	99	42.67	N/A		N/A	

N/A = Not available, SD = standard deviation

[1]American Community Survey, 2016, 5-Year Estimates.

[2]Census estimates for age use the percentage in that age category provided by the ACS times the total population in that column. 35-49 is provided for Census data, as 35-50 category is not available.

[3]Census data for income are reported as number of households, not individuals (N = 62,980 households). Census estimates for income use the percentage in that income category provided by the ACS times the total population.

[4]Census data on educational attainment include estimates on the population 18 to 24 added to estimates on the population 25 years and older (Total N = 127,603 and Female N = 64,928 aged 18 years or over).

[5]Based on Census-defined County Subdivisions, includes Indiantown CCD, Port Salerno-Hobe Sound CCD, and Stuart CCD only.

[6]Based on the survey question "Other than your seafood consumption, are you aware of any recent exposure to mercury at work, school or home?"

Table 2. Mercury (Hg) concentrations among participants, Martin County, Florida (N = 232)

	Arithmetic Hg Concentration			Geometric		
Category	**Mean**	**Median**	**Range**	**Mean**	**95% CI**	**p-value[2]**
Overall	0.47	0.2436	(0.01-3.26)	0.22	(0.18, 0.26)	
Ethnicity[3]						0.0004
Hispanic	0.29	0.14	(0.01-1.73)	0.13	(0.09-0.19)	
Non-Hispanic	0.53	0.29	(0.01-3.26)	0.25	(0.20-0.31)	
Race						0.0277
White	0.53	0.292	(0.01-3.26)	0.25	(0.20, 0.31)	
Black	0.17	0.081287	(0.03-0.94)	0.09	(0.05, 0.20)	
Other	0.35	0.1733	(0.01-1.73)	0.16	(0.11, 0.24)	
No Answer	0.10	0.1059	(0.08-0.12)	0.10	(0.06, 0.17)	
Income						0.0008
<$25,000	0.24	0.11	(0.01-2.39)	0.08	(0.05-0.13)	
$25,000-34,999	0.38	0.20	(0.01-1.64)	0.15	(0.08-0.29)	
$35,000-49,999	0.35	0.23	(0.01-1.50)	0.15	(0.07-0.31)	
$50,000-74,999	0.55	0.30	(0.01-2.38)	0.33	(0.24-0.45)	
$75,000 or more	0.65	0.43	(0.01-3.26)	0.36	(0.27-0.49)	
No Answer	0.28	0.15	(0.02-0.80)	0.17	(0.07-0.38)	

[1]Nineteen observations had Hg concentrations below the detectable limit or not detectable. These Hg concentration values were set at one-half of the detectable limits for analysis purposes.

Of these, 14 were White and 5 were Other race; 8 were Hispanic; 11 had incomes <25,000, 2 between 25,000-34,999, 3 between 35,000-49,999, 1 between 50,000-74,999, 1 had an income 75,000 or greater, and 1 provided no answer.

[2]F-test p-value for ANOVA for difference between arithmetic mean Hg concentrations reported, unless otherwise noted.

[3]T-test p-value for samples with unequal variances reported.

Table 3. Average weekly and monthly fish consumption among participants reporting including fish County, Florida (n = 205).

Variable	N	Mean	SD	Minimum	Maximum	Median
Meals of canned tuna per week	166	0.39	0.62	0.00	3.00	0.00
Meals of canned tuna per month	166	1.85	2.18	0.00	12.00	1.00
Meals of canned white tuna per week	155	0.36	1.00	0.00	11.00	0.00
Meals of canned white tuna per month	155	1.47	3.95	0.00	44.00	0.00
Fish meals at restaurant per week	182	0.62	0.76	0.00	4.00	0.50
Fish meals at restaurant per month	182	2.59	2.49	0.00	16.00	2.00
Fish meals cooked at home per week	176	0.71	0.82	0.00	3.00	0.50
Fish meals cooked at home per month	176	2.57	2.89	0.00	12.00	2.00
Fish meals locally caught per week	151	0.38	0.63	0.00	3.00	0.00
Fish meals locally caught per month	151	1.51	2.10	0.00	12.00	1.00
Shellfish meals per week	186	0.60	0.66	0.00	3.00	0.50
Shellfish meals per month	186	2.55	2.28	0.00	12.00	2.00
Total meals per week	204	2.60	2.58	0.00	15.00	2.00
Total meals per month	204	10.59	8.70	0.00	55.00	9.00

SD = standard deviation

Table 4. Monthly fish consumption patterns by participant demographic characteristics, Martin County, Florida (n = 205).

	Total Number of Meals per Month													
	Canned Tuna		White Tuna		Restaurant		Cooked at Home		Locally Caught		Shellfish Meals		Total Meals	
Category	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Age (years)														
16-24	1.31	1.80	0.33	1.15	3.27	3.22	2.00	3.21	0.83	1.27	2.47	1.60	9.67	9.41
25-34	2.13	2.32	1.33	2.33	2.02	1.96	3.05	3.21	1.55	1.73	2.56	2.25	11.17	7.92
35-50	1.76	2.15	1.70	4.80	2.78	2.58	2.37	2.63	1.58	2.38	2.55	2.38	10.41	9.03
Ethnicity														
Hispanic	1.79	2.27	1.14	2.40	1.98	1.92	2.39	2.55	1.51	2.02	3.00	2.94	10.37	8.31
Non-Hispanic	1.86	2.16	1.57	4.31	2.78	2.61	2.62	2.99	1.51	2.13	2.41	2.03	10.66	8.83
Race														
White	1.80	2.15	1.41	4.26	2.58	2.40	2.25	2.61	1.49	2.17	2.47	2.22	10.13	8.23
Black	2.17	1.72	3.00	3.79	2.00	2.89	4.14	4.63	0.83	0.98	2.78	2.49	11.89	11.44
Other	2.06	2.42	1.43	2.64	2.85	2.76	3.56	3.22	1.77	2.04	2.89	2.44	12.39	9.60
No Answer	n ≤ 2													
Income														
<$25,000	1.97	2.77	1.21	2.61	2.38	2.62	2.58	3.49	1.62	2.16	3.42	2.93	11.46	10.82
$25,000-34,999	2.35	1.69	2.33	2.99	2.83	1.81	2.76	2.66	1.53	1.77	1.96	1.37	11.42	6.61
$35,000-49,999	2.62	2.02	1.27	1.35	3.00	3.00	4.07	3.38	1.18	0.98	2.57	2.17	11.35	6.96
$50,000-74,999	1.47	1.62	0.91	1.56	2.57	3.01	2.36	2.78	1.84	2.46	2.47	1.93	9.88	8.09
$75,000 or more	1.89	2.41	1.89	5.90	2.58	2.25	2.22	2.47	1.41	2.22	2.50	2.36	10.49	9.48
No Answer	<=10													

SD = standard deviation

Table 5. Characteristics of women who consumed fish higher in mercury (Hg) or locally caught in the previous 60 days (n = 131).

		Women who consumed fish higher in Hg or locally caught in previous 60 days (N = 131)			
	Total Sample (N = 232)	High Hg (n = 101)		Locally Caught (n = 74)	
Variable	N	N	%	N	%
Age (years)					
18-24	16	4	3.96	2	2.7
25-34	77	29	28.71	24	32.43
35-50	139	68	67.33	48	64.86
Ethnicity					
Hispanic	55	18	17.82	15	20.27
Non-Hispanic	177	83	82.18	59	79.73
Race					
White	171	78	77.23	61	82.43
Black	9	3	2.97	1	1.35
Other	49	20	19.8	12	16.22
No Answer	3	0	0.00	0	0.00
Income					
<$25,000	45	15	14.85	6	8.11
$25,000-34,999	26	11	10.89	9	12.16
$35,000-49,999	21	4	3.96	6	8.11
$50,000-74,999	52	24	23.76	19	25.68
$75,000 or more	78	45	44.55	32	43.24
No Answer	10	2	1.98	2	2.7
Education					
Elementary/Middle School	10	4	3.96	2	2.7
High School/GED	21	7	6.93	3	4.05
Some College/Tech School	44	16	15.84	13	17.57
College Grad/Post College	152	73	72.28	56	75.68
No Answer	5	1	0.99	0	0.00

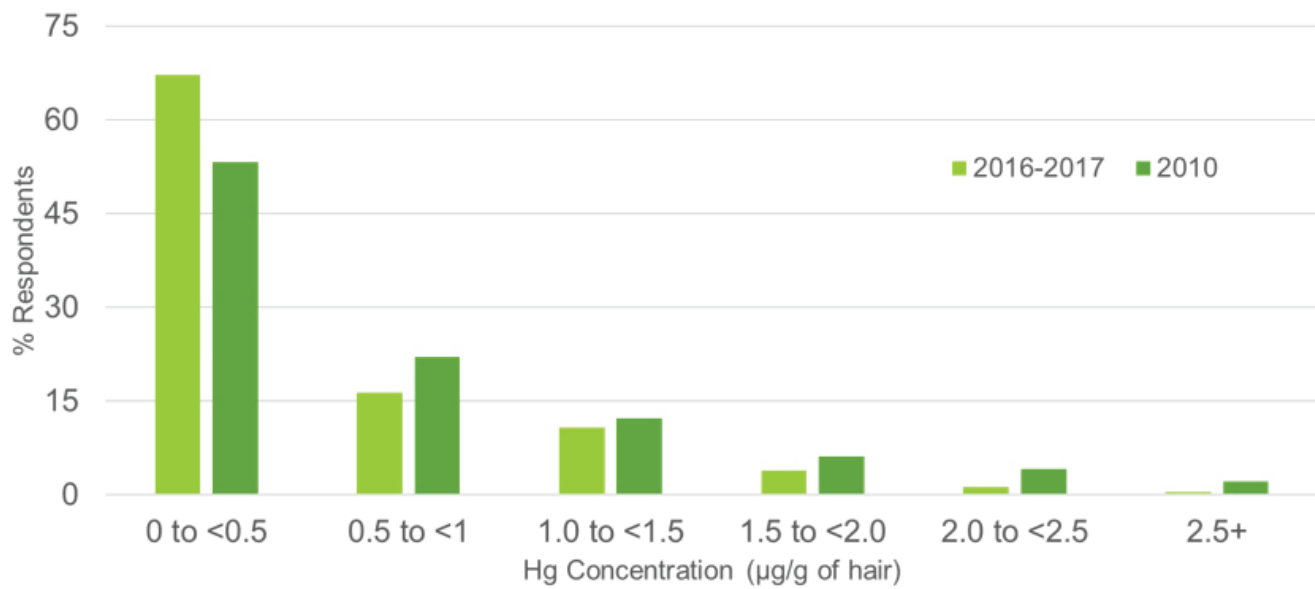

Figure 1. Distribution of arithmetic mean hair mercury (Hg) concentrations for the current study (2016-2017) compared with the baseline study (2010), Martin County, Florida

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FEATURED ARTICLE

Review of Vibrio vulnificus Infections Reported in Florida, 2004-2013

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Summary: The aim of this study was to summarize V. vulnificus infections in Florida, describe the most common exposure routes and symptoms associated with V. vulnificus infection, characterize risk factors associated with death, and identify areas for improvement in the early initiation of presumptive treatment for V. vulnificus infections.

Running Title: Vibrio vulnificus Infections Florida

Keywords: Epidemiology, Infectious disease, Vibrio vulnificus

Abstract:

We examined 299 Vibrio vulnificus infections reported in Florida from 2004-2013 to summarize Vibrio vulnificus infections, determine risk factors and exposures associated with death, and investigate reasons for delays in the presumptive treatment of vibriosis. Exposures were categorized as marine/estuarine contact, seafood consumption, both seafood consumption and marine/estuarine contact, or unknown exposure. Logistic regression was used to characterize risk factors and exposures associated with death. The average annual incidence rate in Florida was 1.6 per 100,000 persons per year and a case fatality rate (CFR) of 30%. More than half (66%) of reported cases had at least one immunocompromising condition. Marine/estuarine contact was the most commonly reported exposure category. High-risk individuals should be aware of the risks that exposure to warm, brackish seawater and consumption of raw seafood pose to their health and their likelihood of acquiring an infection caused by Vibrio species.

Introduction

Vibrio vulnificus are gram-negative, halophilic bacteria, and one of the most common surface water organisms in the world.[1,2,3,4] V. vulnificus infections are a rare but serious public health concern in the United States, causing approximately 45 hospitalizations and 16 deaths annually.[3] In the United States, the estimated national incidence of V. vulnificus infection is approximately 0.04-0.05 per 100,000 persons per year, with a higher incidence, 0.5 per 100,000 population, in coastal areas.[2] With warm to moderate water temperatures and a subtropical climate, Florida is one of the leading states in the number of reported Vibrio infections each year.[4,5,6] From 2004-2013, 1,235 cases of vibriosis were reported in Florida; 299 (24%) infections were due to V. vulnificus, a virulent species of Vibrio associated with serious

morbidity and a high case fatality rate (CFR).[4,7,8] Human infection results from exposure to the bacteria through consumption of seafood, especially raw shellfish, or by skin or soft tissue (SST) exposure to V. vulnificus through contact with marine or estuarine life, bodies of water, or seafood drippings, and can cause a variety of symptoms ranging from mild gastroenteritis, to skin ulcers and breakdown, to septicemia.[3,4,9,10,11] Individuals with underlying health conditions, particularly those with chronic liver disease or alcoholism, are more susceptible to severe complications of a V. vulnificus infection.[4,9] V. vulnificus-associated mortality is often preventable with prompt administration of antibiotics and wound care, but delays in the presumptive treatment of V. vulnificus infection can lead to poor health outcomes.[9,12] The aim of this study is to summarize V. vulnificus infection in Florida, describe the most common exposure routes and symptoms associated with V. vulnificus infections, characterize risk factors and exposures associated with death, and identify areas for improvement in the early initiation of presumptive treatment for V. vulnificus infections.

Methods

Demographic data, clinical data, and laboratory results for persons with a reported V. vulnificus infection in Florida from January 1, 2004 to December 31, 2013 were extracted from Merlin, Florida's reportable disease database.[13] Exposure information, including marine and estuarine water exposures, and seafood consumption in the seven days prior to illness onset were obtained from the extended data (epidemiologic interview) section in Merlin and Centers for Disease Control and Prevention (CDC) 'Cholera and Other Vibrio Illness Surveillance Report' (COVIS) forms.[8] In order to maintain a consistent denominator throughout the study (n=299) and to avoid excluding cases because of missing data in sections of the epidemiologic interview, only known "true" or "yes" answers to epidemiologic interview questions were included in analyses; all "no," "unknown," or missing responses were excluded from analyses. Exposures were classified based on COVIS exposure categories as follows: 1) Marine/estuarine contact: persons with direct skin contact with marine/estuarine life, bodies of water, or drippings from raw or live seafood; 2) Seafood consumption: persons with reported ingestion of seafood (does not include touching seafood); 3) Seafood consumption and marine/estuarine contact: relevant exposures include both ingestion of seafood and marine/estuarine contact; and 4) Unknown exposure: no exposure history reported.
The average annual incidence rate was calculated using yearly population data from Florida CHARTS [14]. Statistical analysis was performed using Epi Info™ version 7 (Centers for Disease Control and Prevention, Atlanta, GA) and SAS 9.3 (SAS Institute; Cary, NC). Incubation periods were calculated using the reported date of exposure and the date of onset of symptoms. The number of days from the onset of symptoms to the first medical encounter was calculated based on the onset date and the hospital admission date, first documentation of a medical encounter following onset of symptoms, or if that information was missing, the lab specimen collection date. Crude odds ratios (ORs) and 95% confidence intervals (CI) were reported for bivariate analysis. Adjusted ORs and 95% CIs were reported for multivariate analysis.[8]

Results

Due to a large amount of missing information from Merlin records from 2006 and 2007, the results from these years may be underestimates, which may result in underestimates for the entire study period. The average annual incidence rate in Florida for this study period was 1.6 per 100,000 persons per year with a median of 30 (range 16-41) cases annually and a CFR of 30%. Of the 299 reported cases, infections were most common in white (88%), non-Hispanic (91%) males (86%). The mean age was 60 (range 2-93) years with the majority (63%) of the 299 cases between 51-80 years of age. One-hundred eighty-one (61%) cases were hospitalized.

Underlying Medical Conditions

One-hundred ninety-seven (66%) of the 299 cases reported at least one of the following underlying medical conditions: alcoholism, liver disease, heart disease, diabetes, renal disease, malignancy, peptic ulcer, history of gastric surgery, or hematologic disease (Table 2). The presence of at least one of these underlying medical conditions was strongly associated with an increased risk of death in bivariate analysis (OR 18.7; 2.2-7.6) and in multivariate analysis (OR 5.3; 2.4-12.0) (Table 1). One hundred forty-one (47%) cases reported more than one of the listed underlying medical conditions. Alcoholism (32%) and liver disease (31%) were the most common underlying health conditions reported. On bivariate analysis, alcoholism (OR 3.7; 95% CI 2.1-6.7) and liver disease (OR 5.5; 95% CI 3.0-10.1) were significantly associated with an increased risk of death. Liver disease remained statistically significant when adjusting for other underlying health conditions in multivariate analysis (OR 4.8; 95% CI 2.0-12.0).

Exposure Categories

Marine/estuarine contact was the most commonly reported exposure route during the study period with a total of 139 (46%) cases; 79 (26%) cases reported both consumption of seafood and marine/estuarine contact; 42 (14%) cases had an unknown exposure history; and 39 (13%) cases reported seafood consumption exclusively. Of the reported cases, the CFR was highest among persons who reported seafood consumption exclusively in the seven days prior to the onset of illness (21/39, 54%); followed by persons with an unknown exposure (19/42, 45%); marine/estuarine contact and seafood consumption (29/79, 37%) and marine/estuarine contact only (19/139, 14%) (Figure 1).

Marine/Estuarine Contact

Among cases with reported marine/estuarine exposures exclusively (n=139), seventy-three (56%) reported multiple marine/estuarine exposure routes. "Swimming/ wading" in salt, brackish or fresh water was the most commonly reported exposure route (64%) followed by "handling/cleaning seafood" (41%). "Boating/skiing/surfing" (31%), being "bitten/stung by sea life" (7%) and doing "construction/repairs" on boat docks/ boats (6%) were common marine/estuarine exposure routes. Most (60%) cases in the marine/estuarine contact exposure category reported sustaining an injury at the time of

exposure. The most commonly reported injuries included: skin punctures from fish hooks and crab claws and abrasions caused by scraping skin against the shells of barnacles, mollusks, or crustaceans. Thirty-two (23%) cases reported the presence of a pre-existing wound, such as insect and mosquito bites or diabetic ulcers on legs and feet, prior to marine/estuarine contact. Fourteen (10%) cases who reported only marine/estuarine contact reported no pre-existing wounds or injuries sustained during the exposure period.[13] Sustaining a wound, as opposed to a pre-existing wound coming into contact with marine/estuarine environments, bodies of water or sea life, was associated with decreased risk of death in multivariate analysis (OR 0.3; 0.1-0.7). The most common clinical presentations among cases with marine/estuarine contact exposures included: cellulitis (76%), fever and chills (54%), muscle pain (32%), and bullae (26%) (Table 3).
Of the 139 reported cases with marine/estuarine exposure exclusively, 58% of cases reported direct contact with salt water, 46% reported brackish water exposure, and 10% reported exposure to a fresh water source in the seven days prior to seeking medical care. Twenty-nine cases (23%) reported exposures to multiple types of water sources.[13]

Seafood Consumption and Marine/Estuarine Contact

Of the 79 cases with a reported history of seafood consumption and marine/estuarine contact in the seven days prior to onset of illness, "handling/cleaning seafood" was the most common exposure route (89%), followed by consumption of oysters (58%), "swimming/wading" (29%), consumption of fish (30%), shrimp (24%), crab (15%), "boating/skiing/surfing" (15%), consumption of clams (5%), "construction/repairs" (5%), being "bitten/stung by sea life"(4%), and consumption of lobster (3%), mussels (1%), and crawfish (1%) [13].
Cases with seafood consumption and marine/estuarine exposures reported a constellation of gastrointestinal (GI) and SST infection symptoms (Table 3).[13]

Unknown Exposures

Forty-two (14%) cases had no reported exposure history. In general, these cases included individuals who expired shortly after admission to a hospital and were therefore unable to be interviewed. Among these cases, cellulitis (29%) was the most commonly reported symptom, followed by shock (20%), diarrhea (15%), vomiting (15%), fever or chills (12%), muscle pain (12%), cramps (10%), nausea (10%), and bullae (5%). Sequelae were reported for 17% of cases (Table 3).[13]

Seafood Consumption

For exposures related to the consumption of raw seafood exclusively (n=39), oysters (90%) were the most commonly reported type of seafood consumed and had the highest CFR (54%) of any single seafood type. Consumption of seafood was associated with risk of death on bivariate analysis (OR 2.9; 1.7-4.9). In multivariate analysis, consumption of raw oysters was strongly associated with death (OR 4.7, 95% CI 2.4-9.0) when adjusting for other types of seafood consumed including: clams, crawfish, crab, shrimp, mussels, lobster and fish [13].

Cases who reported raw seafood consumption in the seven days prior to onset of illness presented with constellations of symptoms more typical of a gastrointestinal infection: fever or chills (49%), diarrhea (38%), septic shock (36%), cramps (36%), and nausea (28%) (Table 3).[13]

Anatomical Sites of Isolation

V. vulnificus was isolated from more than one site in 19 (6%) cases.[13] One hundred eighty-eight (63%) of the 299 V. vulnificus isolates reported in Florida from 2004-2013 were obtained from blood or other normally sterile sites, 95 (33%) were from skin or soft tissue sites, including wounds, appendages, ears, and tissue, 16 (6%) had no reported specimen site, and 12 (4%) were obtained from stool specimens.

Early Recognition and Treatment

Two-hundred eleven (71%) of the 299 cases had a documented date of exposure; of those cases, the mean incubation period was 1.6 (range 0-7) days. Two-hundred sixty-three (88%) cases had a documented onset date; of those cases the mean number of days from the onset of symptoms to the first medical encounter was 1.5 days (range 0-7).

Seasonality

Two-hundred fifty (84%) V. vulnificus infections occurred between May and October of each year (Figure 2). Florida coasts and estuaries provide hospitable conditions for V. vulnificus to flourish during the summer months. Sporadic cases occur between November and April each year, in residents from both coastal and noncoastal Florida counties.

Discussion

This analysis reflects findings similar to a previous summary of Vibrio infections reported in Florida from 1998-2007[4], which demonstrated that reported cases of V. vulnificus infection are most commonly males with underlying health conditions and a history of seafood consumption or participation in fishing, crabbing, and other marine activities where wounds may be exposed to marine/estuarine waters, in the seven days prior to onset of illness. These findings highlight the need for more public health interventions specifically targeting this demographic. Partnering with other agencies and organizations, such as Florida Fish and Wildlife Conservation Commission and the Florida Environmental Health Association to provide prevention and education materials when recreational and commercial fisherman apply for fishing and boating licenses may help to reduce the number of V. vulnificus infections among high-risk persons.

Although V. vulnificus infections are rare, they can quickly become serious. V. vulnificus infections are preventable if persons with increased risk of infection, such as those with alcoholism or liver disease, avoid consuming raw seafood, avoid participating in marine/estuarine activities if wounds are present, conduct proper wound care immediately when sustaining a wound during marine/estuarine activities and seek medical treatment immediately if signs of an infection present.[3,4] Physicians and health care providers

should counsel at-risk patients about their predisposition to V. vulnificus infection, educate patients on early signs and symptoms of infection, and encourage patients to seek treatment and share their exposure history with a provider if they develop any symptoms following seafood consumption or marine/estuarine activities, particularly in the summer months when most infections occur.

When exposures occur, early recognition of infection by the patient and the physician are essential for preventing serious sequelae and death. A study by Klontz et al. demonstrated that when treatment was delayed by 24 hours in patients with V. vulnificus septicemia, mortality rates increased from 33% to 53% and when delayed by 72 hours the mortality rate was 100%.[10] The average number of days from symptom onset to the first medical encounter in this study was 1.5 days, suggesting that more outreach is needed to encourage at-risk patients to seek care at the earliest indication of infection. Delays in treatment may be due to a culmination of factors including patient health-seeking behaviors and provider awareness. Findings from this study suggest that early symptoms of V. vulnificus SST infections can be insidious, and individuals may not recognize the early symptoms as serious. Furthermore, individuals with GI symptoms may not seek care until the symptoms become severe. Therefore, it is imperative that individuals with underlying medical conditions become familiar with the early warning signs of a V. vulnificus SST infection following water activities (edema, erythema, fever, chills, and cellulitis) and GI-related vibriosis symptoms (vomiting, diarrhea, and nausea) following seafood consumption, and share information about possible exposures in the seven days prior to illness onset with providers upon presentation to a medical facility.

It is equally vital that physicians obtain detailed patient exposure histories upon presentation when possible. Physicians should suspect and presumptively treat for V. vulnificus infection in any immunocompromised patient presenting with fever, hypotension, GI symptoms, signs of septic shock, or progressively rapid SST infections and a history of marine or estuarine water exposure or raw seafood consumption in the seven days prior to onset of illness.[3] The CDC recommends the following treatment guidelines based on case reports and animal models: doxycycline (100 mg orally twice daily) plus cefotaxime (2 g intravenously every 8 eight hours) or ceftriaxone (1 g intravenously daily). Levofloxacin (500 mg orally or intravenously once daily) is an alternative treatment[3]. Treatment should not be delayed while waiting for laboratory results. In addition to antibiotics, supportive therapy and aggressive wound care, including fasciotomy or limb amputation, may be necessary for preventing Vibrio-related mortality. Cultures of wound and hemorrhagic bullae are recommended for SST infections and stool cultures should be collected if there is suspicion of vibriosis. Blood cultures should also be collected if the patient is febrile, has hemorrhagic bullae, or any signs of sepsis; all specimens should be forwarded to a public health laboratory for confirmatory testing.[3]

Education and outreach are essential for ensuring that providers and the public have the most current information about Vibrio infection trends. Data from this study demonstrate that the majority (60%) of V. vulnificus SST infections are the direct result of an injury sustained while participating in marine activities, however, sustaining a wound at the time of exposure was associated with a decreased risk of death in this analysis, possibly due to persons seeking care immediately when the wound is sustained rather than waiting until symptoms appear. Prevention messaging focusing on how to appropriately clean wounds immediately after sustaining marine injuries, as well as protecting pre-

existing wounds from contact with marine/estuarine environments, and a discussion of the early warning signs of V. vulnificus SST infection (edema, erythema, fever, chills, cellulitis, muscle pain, etc.) may lead to earlier identification and treatment of these infections. Additionally, of cases with marine/estuarine contact only, 10% of cases reported no pre-existing or sustained wound during the exposure period, suggesting that immunocompromised individuals may develop SST infection as a result of minor scrapes and abrasions coming into contact with marine and estuarine waters. Skin integrity is a health concern in persons over age 50 and those with immunocompromising conditions such as diabetes, and should be addressed in addition to pre-existing and sustained wounds when discussing V. vulnificus risk with patients and the public, especially among individuals with underlying medical conditions.[17]

Fewer seafood consumption V. vulnificus infections were reported in Florida from 2004-2013 than marine/estuarine contact cases; however, more than half of the persons who develop a seafood-associated V. vulnificus infection died as a result of the infection. Despite regulatory policies requiring that restaurants post visible warnings about eating raw shellfish, V. vulnificus CFRs related to seafood consumption in Florida have remained between 50 and 60% over nearly two decades.[4] Some states have imposed stricter regulations to reduce seafood consumption mortalities. In 2003, California implemented a regulation restricting the sale of raw oysters harvested from the Gulf of Mexico from April 1-October 31 each year, unless the oysters were processed to reduce V. vulnificus to non-detectable levels. Prior to 2003, California reported 0-6 raw oyster associated-V. vulnificus infections and between 1-5 deaths per year. After implementation of the regulation, no raw oyster-associated V. vulnificus infections or deaths were reported from 2003-2010.[2,17]

More investigation is needed to determine whether fluctuating water temperatures may play a role in the growing incidence of marine/estuarine contact vibriosis from 2007 to present, or if the increase is a result of improved surveillance and reporting (vibriosis became nationally notifiable in 2007; however, Vibrio infections have been reportable in Florida since 1981).[3,4,5,18] Conditions for V. vulnificus growth include: 5 to 10 parts per thousand (ppt) salinity (range 5-25 ppt), 7.8 pH (range 5-10), and an optimum temperature of 37˚C (range 8-43˚C).[15,16]

There were some limitations to this study. Out of 299 cases reported during the ten-year study period, only 41 reported cases occurred among females compared to 258 males. While gender was not statistically significant in this study, likely due to the small number of cases among females, other studies with larger sample sizes have reported increased risk of death among males with Vibrio infections.[4] Other studies suggest V. vulnificus infections may be less common among females because the female hormone estrogen may offer protection against the V. vulnificus endotoxin.[19,20] In addition to sample size limitations, data available in Merlin are obtained from epidemiologic interviews of reported V. vulnificus infections conducted at the county level; data collection practices may vary from county to county. Information about the cases' underlying health conditions, exposures prior to illness onset, and treatment were often incomplete, and changes in the reporting of Vibrio cases in Merlin from 2004-2010, such as the addition of new data fields, led to inconsistencies in the availability of data for analysis from year to year. Exposures were classified based on COVIS categories according to the information available in Merlin, and may have been affected by recall bias, misclassification, or missing

information. For cases who reported both seafood consumption and marine/estuarine contact, it was not possible to determine which exposure caused the infection.
V. vulnificus cases entered into reportable disease databases most likely capture severe infections for which cultures were obtained and the results reported to the local health department. The data are likely skewed towards severe disease manifestations, such as persons who developed septicemia. Additionally, twelve (4%) patients in this study were co-infected with another species of the family Vibrionaceae, including V. alginolyticus, V. parahaemolyticus, and V. fluvialis, and these cases may have been more severe due to multiple infections.
Public health plays a key role in communicating with the public and providers about V. vulnificus disease incidence, risk factors, and preventive measures. Understanding which types of exposures most frequently lead to V. vulnificus infection, characterizing factors associated with death, and determining the time of year most cases in Florida occur, will help direct public health prevention efforts to reduce V. vulnificus disease morbidity and mortality in Florida.

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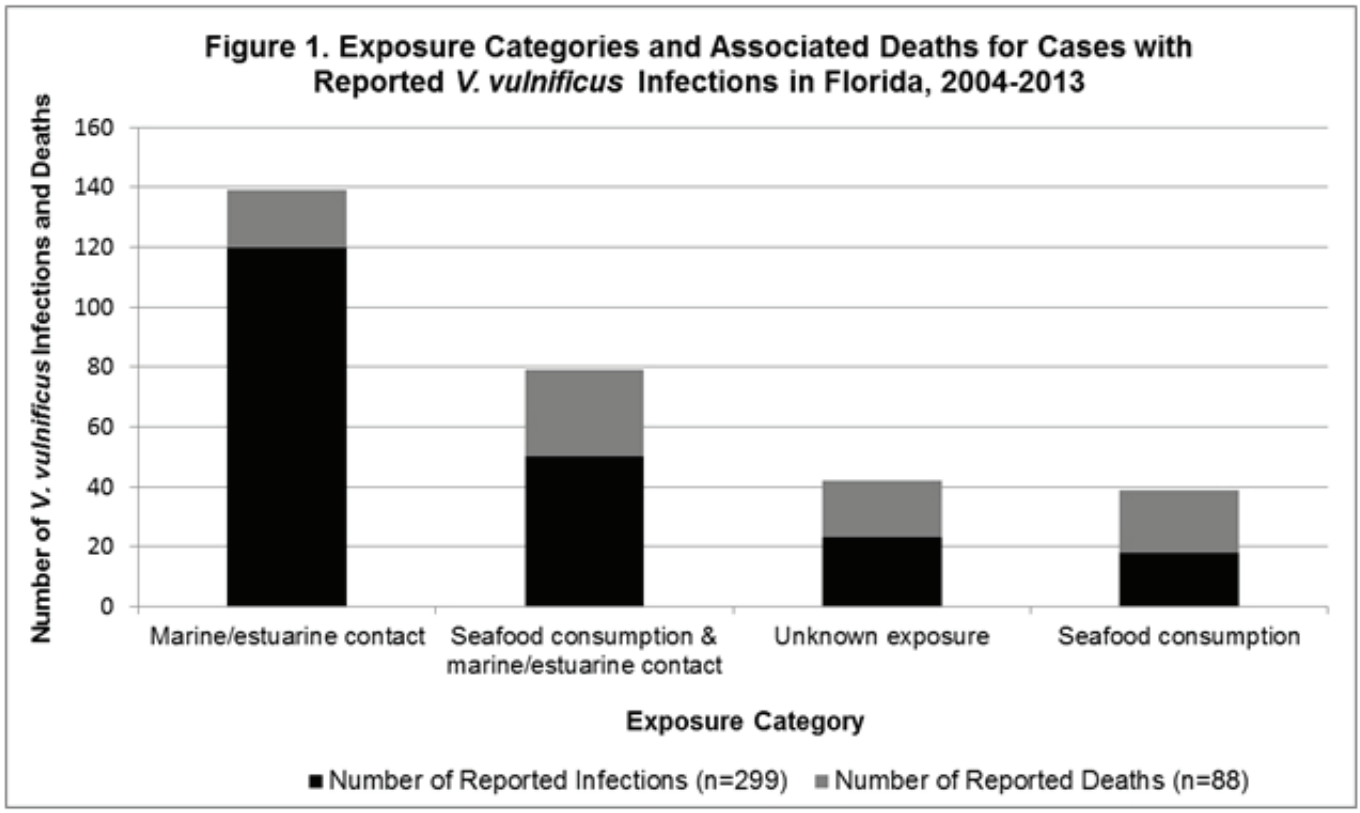
Figure 1. Exposure Categories and Associated Deaths for Cases with Reported V. vulnificus Infections in Florida, 2004-2013
Number of V. vulnificus Infections and Deaths
160
140
120
100
80
60
40
20
0
Marine/estuarine contact
Seafood consumption & marine/estuarine contact
Unknown exposure
Seafood consumption
Exposure Category
Number of Reported Infections (n=299)
Number of Reported Deaths (n=88)

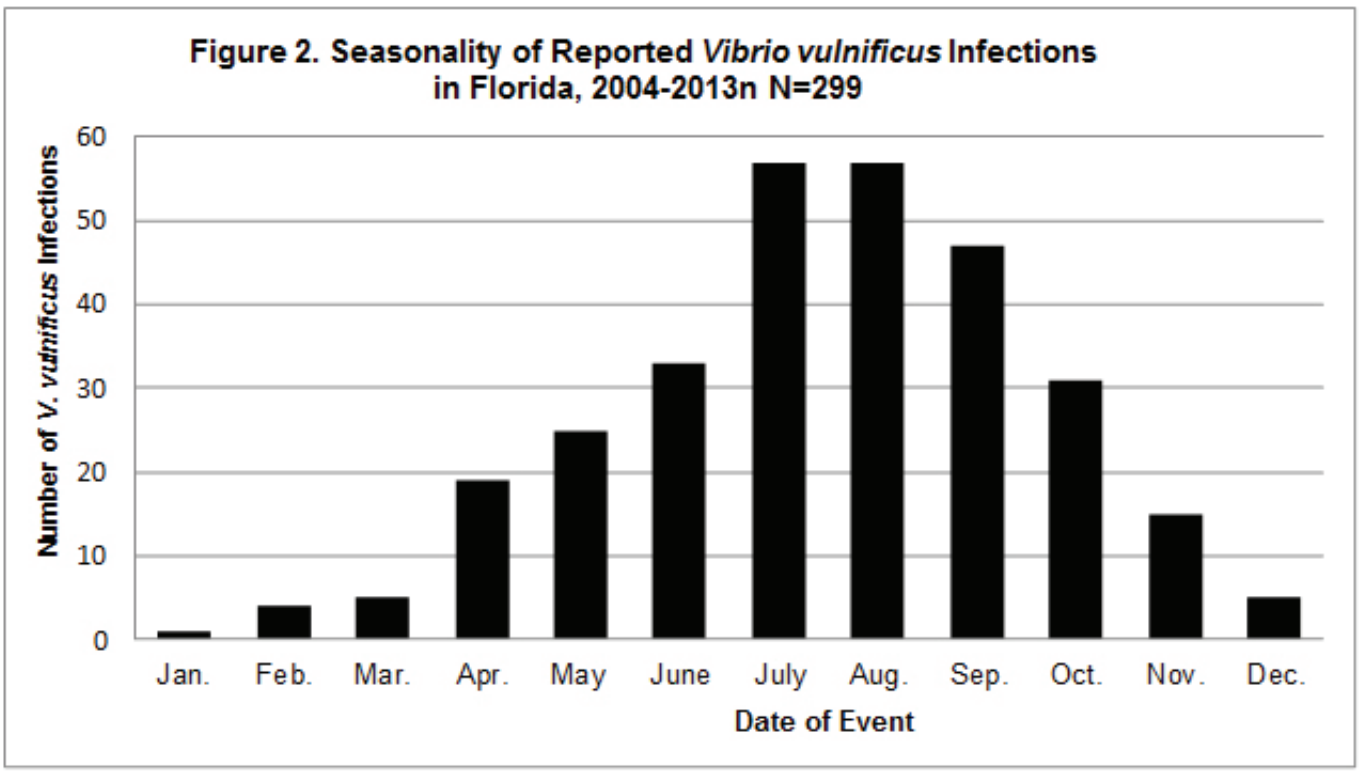
Figure 2. Seasonality of Reported Vibrio vulnificus Infections in Florida, 2004-2013n N=299
Number of V. vulnificus Infections
60
50
40
30
20
10
0
Jan.
Feb.
Mar.
Apr.
May
June
July
Aug.
Sep.
Oct.
Nov.
Dec.
Date of Event

Table 1. Predictors of death in cases of *V. vulnificus* Infection, Florida 2004-2013, N=299								
	Non-fatal		**Fatal**		**Crude Associations**		**Adjusted Associations**	
	No.	**%**	**No.**	**%**	**OR**	**95% CI**	**OR**	**95% CI**
Gender								
Male	189	63.2	69	23.0	0.5	0.2-0.9	0.4	0.2-1.1
Female	23	7.7	18	6.0	1.0	(reference)	(reference)	
Age								
Age 60 and older	119	39.8	41	13.8	0.7	0.4-1.2	0.7	0.4-1.4
Under age 60	93	31.1	46	15.4	1.0	(reference)	(reference)	
Underlying medical condition*	123	41.1	74	24.7	18.7	2.2-7.6	5.3	2.4-12.0
Exposures								
Marine/estuarine contact	120	40.1	19	6.4	0.3	0.2-0.5	NS	
Sustained wound	92	30.8	14	4.7	0.3	0.1-0.5	0.3	0.1-0.7
Pre-existing wound	36	12.0	8	2.7	0.5	0.2-1.1	NS	
Seafood consumption and marine/estuarine	50	16.7	29	9.7	1.6	1.0-2.8	NS	
Unknown exposure	23	7.7	19	6.4	1.9	1.0-3.8	NS	
Seafood consumption	18	6.0	21	7.0	2.9	1.7-4.9	NS	
Clinical Symptoms								
Fever or chills	101	33.8	40	13.4	1.0	0.6-1.6	NS	
Diarrhea	33	11.0	25	8.4	2.2	1.2-4.0	NS	
Nausea	44	14.7	27	9.0	1.7	1.0-3.1	NS	
Vomiting	35	11.7	28	9.4	2.4	1.4-4.3	NS	
Bloody stool	6	2.0	4	1.3	1.4	0.5-6.1	NS	
Cramps	26	8.7	18	6.0	1.9	1.0-3.7	NS	
Cellulitis	137	45.8	25	8.4	0.2	0.1-0.4	0.2	0.1-0.4
Bullae	18	6.0	47	15.7	0.9	0.5-1.7	NS	
Septic shock	24	8.0	46	15.4	9.0	4.9-16.3	14.8	6.3-34.8
Treatment								
Doxycycline	75	25.1	11	3.7	0.3	0.1-0.5	0.2	0.1-0.5
Levofloxacin	34	11.4	11	3.7	0.8	0.4-1.7	NS	
Ciprofloxacin	33	11.0	5	1.7	0.3	0.1-0.9	0.2	0.1-0.8

*Compared to no underlying condition. Includes alcoholism, liver disease, heart disease, diabetes, renal disease, malignancy, peptic ulcer, hematologic disease, or history of gastric surgery.
NS: Not significant

Table 2. Underlying health conditions for cases with reported *V. vulnificus* infection*, Florida, 2004-2013, N=299	
Underlying medical condition	**Proportion (%) of cases**
More than 1 comorbid condition	141 (47)
Alcoholism	97 (32)
Liver disease	93 (31)
Heart disease	74 (25)
Diabetes	58 (20)
Renal disease	39 (13)
Malignancy	34 (11)
Peptic ulcer disease	13 (4)
History of gastric surgery	12 (4)
Hematologic disease	10 (3)
*Excludes "no", "unknown", and missing responses; therefore may be an underestimate of cases with underlying medical conditions.	

Table 3. Symptoms reported by patients with *Vibrio vulnificus* infections*, Florida, 2004-2013, N=299				
Symptoms/Conditions	**Exposure category**			
	Marine/estuarine contact (%) n=139	**Seafood consumption and marine/estuarine contact (%) n=79**	**Unknown exposure (%) n=42**	**Seafood consumption (%) n=39**
Fever or chills	75 (54)	42 (53)	5 (12)	19 (49)
Diarrhea	11 (8)	26 (33)	6 (14)	15 (38)
Nausea	30 (22)	26 (33)	4 (10)	11 (28)
Vomiting	22 (16)	26 (33)	6 (14)	9 (23)
Bloody stool	1 (0.7)	6 (8)	0 (0)	3 (8)
Cramps	10 (7)	16 (21)	4 (10)	14 (36)
Cellulitis	106 (76)	37 (47)	12 (29)	7 (18)
Bullae	38 (27)	19 (24)	2 (5)	6 (15)
Shock	29 (21)	19 (24)	8 (19)	14 (36)
Muscle pain	45 (32)	26 (33)	5 (12)	8 (21)
Headache	18 (13)	12 (15)	0 (0)	5 (13)
Sequelae	27 19)	9 (11)	7 (17)	6 (15)
*Excludes "no", "unknown", and missing responses; therefore may be an underestimate of cases with reported symptoms.				

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Figures

Tables

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Erika Cathey and Karen Chapman work for the Florida Department of Health in Okalossa County, Fort Walton Beach, Florida, USA. Kristina Kintziger and Katherine McCombs work for the Florida Department of Health in Tallahassee, Florida, USA.

Erika Cathey completed a BA in Anthropology and a Master of Public Health (MPH) degree from the University of West Florida in 2013. The same year, Mrs. Cathey accepted a position at the Florida Department of Health in Okaloosa County (DOH-Okaloosa) as a Florida Epidemic Intelligence Service (EIS) Fellow, and currently works at DOH-Okaloosa as a Biological Scientist IV. Mrs. Cathey is a Certified Environmental Health Professional (CEHP) in food protection. Her research interests include social determinants of health, infectious disease, and maternal, infant and child health.

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FEATURED ARTICLE

Mentoring Is for Everyone – Make A Plan Find Your Role

Aurthor: Dr. Sheila D. Pressley
DrPH, REHS/RS, DAAS, CPH, HHS

As we mature and develop in our personal and professional lives, our perception of mentorship changes and we begin to see how broad the definition of mentoring can be. As I reflect on my years in high school, I think back to my principal and to the teachers who took a special interest in me and encouraged me to remain focused. That was a great example of mentorship to me at the time and remains as one of the most important times in my life. As an undergraduate student at Western Carolina University, I thought of a mentor as someone who would guide me through my college career and help me make employment connections. It was there that I met my long-time mentor and eventual colleague, Professor Joe E. Beck. As was expected, I became a mentor because of my involvement with environmental health and with various organizations on campus. I realized the true power of mentorship when I left college and began the next chapter of my life. As I moved through my career as a practitioner, I began to see a mentor as someone who could help in adjusting to a new workplace or to a new responsibility. I have always had great mentors around me and I owe my success to a number of individuals—many of whom are NEHA and AAS members!! Environmental health has always been a very close-knit profession and mentorship has been a part of what the annual NEHA meetings have helped to accomplish for decades. My introduction to NEHA was actually at a Student National Environmental Health Association (SNEHA) meeting as an undergraduate at Western Carolina University. As a professional woman who continues to develop her career, I have mentored several students, young practitioners, and new faculty over the years. I have learned that a good mentor must also be a good mentee and be able to assume a number of changing roles such as that of a listener, a confidant, a motivator, and many other necessary roles to help others excel in life.

What is your definition of mentoring? Is it a series of chance encounters at a professional meeting or venue, or is it the purposeful process of getting to know another professional who may influence you in some way? In today's world of instant access to digital information and technology, it's easy to see why students and young professionals sometimes turn to social media or other sources for career guidance and personal development. These are wonderful sources of information when coupled with the attention and time of a mentor. As I touched on earlier, mentoring comes in many forms and circumstances. Merriam Webster's Dictionary defines the term mentor as a trusted guide or counselor. The mentors I have connected with helped me to maneuver difficult situations and move ahead with my life. Joe E. Beck taught me more than I could ever share in this article or even put into words, but suffice it to say that he showed me the true power of mentorship. We began as strangers and we went full circle to become colleagues. Our future generations of environmental health leaders deserve to have

that from us. As the landscape of environmental health continues to change, and as our current leaders retire and move one, we will need new professionals to replace them and this is where mentoring culminates (Roberts, 2010).

We should not count on mentoring to happen by chance or accident, we must be purposeful in using our time to mentor our future leaders. In other words, we need a plan to implement the process of developing the next generation on leaders in environmental health. The American Academy of Sanitarians (AAS) has always taken the time and interest in mentoring students and young professionals who want to be leaders in our profession. The AAS has done so with the collaboration and support of NEHA for many years. Past mentoring opportunities at NEHA with AAS include one-on-one sessions with AAS members, panel discussions, roundtable-scenarios and a student lounge where conference attendees could connect with each other. While these opportunities have worked and should continue, the challenges in reaching young professionals and students are different today than they were for past generations. Mentoring is most effective when done in person, however, getting mentors and mentees together at NEHA and other conferences like it is cost prohibitive. Without the advantages of SNEHA and other events I was fortunate enough to attend, how can we bring young professionals and students together with mentors? Using social media such as Linked In, Twitter and Facebook will help, but we still need more to bring everyone together. We need a strategic plan that AAS, NEHA, and other affiliate organizations can participate in to expand and strengthen the mentoring opportunities for young professionals and students. So if you're a practitioner and you have a college degree, that means you know how to plan, right? As it turns out, that is not always the case. We may often have good intentions, but creating a plan and putting it into action is easier said than done. Why is that? Because, "true planning requires that we identify the desired outcome and the values that outcome will deliver, then form a vision and contrast it against other potential outcomes" (Beck and Pressley, 2007). Instead of planning, most of us like to sail into the future and see how it goes. This will not work for the current and future needs of environmental health because we have to consider the alternative outcomes. What if we don't have enough faculty members to teach at accredited environmental health science bachelor's programs to produce new professionals to mentor? What funds will be available to get new professionals and students to future NEHA conferences so they can meet new mentors? How will the workforce demands be different for future professionals?

I have been fortunate to have many types of mentors throughout my life and I want to give that to those who will follow me. I accept the challenge of creating a mentoring structure that will give life to future generations of environmental health professionals. What will your role be? There are enough needs for everyone to be involved. Make your presence known, share your knowledge and get involved in some way. You can mentor someone for a short time or you can make a lifetime commitment--as so many have in environmental health. Obviously, the impact will be greater if you devote more time. I have the incredible fortune of helping undergraduate and graduate students everyday in my role as a professor and an academic administrator. I can say with certainty that the future of our profession depends on your involvement as a mentor and/or a supporter of mentoring. To create successful outcomes, universities have had to become more intrusive

in teaching and mentoring their students. We can no longer assume that students understand how to embrace a mentor or know how to create a plan for their lives. This is where you and I can make a difference in shaping the future of environmental health. Join me and together we can ensure that our next generation is ready for the challenges ahead. Be Calm and Become a Mentor!

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About the Author

Pressley has over 25 years of experience as a professional in public health and higher education.

Born in Asheville, North Carolina, the youngest of two children to Rudolph and Rebecca Davidson, Sheila was raised in Kinston, North Carolina. She currently resides in Richmond, Kentucky with her husband and two teenage sons.
Sheila Davidson Pressley was appointed as Interim Dean of the College of Health Sciences (CHS) at Eastern Kentucky University (EKU) in 2017. Prior to her appointment as Interim Dean, she served in many capacities within the college and throughout EKU including the role of Associate Dean for CHS. She has worked at EKU for fourteen years.

Dr. Pressley's duties as Dean are numerous and include working with department chairs, faculty, staff and students on issues related to academic affairs. Budget demands, promotion and tenure, annual evaluations, faculty development and workload, and development/donor relationships are a large part of her responsibilities. She works routinely to address student issues as they relate to degree progression and matriculation. She also works closely with the Provost to advocate for the needs of her college based on the demands of each discipline and degree program.

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District News

The Florida Environmental Health Association has 10 districts located throughout the state of Florida. Each district is lead by the District Board which consists of a District Chairperson, Vice-Chairperson, Secretary and Treasurer. Each district serves their community by offering training and community events in its district. These events can range from training for Environmental Health Professionals to Beach Clean Ups and BBQ Picnics. Each district is unique in its own way and serves the community needs differently depending on the needs of the industry and community within the district.

During the 2017 AEM at Innisbrook Resort in Palm Harbor, Executive Director, Michael Crea announced that he would start on a path to revitalize the FEHA districts. Since the 2017 AEM we have had multiple district meetings across the state. Tampa Bay District started the movement of revitalization by hosting their first district meeting of the year on November 28th at Carrabbas in St. Petersberg, FL. Since then, Gulf Coast, Central, and Treasure Coast have followed the path that Tampa Bay District laid out and hosted their first district meeting in many years. In addition, there have been FEHA districts that have been regularly meeting and hosting community events. Emerald Coast District has been active in their community and in the environmental health industry.

During the next 12 months FEHA plans to revitalize more of the dormant districts and continue on actively promoting the districts that have been active this year. FEHA can not do this without the help of the district board members and the environmental health community in the individual districts. If you have not been active in your district, now is the time to speak up and take an active role in helping promote the health and safety of your district community. Contact FEHA Executive Director, Michael Crea to learn more about what you can do for your district and your community.

Which District Are You In?

Big Bend: Bay, Calhoun, Franklin, Gadsden, Gulf, Holmes, Jackson, Jefferson, Leon, Liberty, Madison, Taylor, Wakulla and Washington Counties
Central: Brevard, Hardee, Highlands, Lake, Orange, Osceola, Polk and Seminole Counties
Emerald Coast: Escambia, Okaloosa, Santa Rosa and Walton Counties
First Coast: Nassau, Baker, Duval, Clay, St. Johns, and Putnam Counties
Gold Coast: Broward, Miami-Dade, Monroe and Palm Beach Counties
Gulf Coast: Sarasota, DeSoto, Charlotte, Glades, Lee, Hendry and Collier Counties
Halifax: Flagler and Volusia Counties
Suwannee: Hamilton, Columbia, Suwannee, Lafayette Union, Gilchrist, Dixie, Levy, Alachua, Marion, Citrus, Hernando, Bradford and Sumter Counties
Tampa Bay: Hernando, Hillsborough, Pasco, Pinellas and Manatee Counties
Treasure Coast: Indian River, St. Lucie, Martin and Okeechobee Counties

Tampa Bay District

Tampa Bay district has had an amazing year. We started out with our first district meeting on November 28th 2017 at Carrabbas in St. Petersburg. This meeting had an amazing attendance with over 30 people attending including Department of Health Employees and private industry employees. FEHA President Gary Frank & President Elect Latoya Backus helped organize the event. Laura Castro, FDOH Regional Epidemiologist gave a presentation on foodborne outbreak investigations and Michael Crea gave a presentation on Regulation in the Body Art Industry.

Tampa Bay District also hosted a 2nd meeting on April 17th 2018 at Lee Roy Selmens Restaurant in Tampa, FL. Guest speakers gave presentations on interesting topics of environmental health. Andy Reich, Scientific Advisor - Bureau of Environmental Health, FDOH gave a presentation on Pesticides & Public Health. Leah Kloss, Biodefense Trainer - Florida Department of Health, Bureau of Public Health Laboratories, Tampa Lab gave a presentation on "Biothreats and Florida's Public Health Labs". This meeting was also well attended with almost 30 people at the meeting.

The district established new district board members which consist of Latoya Backus as District Chairperson, Nicole Garvey as Vice-Chairperson and Joe Zwissler as Treasurer. The position of secretary has recently become available. If you are interested in this position please contact Latoya Backus for more info. Latoya.Backus@gmail.com

Tampa Bay District is planning additional meetings in the next coming months, so

Left: Andy Reich giving a presentation on Pesticides & Public Health.
Below: Captive audience during the presentation at Tampa Bay District Meeting April 17th, 2018

Gulf Coast District

Gulf Coast District began on their path to revitalization on February 13th 2018. Gulf Coast District held their first district meeting in many years at Wings and Rings in North Port, FL.

Guest Speakers were invited to the event and included Kimberly Stockdale, Regional Environmental Epidemiologist FDOH who gave an interesting presentation on Waterborne Surveillance and Investigations. FEHA Executive Director Michael Crea gave a presentation on the Florida Environmental Health Association and the 2018 Annual Education Meeting. Elections were held for the vacant District Board positions. Gulf Coast District now has a full district board which includes Shawn Wilson as District Chairperson, Winston Anderson as Vice-Chairperson, Nancy Hendershot as Secretary and Ken Danielson as Treasurer. Gulf Coast District plans on having another district meeting later this year, so be on the look out for new and exciting news from FEHA Gulf Coast District.

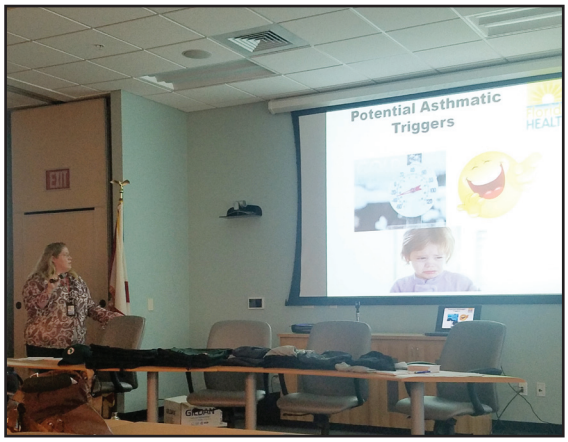
Above: Kimberly Stockdale gives a presentation on Waterborne Surveillance at the Gulf Coast District Meeting. February 13th, 2018

Central District

Central District began its revitalization efforts on March 28th 2018 at the FDOH Brevard County - Bill Posey Conference Center. The district meeting began by voting for a district board. Central District voted in a full board which includes Miranda Oliver as District Chairperson, Patrick Hutchinson as Vice-Chairperson, Amanda Chase as Secretary and Maria Robles as Treasurer.

Several speakers were invited to give presentation at the meeting. Amanda Chase from the Florida Department of Health gave a presentation on Utilizing Aquatic Species to Combat Mosquito Borne Disease. Wanda Back, Indoor Air Quality Specialist for Orange County gave presentation on Improving Your Indoor Air Quality & Reducing Asthmatic Triggers. FEHA Executive Director Michael Crea gave a presentation on the Florida Environmental Health Association and the 2018 Annual Education Meeting.

Central District charged a small fee for the meeting which included the presentations and also covered lunch for attendees. The FEHA Board of Directors donated the balance of what was not collected by this fee to cover the costs of lunch for all those attending. Central District greatly appreciates the help of the Central District members and the FEHA Board of Directors to help make this meeting be a success.



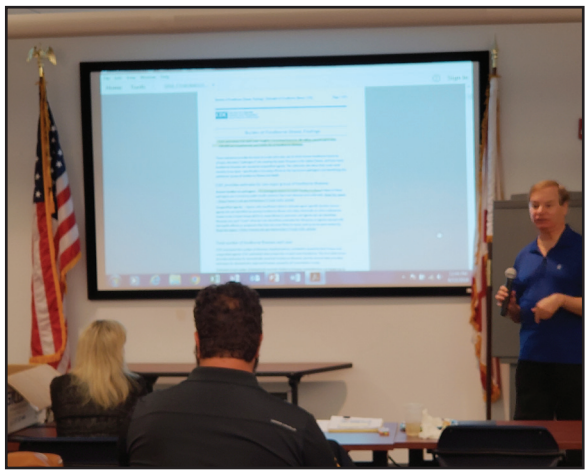
Left: Wanda Back gives a presentation on Improving Indoor Air Quality
Below: Amanda Chase gives a presentation on Utilizing Aquatic Species to Combat Mosquito Borne Disease

Treasure Coast District

Treasure Coast District began to revitalize itself with the appointment of DaJuane Harris as district chairperson at the 2017 FEHA AEM. DaJuane Harris helped organize the latest Treasure Coast District meeting on June 13th 2018 at the Martin County Health Department in Stuart, FL. Attendance was almost 30 people in both the government and private industries. Alan Whyman, The Regional Food Coordinator for Palm Beach County gave a presentation on Food borne Illness investigation and Patrick Hutchinson gave a presentation on ATU Maintenance. FEHA Executive Director Michael Crea gave a presentation on the Florida Environmental Health Association and the 2018 Annual Education Meeting.

Treasure Coast District voted on new district board members which included Ian Moore as Vice-Chairperson and keeping DaJuane Harris at Chairperson, Angeline Dewald as Secretary and Janet McCullough as Treasurer.

Treasure Coast District charged a small fee for the meeting which included the presentations and lunch for all attendees. The district handed out raffle tickets to all those who attended the meeting. 3 raffle winners were picked and the prize was admission to the 2018 FEHA AEM. The winners of the AEM raffle were Joanne Evans, Ian Moore and Diana May.



Left: Alan Whyman gives a presentation on Food Borne Illness investigation
Below: Patrick Hutchinson gives a presentation on ATU Maintenance
June 13th, 2018

FEHA in the Community

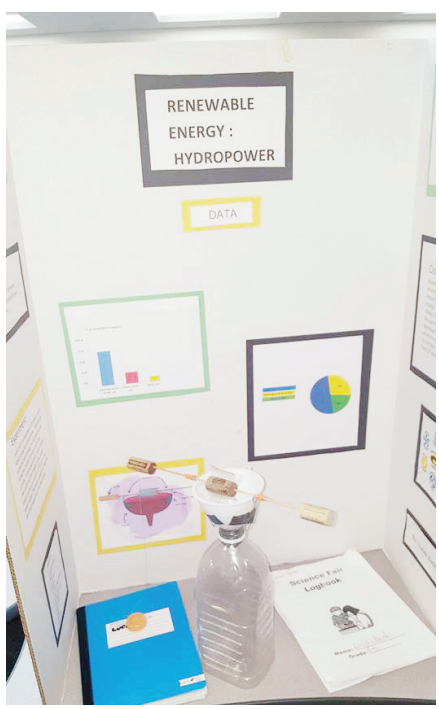
Left: Retirement function for John Geisler (second from left). John was the EH administrator, serving DOH for 35 years. Others pictured include the new administrator (Chuck Minor – far left), Gayle Guidash (previous administrator to John and current Asst. County Health Director), and Richard French (retired administrator prior to Gayle).
Below Right: Dr. David DyJack, Executive Director of NEHA at the FEHA 2015 AEM

Escambia & Okaloosa Clean Up Highway 90
DOH-Escambia OSTDS staff—Christie Gillenwater, Ray Lay and Dennis Bratten—along with DOH-Okaloosa's Trisha Dall, participated in the Emerald Coast FEHA Road Clean Up through Adopt-a-Highway on December 16. Determined to keep the environment clean and safe, the four-member team cleaned up litter along both sides of a 2.5 mile stretch of Highway 90 at the Okaloosa/Santa Rosa County line.

Ray Lay, Dennis Bratten, Christie Gillenwater and Trisha Dall break for a photo during the Emerald Coast FEHA Road Clean Up.

FEHA in the Community

Left to Right: Association partners for a common goal. Members of the NEHA Model Body Art Code Committee & AFDO Body Art Sub-Committee: Christl Tate (NEHA), Laurel Arrigona (AFDO), KC Stevenson (AFDO), Michael Crea (FEHA) and Solly Poprish (NEHA) at the 2018 NEHA AEC



Above & Right: FEHA Members Fatima Conteh & Michael Crea judge science fair projects at Fruitville Elementary School in Sarasota County. 2017

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Florida Environmental Health Association

Annual Education Meeting Agenda
Radisson Resort, Cape Canaveral, FL
July 24th-27th 2018

Monday July 23rd

6pm: Exhibitor Set Up --- East Foyer

Tuesday July 24th

8:30am: Exhibitor Set Up --- East Foyer

9am: Registration Opens --- Lobby

10am-6pm: Body Piercing --- Salon II & III $100

9am-5pm: Indoor Air Quality --- Bahamas

10am-6pm: CPO Day 1 --- Jamaica $75

12pm-1pm: Lunch --- On Your Own

12pm-6pm: RS Test Review --- Bermuda $20

9:30am-6pm: OSTDS Day 1 --- Aruba $180

7pm: Meet & Greet --- Room TBA

Wedensday July 25th

9am: Registration Opens --- Lobby

9:30am-6pm: OSTDS Day 2 --- Aruba $180

8:30am-9:30am: Welcome Breakfast --- Trinidad/Bahamas

9:30am-5pm: Built Environment & PACE EH Salon III

10am-12pm: Diversity In Environmental Health --- Bahamas

10am-6pm: CPO Day 2 --- Jamaica (Inc. with Day 1)

9am-4pm: RS Test --- Bermuda $150

10am-12:30pm: Current Issues in Tattooing --- Salon II

12pm-1pm: Lunch --- On Your Own

12pm-3pm: Board of Directors Meeting --- Trinidad Board Members Only

1pm-6pm: Bio Medical Waste --- Salon II

1pm-6pm: Vector Borne Diseases --- Bahamas

7pm: Karakoke Pool Party --- Pool

Thursday July 26th

9am: Registration Opens --- Lobby

9am-6pm: EH Directors Meeting --- Salon II
Breakouts: Bermuda & Antigua

9am-6pm: Food Safety --- Trinidad

9am-5pm: Environmental Health & Space --- Bahamas

12pm-3pm: Awards Lunch --- Salon III

9am-12pm: CPO Test --- Jamaica $30

3pm-6pm: Recreational Water --- Aruba

6pm-7pm: District Board Member Appreciation ---Jamaica District Board Members Only

7pm: FEHA 70th Birthday Party --- Salon III

Friday July 27th

9am: Registration Opens --- Lobby

9am-6pm: EH Director Meeting --- Salon II

Friday July 27th Continued

9am-12pm: Foodborne Disease --- Aruba

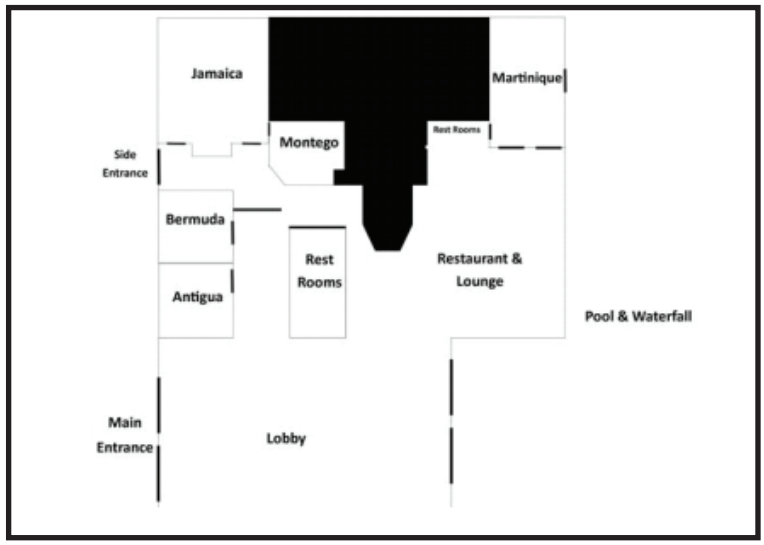
12pm-6pm: NASA Trip --- Off Site $25 Must Have Pre-Registered

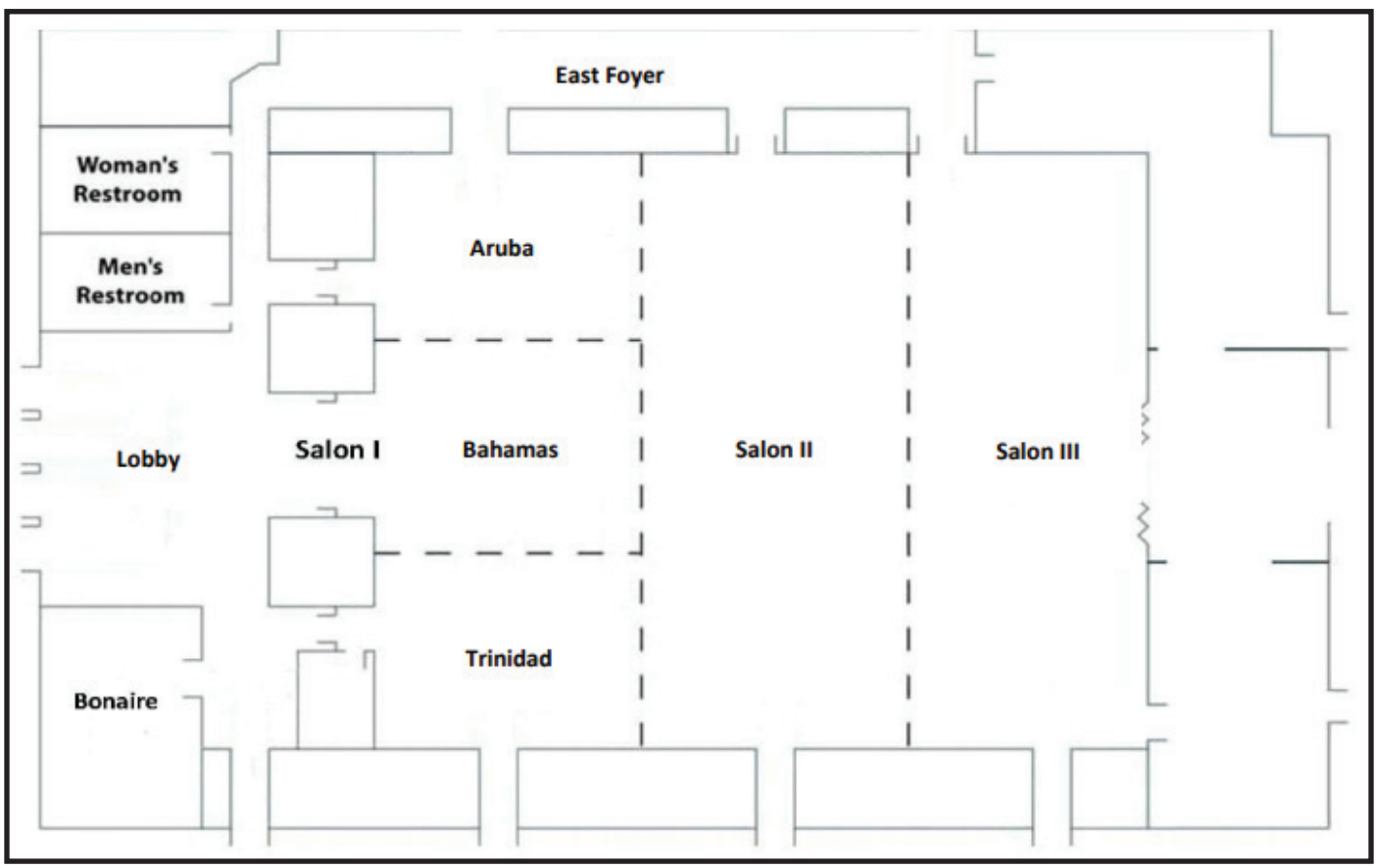
12pm-1pm: Lunch --- On Your Own

1pm-5pm: Creepy Crawly --- Bahamas

1pm-5pm: Waterborne Disease --- Aruba

7pm: Farewell Celebration --- Trinidad





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2018 AEM Meeting Notes

Treasure Coast District of FEHA welcomes you to the 2018 AEM!

Best Wishes for a successful 2018 AEM!!!

2018 AEM Meeting Notes

Emerald Coast FEHA welcomes YOU to the 2018 AEM!!!!

Congratulations to FEHA for 70 Years!

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FEHA Award Descriptions

- *The **Melissa Brock Award*** Recognizes the outstanding achievements in going above and beyond the job description of an Environmental Health director, Administrator, Supervisor or Manager

- The ***Rookie of the Year Award*** recognizes individuals that have exhibited exemplary behavior and have contributed in an outstanding way to the field of environmental health

- The ***Outstanding Environmental Health Professional Award*** recognizes those individuals who have made unusually successful accomplishments of an outstanding nature during the past year

- The ***Charlie Rhodes Award*** recognizes Registered Sanitarians or Registered Environmental Health Professionals that have exhibited exemplary behavior and have contributed in an outstanding way to the field of environmental health. The award will recognize accomplishments that have occurred over a long period of time, e.g., for more than a year.

- The ***Billy G. Tennant Award*** recognizes accomplishments, which have occurred over a long period of time (more than one year), of environmental health professionals.

Special Awards may be submitted for individuals who have made outstanding contributions to public health that may not fit into the other awards categories, e.g., Industry Award.

Visit www.FEHA.org to learn more about FEHA awards & download the Award Nomination form for 2019

FEHA would like to dedicate this edition of the Journal of Environmental Health to those who are no longer physically with us but are with us in spirit.

Ziaul Islam

Ziaul Islam was born in Pakistan where he received a degree in Civil Engineering and was employed in the public sector in this profession for 25 years. In 1993, he immigrated to the United States and worked for state government for 25 years at the Dept. of Transportation, Dept. of Children and Families and in 2005 he joined the Florida Department of Health, Palm Beach County. He worked as an ES I in the Recreational Water Section and in 2011 he was promoted to ES II in the Drinking Water Section, monitoring the chemistry of drinking water and inspected various water treatment systems. In 2015 he accepted a position in the Biomedical and Hazardous Waste Section.

On November 22nd 2017, Ziaul suddenly passed away leaving a void in many peoples' lives. Mr. Islam had very strong work ethics and was very dedicated to his religion and to his family. He was a very respectable man and equally respectful of others. Ziaul is sadly missed by all who have had the privilege of knowing him.

John H. Dame

Passed away April 5, 2015 at his home in Lake Alfred. Born in Ocala, he grew up in Inverness with his brother. He served the Florida Department of Health in Polk County starting in 1955 and worked there for 43 years, ultimately serving as Environmental Administrator.

He served in Japan and Korea in the late 40's and attended Stetson College in Deland, graduating with a BA degree in Law. However, he followed his ultimate calling in Public Health. He came from a very large Public Health family. His father, Dr. George A Dame was known as the "grand old man of public health" and served as Director of the Bureau of Local Health Services of the Florida Board of Health. Besides his father, John's brother, Dr. George M Dame, and uncle, Leland Dame, MD were all county health officers. His first cousin Fleming C Dame Jr., was FEHA president in 1963-1964.

John played a part in the original formation of FEHA in 1947, which was known at that time as the Florida Association of Sanitarians (FAS). He was present at the Florida Public Health Association annual meeting, when the sanitation section voted to form the FAS on October 23, 1947.

He was a member of St. Paul's Episcopal Church in Winter Haven for 60 years, serving on numerous committees and the Vestry. He was a Mason and initiated into both the York Rite and Scottish Rite. He also joined the Army Reserve and achieved the rank of Full Colonel. He was a member of the Kiwanis Club, serving as local President and Regional Lt. Governor. He was very active in the local Chambers of Commerce and served as President of the Polk County Association of Chambers of Commerce. He was very proud to be from Polk County.

After retiring from the Department of Health, he served two terms as Mayor of Lake Alfred as well as a City Commissioner. He also worked through the Polk County Extension Service on the Water School Committee and the Natural Resources Committee. He was a life-long conservationist and ecologist, and believed very strongly that public health and ecological health were one in the same.

He is survived by his only son, John H Dame, Jr. a nature artist in Melrose, Florida. He is very fondly remembered by his colleagues and former staff as a very caring, thoughtful, intelligent man. He was a true gentleman of the highest integrity. He is also lovingly remembered for his long slow manner of speaking. He is remembered by some as "knowing so much Environmental Health that he has forgotten more than I'll ever know".

Melissa Lynne Brock

Passed away on April 3, 2017 following a courageous battle with cancer.

Melissa graduated from Eau Gallie High School and continued her studies at Florida Institute of Technology where she earned a Bachelor's Degree in Environmental Science. She then accepted a position working for the State of Florida and lived in Tallahassee for eleven years, working in Wakulla and Gadsden Counties. She was then called back to Brevard County when she accepted the position of Environmental Health Director, a position that she has held for the past eleven years. She was proud of her Brevard roots and cared very much about our natural resources and wildlife.

She was a wonderful mother to her son, Benjamin and supported him in all of his activities. She was a proud soccer mom and, as a keen fan of the Orlando City Lions, she enjoyed taking Ben to see the occasional soccer game.

If you have an Environmental Health friend that has passed in recent years and would like them to be included in the next issue of the Florida Journal of Environmental Health, please email a photo and a short bio to info@FEHA.org

Florida Environmental Health Association

Annual Education Meeting
Mission Inn Resort, Howey in the Hills, FL
July 30th-August 2nd 2019

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