Extracts from the Lab

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A Jerky Ride in New Hampshire

Editor Notes: The following describes a Salmonella *outbreak investigation from the perspectives of various stakeholders in the public health laboratory system (PHLS). Through collaboration and teamwork, a food product was implicated and further illness was prevented. This investigation serves as a great example of a well functioning PHLS, which operates "in an interconnected and interdependent way to facilitate the exchange of information, optimize laboratory services, and help control and prevent disease and public health threats."*[1]

Epidemiologist Steffany Cavallo, MPH, NH DHHS, Bureau of Infectious Disease Control

Over the summer of 2013, the New Hamsphire Department of Health and Human Services, Bureau of Infectious Disease Control (BIDC) Surveillance Section and the New Hampshire Public Health Laboratories (NH PHL) saw a sporadic number of *Salmonella enterica* serotype Typhimurium (*S. typhimurium*) cases with matching pulsed-field gel electrophoresis (PFGE) patterns. These cases matched a national cluster, which had spiked in May of 2013, but had remained unsolved due to the commonality of the serotype and PFGE pattern. Of the over 2,000 *Salmonella* serotypes, *S. typhimurium* is the most common, and within this specific PFGE pattern there is even more variation. The national cluster was closed after multiple locus variable-number tandem repeat analysis (MLVA) testing—a third type of genetic fingerprinting—identified 14 different patterns within the original cluster.

Pulsed-field gel electrophoresis (PFGE) is the process of isolating the DNA of a bacterial isolate; using restriction enzymes to cut the DNA at specific, known locations; separating the DNA fragments on an agarose gel using electric currents; and then visualizing the fragments using a dye and ultraviolet light, thus creating a unique DNA fingerprint of the isolate which can be compared with other DNA fingerprints for isolate identification.

Outbreak Detection

Despite the closure of the multi-state cluster, New Hampshire continued to see cases through July and August, and by August 20th the State case count had reached eight. Despite being a common PFGE pattern, this is an unusually high number of cases for a small state such as New Hampshire. These first eight cases were primarily adult females living in the Concord, NH area, who had several common exposures including nuts/seeds, yogurt, eggs, chicken, and pet dogs. In consultation with the NH PHL Molecular Diagnostics Unit, the eight samples were sent to the Centers for Disease Control and Prevention (CDC) for MLVA testing. On August 28th, the NH BIDC was notified that all eight specimens were identical by MLVA. On August 30th, nine additional *S. typhimurium* isolates with matching PFGE patterns were identified

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by the NH PHL. Due to the MLVA results from the first eight specimens, these isolates were considered presumptively part of the cluster.

Epidemiologic Investigation

Upon notification that the first eight patients had matching MLVA patterns, the NH BIDC, with assistance from the nursing staff at the Nashua Division of Public Health and Community Services (a local health department), decided to re-interview all cases with the National Hypothesis Generating Questionnaire (NHGQ). The NHGQ is an extensive interview that assesses more than 200 food and other exposures, including pets, pet foods, and pet activities. A total of 14 NHGQ patient interviews were completed and revealed that 93% of cases were exposed to dogs in the seven days prior to symptom onset and 76% also had exposure to pet treats. These proportions were statistically higher than would be expected in the general population.[2]

Though this information was highly informative, the interviews were unable to isolate a specific pet food or pet treat brand. The interviews did reveal some common themes such as 'natural' and 'organic' pet foods and a number of individuals who shopped at local pet stores rather than large national chains. One case indicated that they made their own pet food and the only food given to their pet that was not homemade was a chicken jerky product from a local pet store. A site visit to the pet store confirmed that only one chicken jerky was sold (Brand X) and it was locally made (Figure 1). Though pet treat and pet food outbreaks have occurred in the United States previously, they have typically been associated with national brands of pet food. Considering the demographics of the *Salmonella* cases in this outbreak (New Hampshire only), a locally made product was highly suspicious.

Figure 1. Brand X Chicken Jerky.

A pet treat–specific questionnaire asking about pet treats (including the Brand X chicken jerky) was drafted and rapidly administered. The first 6 of 7 patients interviewed reported purchasing this locally made chicken jerky. A package of unopened jerky was brought in for testing, initial contact with the manufacturer was made, and the product was voluntarily recalled on September 9, 2013.

A site visit to the manufacturer was conducted on September 10, 2013 by representatives from the Food Protection Section (Division of Public Health Services) and the BIDC. The visit identified a number of areas of concern, the most important being inadequate processing of the chicken jerky to ensure it reached a temperature high enough to kill *Salmonella* (>165°F). Other important factors were bare hand contact with the finished product, which could potentially allow cross-contamination, and the vacuum sealing of the finished product, which could allow bacterial proliferation of a facultative anaerobe such as *Salmonella* if the product was contaminated at the time of packaging. During the site visit, an unopened package of chicken jerky as well as nine environmental swabs from along the production chain were collected and brought to the NH PHL for testing (Figures 2 and 3).

Figure 2. The NH PHL provided the BIDC and the Bureau of Food Protection staff with a kit for specimen collection.

The same day, the unopened package of Brand X chicken jerky tested preliminary positive for *Salmonella*, and six additional cases confirmed that they had purchased Brand X chicken jerky. A press release was issued announcing the recall and advising consumers to dispose of the product. Open packages of

Figure 3. Photos of equipment used to produce the chicken jerky. On the left is a meat slicer and a commercial-grade dehydrator. On the right are plastic bins used to store extra chicken jerky as well as another dehydrator.

chicken jerky from patient homes were also collected and brought to the NH PHL for testing.

As of November 14, 2013, there were a total of 36 confirmed cases (Figure 4). Of those 36, nearly all reported exposure to dogs in the 7 days prior to illness onset, and a link to the chicken jerky had been confirmed in 31. Nearly half of all confirmed cases were hospitalized (44%), most were female (64%), and the average age was 43 years (median: 45, range: 6 months to 76 years). Additionally, seven probable cases of *Salmonella* illness associated with the chicken jerky were reported to the BIDC but did not have a laboratory confirmed diagnosis, for a total of 43 illnesses associated with this outbreak.

Environmental and Sample Testing/ Laboratory Results

A total of four chicken jerky samples were brought to the NH PHL for testing: one unopened package of chicken jerky, two packages of opened chicken jerky from patient homes, and unpackaged chicken jerky collected from the manufacturing facility. All tested positive for the outbreak strain of *S. typhimurium*.

Additionally, 7 of 9 environmental swabs taken at the facility tested positive for the outbreak strain. Items testing positive included both dehydrators used to make the chicken jerky, the bins used to store chicken jerky, the scale used to weigh chicken jerky prior to packaging, and the vacuum sealer equipment.

Factors Influencing Infection

A variety of factors could have influenced the ability of *Salmonella* to be transmitted to patients. A handful of cases reported illness in their pets in the week prior to their illness, which could have posed a particular risk if dogs had accidents in the house or if owners regularly pick up after their dog. Asymptomatic dogs could have also transmitted *Salmonella*. The most direct risk during this outbreak would have been direct contact with the contaminated pet treats. More than 60% of cases reported "Never" or "Rarely" washing their hands after handling pet treats, and one case reported actually consuming the pet treats.

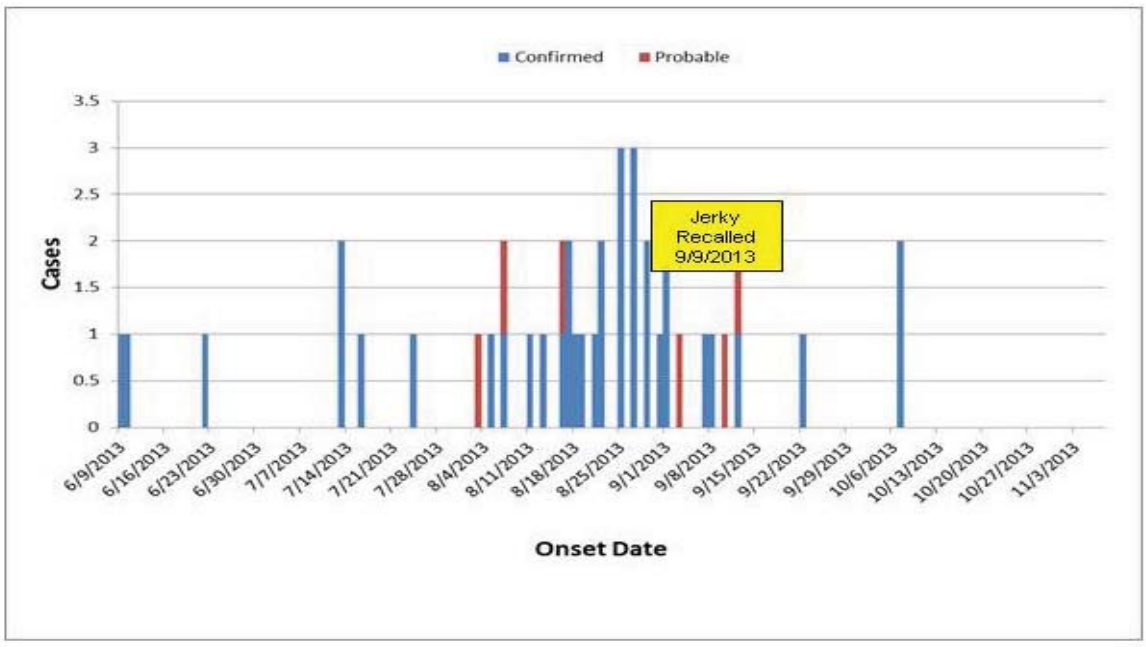

Figure 4. Epidemic curve as of November 13, 2014.

This outbreak likely occurred due to a number of factors including the under-processing of the chicken jerky and gross contamination of the production facility. Only four cases have occurred since the recall was announced and the product pulled from the shelves in early September 2013. Rapid public health investigation and a coordinated response to this

outbreak likely prevented many more individuals from becoming ill in New Hampshire.

Molecular Microbiologist Jennifer Mahoney, PhD, NH Public Health Laboratories

PFGE is routinely performed on all *Salmonella* (and other bacterial foodborne pathogen) isolates in the Molecular Diagnostics (MDX) Unit at the NH PHL. This method allows us to generate a DNA fingerprint that can be used to genetically link cases and identify a source during an outbreak. In addition, as active participants in CDC's PulseNet, the MDX Unit has the ability to compare New Hampshire isolates with a national network of PFGE patterns for real-time outbreak tracking and management.

During the summer of 2013, the NH PHL's routine PFGE testing revealed an increase in *Salmonella enterica* serotype Typhimurium isolates with indistinguishable PFGE patterns. The pattern that emerged was a common one and would not always have indicated a cluster. In fact, this pattern matched a national cluster that was ultimately closed by CDC and had remained unsolved as a direct result of the commonality of this particular PFGE pattern. However, the number of isolates from local residents submitted to the NH PHL in a short time frame was unusually high and warranted further investigation at the state level.

The PFGE results pertinent to this cluster were reported to the BIDC following an existing mechanism for communication of routine results and result interpretation between the MDX Unit and the foodborne epidemiologist. The BIDC then launched an epidemiologic investigation to identify any possible connection among these cases. The volume of testing continued to increase, and the PFGE staff did a remarkable job of managing each isolate related to this outbreak in addition to routine pulsing during their busiest time of the year, never missing a beat. This investigation exemplifies how an existing framework for communication and collaboration is critical to ensuring a swift response to a potential public health threat. The MDX Unit at the NH PHL works closely with epidemiologists and public health nurses on a daily basis to communicate test results and interpretations that aid in outbreak investigations. Relying on this existing communications infrastructure, rather than developing one as the outbreak unfolded, allowed the NH PHL to report results related to this potential cluster in a meaningful and timely fashion.

Though PFGE is a powerful tool in outbreak investigation, when a common pattern is involved there can be a need for further resolution of relatedness among strains. In order to delineate a cluster of indistinguishable isolates, MLVA is performed by the CDC. This sequence-based method of typing target regions in the genome of nucleotide repeats generates patterns that are unique to each species and sometimes strain. When the first eight isolates came back with matching MLVA patterns, the NH PHL had further confirmation that all of the cases were genetically related and likely acquired from a common source (Brand X chicken jerky).

This outbreak investigation serves as a great example of how internal and external partners can come together through teamwork, cooperation, and communication to stop a public health threat and prevent further infections.

Food Safety Microbiologist Jayne Finnigan, NH Public Health Laboratories

The NH PHL is fortunate that a good working relationship exists between interdepartmental entities at the NH Department of Public Health Services (DPHS) as well as the public health community in New Hampshire. The NH PHL Food Safety Microbiology Unit (FSMU) works closely with the NH BIDC epidemiologists, the NH Bureau of Food Protection environmental sanitarians, as well as city and town health officers to help prevent foodborne illness for New Hampshire citizens and visitors. Every Thursday, an Outbreak Team meeting is conducted with these entities and other related parties to discuss reported illnesses of concern. At the September 5, 2013 meeting, the FSMU learned about several *Salmonella typhimurium* isolates sent from hospital labs to the NH PHL Clinical Microbiology Unit for confirmation. These isolates, which had indistinguishable PFGE patterns at the NH PHL, had been referred to the CDC for MLVA testing. The BDIC epidemiologists reported that the CDC confirmed all the isolates had matching MLVA patterns. They then reported that an additional nine isolates were recently identified having the same PFGE pattern; an outbreak or illness cluster was happening! A questionnaire was developed and given to the patients. The results of this questionnaire and meticulous detective work pointed to a specific brand of chicken jerky pet treats.

Early Monday morning (September 9, 2013), a NH Food Protection epidemiologist submitted a store-bought unopened package of the suspect jerky and the FSMU began testing. For *Salmonella*, the lab weighs 25 grams of the sample and adds 225 mL of a specific pre-enrichment broth. This pre-enrichment solution is incubated overnight and the polymerase chain reaction (PCR) test can then be performed the following day. A portion of the solution is then added to three selective enrichment broths that are then incubated overnight. These selective broths are designed to favor and encourage the growth of low levels of *Salmonella* and to help suppress background organisms of foods. Since the lab did not know the contamination level of the jerky, several subsamples were tested.

There are at least nine different validated broths to choose from depending on the food item. Unlike the human gut, foods can be very inhospitable to pathogens for various reasons: the pH or water activity is poor for bacteria or there are many competing organisms. For these reasons, different broths are tailored for specific foods.

Early Tuesday (September 10, 2013), a Foodborne Outbreak Kit was assembled for the NH DPHS team assigned to inspect the jerky manufacturing site. Fresh neutralizing broth was prepared for the environmental samples in order to neutralize any residual sanitizer that may be present. A total of nine environmental samples were submitted for testing from a variety of contact surfaces, as well as an end-product jerky sample, from the manufacturing site. They arrived at the lab for testing early Tuesday afternoon. The NH PHL Media Prep Unit did a great job of preparing enough broth, plate, and tubed media in a very short time frame so that the Lab was able to respond quickly to this outbreak.

PCR testing was completed on the unopened bag from the previous day, and preliminary positive results were reported at that time. Since the manufacturer had voluntarily recalled the product the previous day, the preliminary report helped reinforce the decision to recall product. It also supported the issuing of a press release and the Health Alert Network message. PCR is a screening test, so the culture process continued with inoculation of the selective enrichment media. This allows for characterization of organisms originating from the food and environmental samples to begin as soon as possible in an attempt to link food, environmental, and ill patient isolates.

Each enrichment was subcultured onto three different plates, for a total of 15 plates per sample or subsample; this outbreak used over 300 plates! From each positive sample, seven typical colonies were picked for biochemical screening prior to confirmation testing, for a total of over 700 tubes.

Foods typically have bacteria that may look like *Salmonella* on XLD, Hektoen, and Bismuth Sulfite, the plates used for *Salmonella* testing, so picking several colonies for screening bios is essential.

Thursday morning (September 12, 2013), the Lab had pure isolates of *Salmonella* serogroup B from the unopened package. Serotyping for confirmation was started immediately in the NH PHL Clinical Microbiology Unit and PFGE testing in the NH PHL Molecular Diagnostics Unit. This testing confirmed that the isolates from the unopened packages matched the patient isolates.

A typical FSMU food testing result is almost always a negative or "None Found." This is to be expected from routine food samples tested "off the shelf" for surveillance in conjunction with the U.S. Department of Agriculture and U.S. Food and Drug Administration grants and the NH PHL Routine Food Testing Program. The NH PHL Laboratory Information Management System Unit was able to fine-tune our positive final reports to include the multiple tests performed for this outbreak.

This collaborative investigation is noteworthy because the outbreak strain of *Salmonella* was identified in patient, pet food, and environmental isolates. Laboratory confirmation of an outbreak's source occurs infrequently, and a vehicle is implicated in only 37% of reported foodborne outbreaks in the U.S.[3]

Managing Director Robert Gibson, MPH
NH Veterinary Diagnostic Lab

Like the reportable disease list for humans, states have an animal reportable disease list. In most states, this list is based largely on federal guidelines and the World Organization for Animal Health (OIE). In addition to various significant communicable animal diseases, the list contains a variety of foreign animal diseases (FADs) that are not currently found in the United States.

When veterinarians and diagnostic laboratories identify communicable diseases from the list in patients, they are required to report them to the State Veterinarian, who is in communication with the appropriate public health officials. Concerns for awareness and compliance with reporting requirements are also the same as for human diseases. One gap that may weaken disease surveillance and reporting is the lack of reporting to public health officials by private labs. There are zoonotic agents/diseases that overlap both the human and animal reportable disease lists. A few of these are anthrax, brucellosis, listeriosis, or infection with *Salmonella enteritidis.* These results can impact pet food recall decisions. Those recalls are listed on the FDA website and are further disseminated on various veterinary sites such as the American Veterinary Medical Association.

According to the World Health Organization, a zoonotic disease is "...any disease or infection that is naturally transmissible from vertebrate animals to humans and vice-versa..." [4]

New Hampshire Pet Treat Outbreak

Since the beginning of the New Hampshire contaminated dog treat investigation, the NH Veterinary Diagnostic Lab (NHVDL) has had no canine *Salmonella* isolates to report. They have also not seen any increase in enteric culture submissions. This absence of confirmed veterinary cases may be due to a variety of factors:

1. This particular strain of *Salmonella* may not have been as virulent for dogs, or if infected, they may have been asymptomatic.
2. In animals, as in humans, *Salmonella* is often self-limiting and the condition may have resolved before the owner noticed the dog was sick or took their pet to a veterinarian.
3. If the animal was taken to a veterinarian, the first recourse may have been an empirical choice of antibiotic, rather than an additional out -of-pocket lab expense. Since most *Salmonella* species are susceptible, any dog infected with the outbreak strain likely would have responded to treatment.

An effective public health system relies on numerous participants and clear communication. Whether it is *Salmonella*, antibiotic resistance, or a threat from bioterrorism, the NHVDL is ready to aid practitioners and State officials in the identification and monitoring of reportable diseases.

Editor's Notes: This article demonstrates the importance of collaboration among public health laboratory system partners. A rapid, coordinated response limited the spread of this outbreak.

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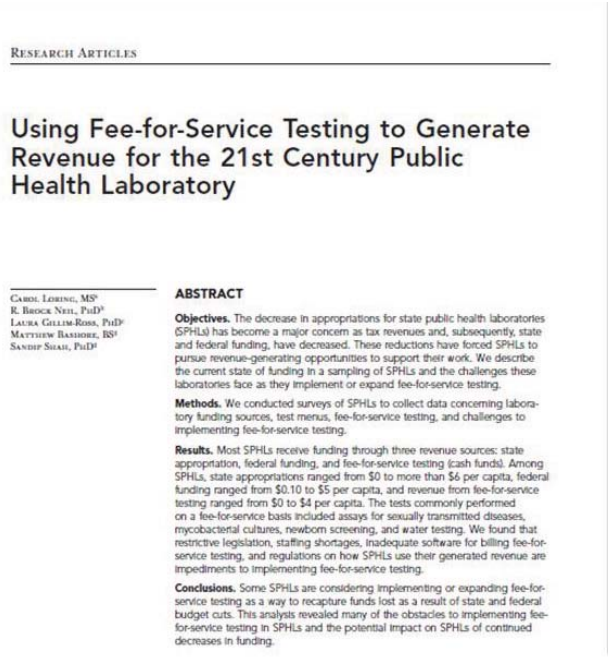
The Buck Stops...Where?

In the September 2013 Supplement to the journal *Public Health Reports*, a research article examining issues surrounding public health laboratories billing for services was published. Carol Loring, MS, NH PHL Virology and Special Testing Laboratory Supervisor was lead author of the study. We spoke to Carol to gain some insight into the impetus for the project and what conclusions were found. The full article can be read here: http://www.publichealthreports.org/issueopen.cfm?articleID=2999.



RESEARCH ARTICLES

Using Fee-for-Service Testing to Generate Revenue for the 21st Century Public Health Laboratory

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ABSTRACT

Objectives. The decrease in appropriations for state public health laboratories (SPHLs) has become a major concern as tax revenues and, subsequently, state and federal funding, have decreased. These reductions have forced SPHLs to pursue revenue-generating opportunities to support their work. We describe the current state of funding in a sampling of SPHLs and the challenges these laboratories face as they implement or expand fee-for-service testing.

Methods. We conducted surveys of SPHLs to collect data concerning laboratory funding sources, test menus, fee-for-service testing, and challenges to implementing fee-for-service testing.

Results. Most SPHLs receive funding through three revenue sources: state appropriation, federal funding, and fee-for-service testing (cash funds). Among SPHLs, state appropriations ranged from $0 to more than $6 per capita, federal funding ranged from $0.10 to $5 per capita, and revenue from fee-for-service testing ranged from $0 to $4 per capita. The tests commonly performed on a fee-for-service basis included assays for sexually transmitted diseases, mycobacterial cultures, newborn screening, and water testing. We found that restrictive legislation, staffing shortages, inadequate software for billing fee-for-service testing, and regulations on how SPHLs use their generated revenue are impediments to implementing fee-for-service testing.

Conclusions. Some SPHLs are considering implementing or expanding fee-for-service testing as a way to recapture funds lost as a result of state and federal budget cuts. This analysis revealed many of the obstacles to implementing fee-for-service testing in SPHLs and the potential impact on SPHLs of continued decreases in funding.

How did you get involved in a project looking at fee-for-service billing practices across public health laboratories?
From August 2011 through July 2012 I was a participant in the National Center for Public Health Laboratory Leadership Emerging Leader Program. In this program, public health professionals from all over the U.S. receive specialized training in various areas of leadership development. A requirement of the program is that all participants work together on a project to enhance workforce development and inform the field of public health. This research project was the result of that program.

Why a project looking at fee-for-service?
You know, it's been a tough couple of years for State Public Health Laboratories (SPHL). The economic downturn in 2008 caused state revenues across the country to fall. Consequently, health departments everywhere had their budgets slashed. At the same time, the federal government also tightened spending. Many people don't realize that all state public health laboratories receive funding for all kinds of laboratory testing through federal grants. But while funding may decrease, it's rare for laboratories to reduce services. Historically, SPHL have not billed for their services, but our group thought that this was an area that needed to be looked at. We decided to compile information about the experiences of labs in this area.

And what did you find?
We found that the funding formulas for SPHL are as varied as the states themselves! Some labs receive no funding from their state government, while others receive a high percentage of funds from their government. Some states bill only Medicaid and other state agencies, while a few work with billing agencies and bill private health insurance. Some labs are able to keep the revenue they generate in a dedicated lab fund, while others don't keep any fees, as they go directly to the state general fund.

Were there any groundbreaking discoveries in this article?
Not so much "groundbreaking," but I'd definitely say "timely." This is a nice article for laboratory directors who may be considering implementing billing of private insurance in their labs. It provides a lot of anecdotal information on the experiences of others, in one journal article.

It sounds like an awesome article!
It is! You should read the whole thing!

Well, Well, Well...State Helps Community with Well Water Testing

Kim Beers, Laboratory Scientist, Water Analysis Lab

In New Hampshire (as in most states), there is no requirement to test private well water. Private well testing regulations are managed at the local level and vary widely throughout the State. Most drinking water contaminants have no taste, odor, or color; therefore many people do not realize the need to test. Ignorance is bliss? Not when you're potentially ingesting unhealthy levels of bacteria, arsenic, nitrates, etc. without realizing it. Some contaminants in drinking water have been linked to cancer and toxicity, posing a risk to human health. Although the reasons why homeowners choose not to have their water tested are not entirely understood, there are many misconceptions:

- perceived hassle of obtaining the proper containers from the lab,
- sampling the water according to directions,
- getting the samples to the lab in a timely manner,
- and the assumed expense of testing.

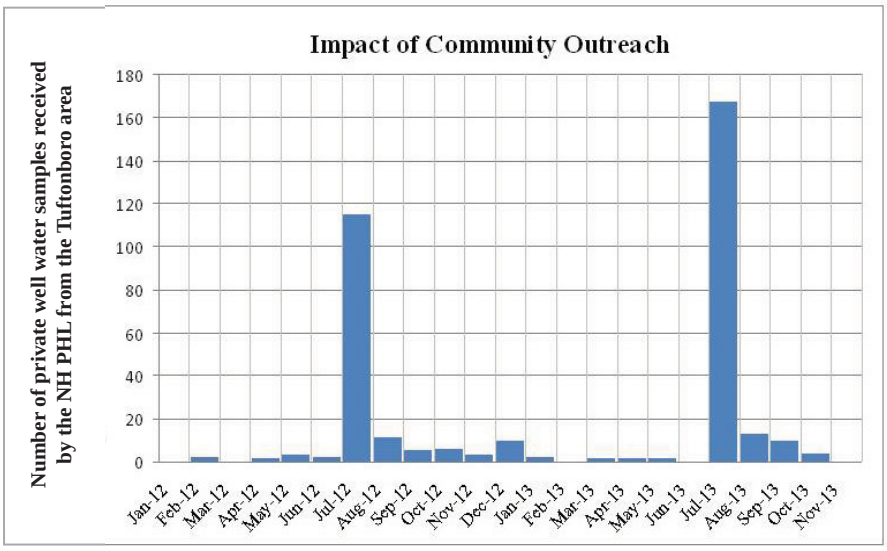
In 2012, members of the Tuftonboro, NH, Conservation Commission (TCC) attended a drinking water workshop sponsored by the New Hampshire Department of Environmental Services. One of the presenters spoke on the health effects of arsenic in well water. Living in the "Granite State", our residents have the benefit of claiming a beautiful, mountainous state filled with extensive granite formations and quarries as their home. What's the downside of all of this granite? Wells drilled into them tend to have higher amounts of arsenic due to natural leaching from the bedrock. The Commission members knew most of their residents received their water from bedrock wells and had the potential of having high levels of arsenic. They wanted to pass this information on to their residents, but they also wanted to help make testing their water as convenient as possible to encourage action.

The TCC decided to work with the NH PHL Water Analysis Laboratory (WAL) to coordinate a town-wide, private well water sampling event. The TCC spent

months doing presentations and writing newsletter articles educating their residents about the importance of testing their well water. They announced the sampling event to their town with a flyer in the town's tax bills to ensure the widest outreach. The residents could pick up a sampling kit (provided by the NH PHL WAL) from Tuftonboro town offices or the transfer station over the span of one week. They were told to collect their samples on Sunday and drop them off at the transfer station on the same day. They chose the transfer station since it is open on Sundays and most residents go there once a week. The sampling itself needed to be completed on Sunday due to testing requirements (such as short hold times for some bacteria and nitrates). The volunteers at the transfer station made sure each sample kit included its paperwork and payment. The samples were stored in a walk-in cooler overnight and delivered to the NH PHL first thing Monday morning.

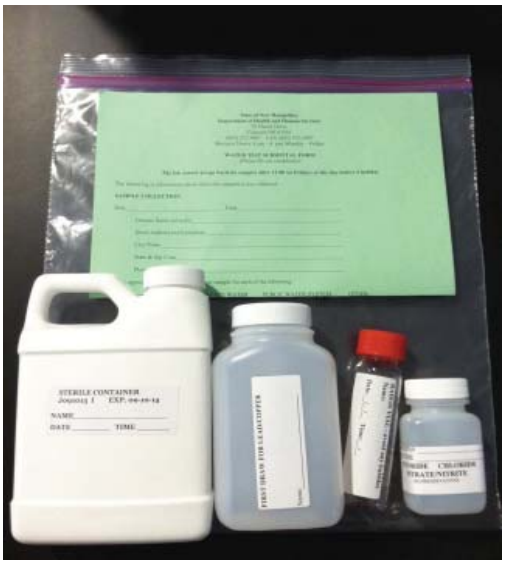
Once delivered, the WAL staff sorted the 122 sample kits according to collection time. This way, the samples closest to their maximum hold time were analyzed first. The lab had to redistribute staff to ensure all samples were analyzed within their hold times and reports were sent out to the homeowners within two weeks.

This sampling event was so successful that many of the residents who missed the first event requested a second one. The TCC coordinated a second sampling event in 2013, at which time 163 sample kits were delivered to the WAL. Again, the TCC and WAL were able to work together to make sure private well owners would have a convenient way to have their water tested. The following chart clearly demonstrates how the number of samples collected and tested in a given area can be increased by community outreach.



Each sampling event showed that while the results are in line with New Hampshire averages, over 34% of the wells tested had one or more elements above recommended levels, which indicated a potential health risk. Public forums were held by the TCC and NH Department of Environmental Services after the reports were delivered to help answer any questions and provide information on how to treat water based on the level and type of contamination found.

These two events truly showed how the collaboration between towns, state labs, and state agencies can help residents ensure their drinking water is safer. It was definitely a heavy load for the lab to take on all at once, but worth it when it helped so many New Hampshire residents find out the quality of their well water.



The water sampling kit provided by the NH PHL WAL.

Members of the TCC raising awareness about the importance of testing well water. (Photo courtesy of Steve Wingate.)

Norovirus: The Virus That Keeps on Giving

Fengxiang Gao, MD, MPH, Virology & Molecular Diagnostics Program Manager

Noroviruses, first identified in Norwalk, Ohio, in 1968, are the most common cause of acute gastroenteritis in the United States. Although norovirus gastroenteritis is generally mild with a short duration, the illness can be severe and sometimes fatal, especially among vulnerable populations such as young children and the elderly.

The NH PHL began norovirus testing in 2003 using an in-house real-time polymerase chain reaction (PCR) procedure and has been routinely performing this test ever since. The Virology and Molecular Diagnostics Program at the NH PHL is equipped with five real-time PCR instruments, three conventional PCR instruments, and one ABI 3130xl DNA Analyzer to assist in clinical diagnosis and support laboratory surveillance as well as outbreak investigations. Between 2003 and 2005, there were 50–70 specimens tested and 20–30 positives identified each year (Table). In 2006, 139 specimens were tested of which 66 were positive (47.5%). The year with the most specimens received was 2007 when 636 specimens were tested and 267 were positive (42.0%).

Norovirus specimens about to be processed.

Noroviruses are genetically classified into five different genogroups (GI, GII, GIII, GIV, and GV), which can be further divided into different genotypes. Most noroviruses that infect humans belong to genogroups GI and GII. Noroviruses from genogroup II, genotype 4 (GII.4) account for the majority of adult outbreaks of gastroenteritis and often sweep across the globe. Recent examples of GII.4 strains that caused norovirus pandemics include GII.4 Minerva, GII.4 New Orleans, and the recently identified GII.4 Sydney.

The NH PHL started norovirus DNA sequencing in 2007 to monitor genetic changes in the virus. In 2009, the CDC launched a DNA sequence-based norovirus surveillance program named CaliciNet, of which the NH PHL is an active participant. Three NH PHL staff members have been certified by the CaliciNet to perform phylogenetic analysis of norovirus sequences and upload norovirus sequence data to the national database. Since 2010, the NH PHL has uploaded 164 norovirus sequences from 69 outbreaks. The majority of the specimens tested for norovirus at the NH PHL were from suspected outbreaks; long-term care facilities are the most reported settings for norovirus outbreaks in New Hampshire.

Phylogenetic analysis of norovirus sequences identified from New Hampshire outbreaks indicated that GII.4 Minerva was predominant from 2006 to 2009. The GII.4 New Orleans replaced the GII.4 Minerva and became predominant in 2010 and continued to be the predominant strain until 2012. On January 8, 2013, the NH PHL identified the first New Hampshire case infected with the GII.4 Sydney, which has been the primary norovirus strain circulating in New Hampshire since then. We are anticipating that the GII.4 Sydney will continue to be the dominant strain in New Hampshire for the next few years.

The NH PHL continues to work closely with epidemiologists at the DHHS Bureau of Infectious Disease Control (BIDC) on norovirus surveillance and outbreak investigations in New Hampshire. We encourage health care providers to collect and submit stool specimens for norovirus testing. The PHL continues to provide high quality testing services for the detection of norovirus and assist the BIDC in the prevention and control of norovirus infections in New Hampshire.

The DHHS Bureau of Infectious Disease Control (BIDC) investigates all outbreaks of acute gastroenteritis and coordinates the distribution of stool specimen collection kits for subsequent testing at the NH PHL. For questions concerning outbreaks, please call Jennifer Mahoney, Molecular Diagnostics Unit Supervisor at (603) 271-4669. For specimen collection kits, please call John Pollock at (603) 271-4605.

Table. NH PHL norovirus testing results for 2003– 2013.

Year	Number of Specimens Tested	Number of Specimens Positive (%)	Predominant Strain
2013	289	90 (31.1)	GII.4 Sydney
2012	299	153 (51.2)	GII.4 New Orleans
2011	210	119 (56.7)	GII.4 New Orleans
2010	105	39 (37.1)	GII.4 New Orleans
2009	386	163 (42.2)	GII.4 Minerva
2008	317	88 (27.8)	GII.4 Minerva
2007	636	267 (42.0)	GII.4 Minerva
2006	139	66 (47.5)	GII.4 Minerva
2005	72	27 (37.5)	*
2004	53	29 (54.7)	*
2003	57	29 (50.9)	*

*DNA sequencing was not performed.

Staff Spotlight—Mary Holliday

Susanne Desrosiers, Microbiologist, Virology & Special Testing Unit

Mary Holliday is the Finance Administrator for the NH PHL. Her duties include keeping track of outgoing orders and incoming invoices to ensure that all expenditures are charged to the correct accounts and grants. She is also responsible for maintaining grants, laboratory billing, and revenue—all those myriad fiscal jobs that keep our laboratory running smoothly. The path that brought her to managing finances for the NH PHL is an example of how training in laboratory medicine can open doors into other fields of interest.

Mary grew up in Littleton, NH, and became interested in laboratory science when she was in high school. She attended the Medical Laboratory Technician (MLT) program at Vermont College, then part of Norwich University. She passed the Registry Exam by the American Society of Clinical Pathologists (ASCP) as an MLT in the "Generalist" category. This enabled her to work in all sections of any clinical laboratory.

Since Mary's husband had a career in the Air Force, they lived in nine different places over the course of thirteen years. While living in Tennessee, Mary obtained state licensure as an MLT and then as a Medical Technologist (MT). While working as a laboratory generalist, Mary took her first computer class with the School of Lifelong Learning with the intention of obtaining a bachelor's degree to become a laboratory supervisor. After considering her options, Mary decided to pursue a degree in Business Administration, which she refers to as "going over to the dark side." While completing that degree, she worked in both laboratory and business positions.

Mary and her family enjoy the quality of life in New Hampshire and decided to settle here. Mary worked in the laboratory at Huggins Hospital in Wolfeboro and then at Lakes Region General Hospital in Laconia. She earned a Master of Business Administration degree from Plymouth State University and also passed the ASCP Registry exam as an MT. She transitioned to positions in financial analysis at several hospitals, thus bridging the gap between laboratory and finance. She believes that both fields require the same linear thinking skills and that her two-pronged education and experience led her to her present position.

Mary has worked for the NH PHL for twelve years. She feels her laboratory background gives her an advantage in the performance of her financial management duties. Because of her experience on the technical end, she has a better understanding of the laboratory's needs and the complications encountered when analyzing laboratory expenses. Thank you, Mary, for being an important part of the NH PHL Management Team!

Answers to Spot the Differences!

(Game on page 14)

1. Mask
2. Gloves
3. Level of liquid in red beaker
4. Pipettes
5. Pen in pocket
6. Biohazard label on sharps container (upside down)
7. Blue tube exchanged for yellow tube in rack
8. Position of clock arm
9. Scientist's hair
10. Bench paper

NH PHL Updates

Celebrating Our Madame President

The Association of Public Health Laboratories (APHL) is a non-profit membership organization recognized nationally and internationally as a leader in representing the laboratories that protect the health and safety of the public. Each year, a new president is elected from among the members, and this year, we are proud to announce that our very own lab director, Christine Bean, PhD, MBA, MT (ASCP), is serving as President. Dr. Bean has an extensive microbiology background and taught at the University of New Hampshire prior to joining the NH PHL in January 2005. Laboratory workforce, training, and leadership concerns continue to be her priorities, and in her role as APHL President, she will focus on laboratory workforce issues and the implementation of the APHL Laboratory Efficiency Initiative (LEI). She serves as the APHL Board liaison to the Workforce Development Committee and is currently working on a training needs assessment for the northeast region as part of the LEI.

Dr. Bean accepts a recognition award showing the NH PHL's support of her new position as APHL President.

During this year, APHL, along with its Board members, rewrote the strategic plan for the organization for 2014–2016. The central challenge is to advance the capabilities and capacities of the PHL System. We are proud of Dr. Bean's achievements and know that she is doing a great job as "Madame President." Congratulations, Chris!

NH PHL Radiological Chemists Receive Award

On September 12, 2013, NH PHL radiological chemists Debanond Chakraborty, Brian Scherer, and Melissa McNamara received the Food and Drug Administration (FDA) Office of Regulatory Affairs 2013 Scientific Collaboration of the Year Award. The award was given to the Winchester Engineering and Analytical Center Strontium-90 (Sr-90) Tri-State Fish Study Analysis

President Bean's Secret Service Agents (from left to right): Lou Barinelli, Wendy Lamothe, Denise Howard, and Jill Power.

NH PHL's Award Winning Chemists (from left to right): Brian Scherer, Melissa McNamara, and Debanond Chakraborty.

Group, which consisted of 22 public health scientists from New Hampshire, Vermont, and Massachusetts. After identification of higher than expected levels of Sr-90 in fish from the Connecticut River, the group collaborated to determine background levels of Sr-90 in fish throughout northern New England. The award recognized the important efforts of this group, which contributed to the FDA's mission of protecting and advancing public health. More information about this study can be found in the Summer 2013 edition of *Extracts from the Lab*.

Promotions

Mamta Dua, formerly Toxicologist II under FERN chemistry grant funding, has been promoted to Toxicologist IV, the position vacated by Michele Yacopucci. Mamta's duties will include overseeing testing in the Chemical Terrorism Preparedness Program under the Public Health Emergency Preparedness (PHEP) grant. Mamta has been working at the NH PHL in the Chemistry Program since September of 2004. Congratulations, Mamta, on this well earned promotion!

New Employees

The NH PHL welcomes Julianne Nassif as the new Toxicologist V, Chemistry Program Manager. Julie has considerable experience in analytical chemistry having previously worked at the William A. Hinton State Laboratory in Massachusetts and at a commercial environmental laboratory. More recently, Julie has been working as a consultant to industry in preparing environmental health and safety plans and to the Association of Public Health Laboratories (APHL) in raising awareness of environmental health laboratories and better engaging the community. She has been active in shaping national programs and policy related to human biomonitoring and chemical threat response through committee work with APHL (Biomonitoring

Subcommittee co-chair, Environmental Health), CDC (LRN-C, Environmental Public Health Tracking), and the United States Department of Homeland Security (Integrated Consortium of Laboratory Networks).

Julie has an undergraduate degree in environmental health from Quinnipiac University and a master's degree in environmental science from the University of Massachusetts at Boston. Julie lives in Westwood, Massachusetts, with her husband, two daughters, and a large, overly friendly dog. She has many eclectic interests, which include running, biking, cooking, art, and live music.

Farewells

Sally Hartman retired in August 2013 from the NH PHL after 27 years of State service. Sally began working in forensic toxicology as a Laboratory Scientist (LS) II in August of 1986. She held that position until February 1988 when she was promoted to Toxicology

Unit Supervisor (LS IV). The final eight years of her career were as a Toxicologist V where she served as the Chemistry Program Manager for the NH PHL. In this position she led the development and growth of the Chemical Terrorism Program, oversaw the CDC Biomonitoring Grant, and was successful at obtaining a Food Emergency Response Network (FERN) award from the U.S. Food and Drug Administration (FDA) to expand testing in the area of food emergency response. The lab currently has both FDA and USDA FERN grants in chemistry, in part due to Sally's hard work and guidance. In 2011, she achieved the first ever CLIA accreditation for the Laboratory Response Network Chemistry Program at the NH PHL.

Sally served on numerous committees including the Emerging Issues Cancer Coalition, the Newborn Screening Advisory Council, and the NH Department of Public Health Services Strategic Planning Workgroup. She worked collaboratively with the University of New Hampshire (UNH) Chemistry Program to set up courses for State employees in 2009 and to mentor UNH graduate students working on projects at the NH PHL. Sally continues to serve as a member of the UNH Chemistry Program Advisory Board for a three-year term, which began in 2012.

We wish Sally many happy years in retirement with her husband Bob. She enjoys traveling, golfing, and spending time with her grandchildren. Thank you for all you have done for the citizens of New Hampshire!

As a symbolic gesture in celebration of her retirement, Sally discards her well used lunch bag. She states, "This bag has served me well, but I don't have to pack lunches anymore."

Michele Yacopucci, PhD, joined the NH PHL Chemistry Program in 2002. She was instrumental in qualifying the NH PHL's Chemical Terrorism Preparedness Program as a CDC Level 2 laboratory. She spent more than 10 years on validation, development, and training technicians for different chemical methods required by federal programs. Her chemistry skills also showed in her great cookie and pastry baking. She enjoyed baking as much as sharing the funny stories of her three lovely daughters. In August 2013, she left New Hampshire and joined the State Hygienic Laboratory at the University of Iowa. We miss her here but wish her the best in her future endeavors.

Alisha Nadeau joined the NH PHL Molecular Diagnostics Unit in 2009. She played an integral role in setting up the bacterial DNA fingerprinting program, pulsed-field gel electrophoresis (PFGE), which is used to help detect, investigate, and control outbreaks of foodborne infection. She was instrumental in assuring that New Hampshire met CDC's strict performance goals for PFGE testing. Her great organizational skills, dedication, and expertise will be greatly missed. Alisha left the PHL in January 2014 to pursue a master's degree in nursing at the University of New Hampshire. We wish her all the best as she starts on this new journey.

Spot the Differences!

Find the ten subtle and not so subtle differences between these two lab scenes. Answers on page 10.

Before

After

New Hampshire Department of Health and Human Services

Nicholas Toumpas, Commissioner

José Montero, MD, Director
Division of Public Health Services

Christine Bean, PhD, Director
Public Health Laboratories

To join communities and families in providing opportunities for citizens to achieve health and independence.

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Please call (603) 271-4661 to reach the lab directly or email Jill Power at jill.j.power@ dhhs.state.nh.us with any newsletter-related questions.

The NH PHL Newsletter Committee would like to thank those who contributed to this publication—not only do they have their everyday tasks to tend to, but they graciously agreed to write an article (or two!) and we sincerely appreciate their willingness to help.

The NH PHL Newsletter Committee: Kim Beers, Amanda Cosser, Susanne Desrosiers, Jill Power, Peggy Sweeney, and Sandie White