capsid

the official newsletter of NoroCORE

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the goal

"...working together to reduce viral food borne illness"

NoroCORE, the USDA-NIFA Food Virology Collaborative, is a food safety initiative that focuses on outreach, research, and education in the field of food virology.

NoroCORE's ultimate goal is to reduce the burden of food borne disease associated with viruses, particularly noroviruses.

contents

Science, Together

Science is a highly collaborative field and a critical component is the sharing of knowledge, skills, and techniques. When efforts cross different scientific disciplines, experts in the component disciplines must share their knowledge and abilities so that the product of the effort is more than a simple sum of its parts. NoroCORE is built on the principles of highly collaborative team science and our members actively engage in this type of collaboration in many ways.

Team members hold regular conference calls and face-to-face meetings to share and discuss research progress; they share written protocols, data, and reagents required for research; and often teams provide in-person training to collaborative partners in need of their expertise. We'd like to highlight some great examples of the latter - NoroCORE member institutions providing their colleagues with in-person, hands-on training. Over the past year, North Carolina State University (NCSU) team members from the laboratory of Dr. Lee-Ann Jaykus have offered in-depth, in-person training to team members from both Louisiana State University (LSU) and North Carolina A&T University (NCAT). Likewise, Centers for Disease Control and Prevention (CDC) team members have provided similar training to collaborators at Clemson University. Here we share more details from LSU's training experience - check out the NoroCORE blog to learn more about NCAT's and Clemson's.

Dr. Marlene Janes' laboratory at LSU is engaged in a prevention and control-related project to determine the feasibility of direct detection of noroviruses in seawater and oysters. This would potentially complement or replace the use of traditional fecal indicator bacteria testing. This project is a new direction for Dr. Janes' laboratory, and thus

Dr. Jen Shields (back right) observes Dr. Marlene Janes (left center) and Ph.D. student Naim Montazeri (left) harvesting oysters for sampling from the Gulf of Mexico.

Science, Together (...continued)

LSU Ph.D. student Naim Montazeri shows off the oyster haul.

required external input of expertise. Dr. Jen Shields of NCSU, whose background includes experience in water sampling and molecular methods, visited the Janes lab twice, spending one week with the lab per visit. Dr. Shields worked with Dr. Marlene Janes and her Ph.D. students, Naim Montazeri and Morgan Maite, to bring them up to date on current environmental virology knowledge and relevant molecular techniques. Dr. Shields assisted the team in the formulation of a sampling plan, implementation of laboratory protocols for RNA virus work, and provided instruction on culture and molecular techniques.

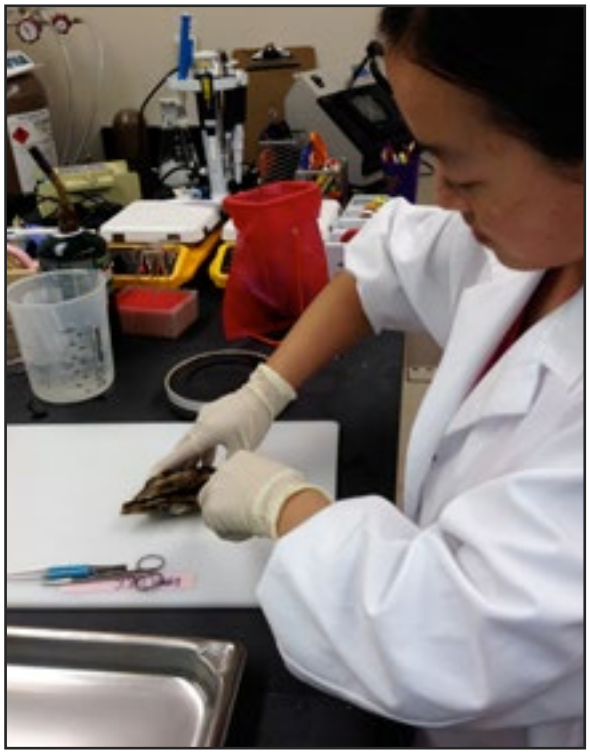
For the sampling plan, she participated in the initial sampling trip in the Gulf of Mexico, assisting with the selection of sampling sites and sharing proper sampling techniques. She also provided guidance on the creation of a standardized laboratory protocol for virus RNA work and assisted with implementing improved workflow within the laboratory to minimize the possibility of contamination. Work with RNA viruses is particularly prone to contamination issues- if a lab has not previously engaged in this type of research, changes in work areas often need to be made to accommodate the increased risk.

Dr. Shields also instructed team members on sampling process techniques such as filtration of water samples; dissection of oysters; RNA extraction from water and oyster samples; reverse-transcription, real-time PCR (RT-qPCR); the creation and use of internal amplification controls (specific controls that help with assessing the reliability of PCR data); data analysis tools; and detection methods for novel microbiological indicators of fecal contamination in water and oysters (bacteriophage). Dr. Shields and the team also created standard operating procedures for all of these assay methods in the process. She provides ongoing advice and support as needed, and will further assist in the analysis of final results.

There was more to this experience than just the straightforward benefit of receiving new skills and protocols. Drs. Janes and Shields both emphasized that the in-person training dramatically reduced the amount of time it would have otherwise taken to learn and implement new techniques and protocols. The LSU team has been able to get their project up and running in a matter of months, and feels that it would have taken at least a year without this help. In our conversation, Dr. Shields complimented the LSU team's interest, commitment, and enthusiasm about the project, and their readiness to gain new knowledge and skills. Accessibility to someone with the requisite expertise allowed the LSU team to receive quick and accurate answers to their questions, saving them time and assuring that their project was "moving in the right direction."

The collaboration also facilitated implementation of some practical aspects of the project, such as supply ordering and physical laboratory workflow setup. Dr. Shields noted that it was a "big, big plus" being able to see the laboratory, the machines, and the current setup at LSU. "Without having gone there and seen that, I wouldn't have been able to help with that aspect at all." The personal nature of such training has also facilitated ongoing troubleshooting, as Dr. Shields is able to help answer questions via email or phone, and assist in facilitating reagent exchange with the LSU team. Dr. Janes told us that the LSU team "uses the training every day, and has trained additional students as well." Ms. Maite shared, "[Dr. Shields] is a great instructor and teacher. We will use these skills from here on out. It's much appreciated…and without that assistance we wouldn't have been nearly as prepared as now."

LSU student in the Janes laboratory shucks an oyster for sample processing.



NoroCORE Update

In this second issue of Capsid, we provide a snapshot of our intended Extension and Outreach Core activities. This is our fifth core function, and in many ways, our most important (the first four cores, all research-based, were described in the first issue of Capsid).

This is because we believe that it is necessary to use the best science to design effective control strategies, but that active stakeholder engagement is important to make sure those controls are practical and effective in real-world settings. Without the science, we don't have the information or understanding to design appropriate controls. Without the extension and outreach, we cannot put those controls into practice. And without communication between scientists and stakeholders, we can't do either. So, in essence, the purpose of this core is to keep the work of us scientists relevant to the needs of the professionals working on the "front line" in the field.

NoroCORE has many, many stakeholder groups ranging from the industries that battle daily with the foodborne virus issue, to supporting industries that help them "fight the good fight," to governmental regulators dedicated to keeping the food supply safe and wholesome. Based on the fact that the vast majority of foodborne virus outbreaks are associated with retail and institutional food settings, and these outbreaks are most likely due to poor personal hygiene practices of infected food handlers (and/or vomiting incidents), NoroCORE is actively engaging these stakeholders. Because many public health professionals (among others!) still believe that bacteria, and not viruses, are the leading cause of food-related illness, we are also developing materials to adequately convey the virus story to this group. The same can be said for consumers.

Relative to specific commodities, epidemiological evidence suggests that fresh produce (fruits, vegetables, and nuts) and molluscan shellfish are at elevated risk of virus contamination, so these industries are target audiences as well. We are reaching out to other stakeholder groups that support efforts to keep the food supply free of virus contamination, including companies that produce hand and surface sanitizers; testing companies and those designing and manufacturing detection technologies; and food processing equipment manufacturers. Government stakeholders are another key group, as they participate in prioritizing research agendas and establish the policies that drive public health improvements in food safety.

In keeping with the classic extension and outreach model, we believe that control of foodborne viruses cannot be adequately addressed and sustained without mechanisms to translate basic and applied research findings into real-world practices. Using this model, the NoroCORE team is working to identify specific target audiences; characterize audience knowledge; create programs to increase appreciation for food borne viruses in an effort to promote their control; and assess the efficacy of such programs relative to imparting knowledge and when applicable, changing behaviors. The efforts of this core are lead by Dr. Angela Fraser of Clemson University and Dr. Christine Moe of Emory University. Dr. O.D. "Chip" Simmons serves as our staff extension professional working with the fresh produce and shellfish industries. Dr. Jianrong Li (The Ohio State University), Dr. Don Schaffner (Rutgers University), Ms. Sheri Cates (RTI-International), and many others are contributing to our extension and outreach efforts.

Core 5 Activities:

Activity 5.1: Actively engage a broad stakeholder group.

Activity 5.2: Increase the appreciation of food safety and public health professionals for the role of viruses in foodborne disease by producing educational materials for inclusion in curricula.

Activity 5.3: Evaluate consumer food safety knowledge about foodborne viruses and refine existing educational resources to cover this topic.

Activity 5.4: B.etter understand barriers to hygiene practices of food handlers and design user-friendly educational materials that train and promote good hygiene practices in the retail, grocery, and institutional food settings.

Activity 5.5: Produce educational materials for inclusion in national GAPSs training for the fresh produce industry.

Activity 5.6: Engage the shellfish sector to determine the most appropriate audiences and messages for reducing the likelihood of viral contamination in this commodity.

Activity 5.7: Work with government regulators to address barriers to controlling virus contamination of foods.

How are we engaging stakeholders? In many ways…. presentations at professional and annual trade association meetings; in-person meetings; one-on-one discussions with key stakeholders; entering into research agreements with stakeholder companies; exhibiting, sponsoring symposia, and attending subcommittee meetings at annual gatherings of the International Association for Food Protection (IAFP) and the Institute of Food Technologists (to name a few); producing fact sheets; and trying to use social media to increase awareness of the foodborne virus problem. These are just a few examples. We know that there are many other opportunities for stakeholder engagement and we intend on capitalizing on them over the next year. Stay tuned….you may well be asked to give us guidance sometime soon!

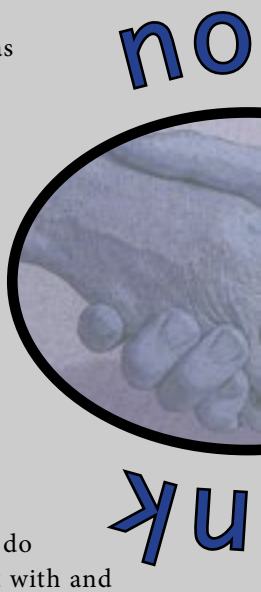
Collaborator

Dr. Beatriz Quiñones
Research Molecular Biologist
U.S. Department of Agriculture/ARS
Western Regional Research Center
Produce Safety and Microbiology Unit
Albany, California

"The fact that it's health related, you always feel connected to it. I feel like there is a direct problem in society that I can tackle, a problem that I can contribute some strategy to."

Dr. Beatriz Quiñones was born and raised in Puerto Rico. She completed her undergraduate studies at Texas A&M in Microbiology prior to obtaining a PhD in Molecular and Cell Biology at UC Berkeley. As a PhD student, she studied membrane trafficking in mammalian cells, followed by a post-doctoral project also at UC Berkeley studying cell-to-cell signaling and quorum sensing in bacteria on plant surfaces. Upon completion of this project, she applied for a post-doc position at the USDA in Albany, developing microarray-based detection methods for food borne pathogens, and from there was hired on as a research scientist. Her laboratory focuses on developing methods for the identification of food borne pathogens.

In her initial years in this position, Dr. Quiñones expanded on the detection methods she worked on as a post-doc at the USDA, investigating differences at the genome level to better identify *Campylobacter* and Shiga-toxin producing *E. coli*. The major technique she is working on - a colorimetric detection method with DNA microarrays to genotype foodborne pathogens - was evaluated in collaboration with InDevR, Inc, a company in Boulder. She is now working to adapt this technique to norovirus. When asked which she preferred, bacteria or viruses, she replied that they are so very different, she could not choose; however, the additional challenges involved in working with viruses makes them very interesting. Of her education and training, she feels the post-doc experience in microbiology at UC Berkeley best prepared her for her current position. Dr. Quiñones chose a government position due to the interesting projects available that also offered stability and job security, as well as the opportunity to continue living in an area she loves.



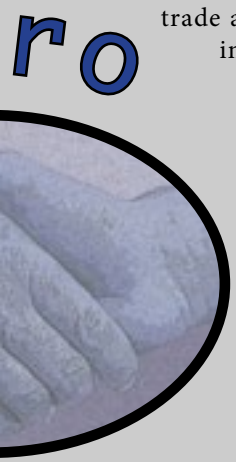
On a day-to-day basis, her position is mostly research-oriented. Her laboratory currently employs two technicians, one of whom is funded by NoroCORE, and an undergraduate student from UC Berkeley. Periodically, she hosts graduate and undergraduate students; among them are graduate students from a partnership with an institute in a key agricultural area of Mexico. She likes that she is able to do meaningful research with applications to food safety problems, as well as have the opportunity to interact with and train technicians and students. She chose to work in food safety because of the potential to develop applied methods that will benefit society. The ultimate fruition of her work would be the implementation of her methods in processing settings.

When the opportunity to interact with NoroCORE arose, she felt that it would be an excellent chance to develop a new method for detecting an important pathogen with a significant impact on food safety. She hopes to contribute the development of a cost effective, rapid test that can help scientists efficiently identify which strain of norovirus is present in a sample. Through her participation in the NoroCORE project, she hopes to establish new research collaborations across all sectors; expand her knowledge of norovirus and food safety related to viral disease; and develop methods that would benefit others across these sectors. When asked for her best advice to students or young scientists: "I always advise them to focus on a project that they're interested in…to feel passion for it. Always evaluate your options…really enjoy the project and the science behind it."

Dr. Barbara Blakistone
Director of Scientific Affairs
National Fisheries Institute

"NoroCORE is a strong project. The hardest part is to take all that info, digest it down, and give it to the people who need it the most."

Dr. Barbara Blakistone is the Director of Scientific Affairs for the National Fisheries Institute (NFI), a trade association based out of Washington, D.C., that works to support U.S. seafood companies (from larger organizations to small "mom and pop" operations). Dr. Blakistone completed her undergraduate degree in Biology at the University of North Texas. She later became interested in food science and returned to graduate school at North Carolina State University to complete her Masters and Ph.D. in dairy science. With her freshly-minted degrees, Barbara took a job with International Paper, working on a large aseptic packaging project, followed by positions in industry and with the Dairy Board in Washington. An opportunity soon arose to work for the Grocery Manufacturers Association. The GMA needed someone with both expertise in packaging and the ability to work in a microbiology laboratory, and Barbara fit the bill. After eight years working with GMA, Barbara had acquired a strong skillset suited to working with trade associations, which led to her current position with NFI. As much as she had liked industry, once she got into working with trade associations and built up her management background with these groups, it ended up being a natural fit. As Barbara put it, at the time of her hire "I didn't know seafood but I knew food science and trade associations." She brought her expertise to NFI on the ins and outs of how to operate as a trade association, and has been learning the seafood part along the way.



Dr. Blakistone's daily work orbits around meeting the needs of NFI's roughly 250 members, which varies from helping with questions about rules and regulations they may not understand, to information gathering when a product is held up in port, liaising with regulatory agencies, answering labeling questions, and addressing food safety issues. She serves as liaison for NFI's Importers Committee and Surimi Committee. As an example of the types of issues she helps with, Barbara discussed a question posed by the Surimi industry. Surimi is a paste made of fish or other meat and used in various food products (the U.S. mostly knows this as "imitation crab"). The Surimi group wanted to know if they could change the process schedule without impacting taste and food safety. Barbara worked with the appropriate contacts to coordinate a consumer taste panel to help answer the question. Had the change been made, it would have resulted in processing changes and consequent testing of food safety, and the NFI would have worked with the companies as needed during the change. Her favorite part of the job is working with the members and helping them: "it's quite the buzz when I manage to [initiate change] that helps them." Her advice to anyone aspiring to a similar position is to get experience in industry. "If you have degrees in Food Science, you owe it to yourself to go work in industry for awhile, find out what that's all about," before committing to a career path and becoming defined by a particular area.

Dr. Blakistone became involved with NoroCORE on behalf of NFI because she feels that NFI ought to be "plugged into" such a strong information channel to hear what comes out of it, particularly since oysters are well-known as a food at high risk for norovirus contamination. Barbara notes that food safety is "the hottest thing going right now. It's the big concern, and you cannot work with industry if you don't have a strong interest in food safety and quality." NFI hopes to gain information for its members from NoroCORE, from general research updates to specific deliverables such as factsheets tailored to the seafood industry. NFI's associates and members communicate to NFI what information is needed, and NFI works to obtain and provide that information, as well as channel it to people doing outreach projects. NoroCORE is therefore important to NFI as a reliable source of information; NFI can serve as a conduit of that information, liaising between the people who need it and the source.

Inactivating enteric viruses in green onions

Publication: Hirneisen, K. A., and Kniel, K. E. 2013. Inactivation of internalized and surface contaminated enteric viruses in green onions. Int J Food Microbiol 166: 201–206.

Objective & Rationale:

Hepatitis A virus (HAV), human norovirus (NoV), and human adenovirus type 41 (Ad41) are important enteric (gut-related) viruses, both because they cause illness and for their economic impacts on the food chain and consumers. One way these viruses can come into contact with foods is during the pre-harvest period- the time leading up to when crops are picked and sent on for processing. This can happen through means such as contaminated water, manure, pesticides, or compost, and from infected people handling the plants in the field.

The produce industry has some methods for reducing the number of viral particles on their crops and new techniques are being developed. One of the challenges is finding ways of maintaining the fresh appearance and palatability of the food, while still inactivating the viruses that may be present. Green onions are usually harvested by hand and then sprayed with a calcium hypochlorite solution, a common and broadly-effective disinfectant (think swimming pools). There is concern that these kinds of sprays are not effective on microorganisms that may be within leaf surfaces of produce.

This study demonstrates the variable efficacy of decontamination treatments that exist for a single produce item. The researchers assessed the effectiveness of ultraviolet light (UV), ozone, and high pressure treatments compared to the typical chlorine spray in reducing the viral load of HAV, MNV (murine norovirus, a surrogate for human norovirus), and Ad41 on experimentally-contaminated green onions. They also wanted to know if there was a difference in the efficacy of these treatments when the viruses were inside the onions, because there is evidence these kinds of viruses can enter a plant's tissues through cuts or be taken up by the roots. The concern is that viruses inside the plant could be more resistant to inactivation, as the traditional sanitation practices usually target surface contaminants.

How do these methods work? Shining UV light on produce is an inexpensive and simple treatment that damages nucleic acids then generates compounds that inhibit genetic replication. High pressure is thought to inactivate viruses by changing or damaging the viral capsids. Ozone oxidizes organic matter, and is most effective on foods with smooth and intact surfaces. These methods work to varying levels depending on the initial dose and the amount of virus present.

Method:

- The three viruses were propagated in cell culture specific to the viruses' requirements. Ad41 was selected because it is a common environmental contaminant and it is very different structurally from MNV and HAV. The infected cells underwent cycles of freezing and thawing to make them split open, releasing the viral particles so they could be collected.
- Green onions were grown from seed in a greenhouse, picked near maturity, and used in either the surface contamination or internal contamination experiments.
- For the internal contamination group, the onions were placed upright in containers of hydroponic growing solution inoculated with one of the three viruses and kept there for five days. The onions in the external contamination group were inoculated by dripping solutions containing the viruses over the surface.
- Subsets of the internally and externally-contaminated onions were exposed to the four inactivation treatments: calcium hypochlorite spray, UV light, ozone, and high pressure. Each treatment group had its own control where onions were handled similarly but not given the actual treatment.
- The researchers collected any remaining, post-treatment virus particles by pulverizing the onions in a bag with PBS (a buffer solution), using the fluid for cell culture. The team counted viral plaques for MNV (host cells in culture that were killed by the virus) and used RT-PCR to estimate the amount of Ad41 and HAV. Similar virus isolation and quantification from contaminated, untreated onions served as a baseline for comparison.

Results:

- For MNV, high pressure was the most effective at reducing viral levels both inside and on the surface of the onions to beyond the limit of detection, and was significantly more effective than ozone, UV, and chlorine treatments, which were all about equally effective.
- For HAV, high pressure, UV, and ozone were not significantly different in their effectiveness inside or outside the onions, but they were all better than chlorine.
- For Ad41, high pressure was the most effective followed by ozone, with chlorine and UV treatment nearly equivalent.
- The three viruses were also taken up into the onions in different amounts, with MNV taken up the most, HAV slightly less, and Ad41 taken up the least.

Significance:

Overall, viral inactivation for both internalized and externalized viruses was greatest after pressure treatment and lowest after chlorine and UV treatment.

The authors point out that the onions would have had variation in the number of viruses contaminating them, making it difficult to conclude if there was a significant difference in the effectiveness of the treatments. High pressure treatments can also affect the texture of onions, which may impact its use in industry.

As for whether the treatment methods reached internalized virus particles, all of the treatments caused viral inactivation to some extent for all of the viruses, both internally and externally.

There were also some surprises in the analysis. Ad41 is a double-stranded DNA virus and these are considered at least ten times more resistant to UV light than single-stranded RNA viruses like MNV and HAV. You would expect it to have the lowest level

of inactivation. Yet in this study, the level of inactivation of Ad41 fell between that of the other two viruses.

The differences in viral uptake into the onions may have been due to the fact that MNV and HAV are about the same size and shape, compared to the much larger, bulkier Ad41.

Techniques such as ozone and high pressure processing appear to be effective at reducing enteric viral contamination on the inside and outside of produce such as green onions, and could serve as future methods of decontamination.

This research emphasizes that processing methods for produce should address the potential for internalized viruses, as well as the need for continued research into optimizing the various treatment options for the numerous forms of produce available to the consumer.

Noro in the News

As for Sydney, no worries, mate.

In our last issue we highlighted the emergence of the new strain of human norovirus, GII.4 Sydney, which has been making worldwide headlines since it appeared in March 2012. Since then, epidemiologists have pored over the outbreak data related to Sydney and we return with updates in hand. The norovirus season usually runs from fall to spring each year, with 80% of the cases occurring between November and April. The concern was that Sydney might cause more outbreaks of disease or produce more severe clinical signs, as has happened sometimes in the past with the emergence of new strains, but at the time it was too early to have a complete picture.

To recap, there are five groups of noroviruses, categorized as genogroups (G) I-V. GI and GII are associated with virtually all human disease, and within the genogroups are genotypes (the "4" in GII.4) containing the various, genetically-related strains, which are named for their location of origin (Sydney, Australia). The GII.4 viruses cause over 70% of all norovirus outbreaks and new strains typically emerge every few years. In the U.S., GII.4 New Orleans was the predominant strain before Sydney settled in at the end of 2012.

The emergence and success of new strains is related to the susceptibility of the host population and the high mutation rate of the virus, which can lead to changes in its outer coating, or capsid. It is this capsid that interacts with our cells and is "seen" by our immune system, and the virus's changing appearance gives our immune system a constantly-moving target for generating antibodies against.

As for our end of things, the human population develops a generalized immunity over time, termed "herd immunity," to the major circulating noroviruses. Herd immunity is a product of people who have already had the virus and are temporarily immune, as well as the decreased chance the remainder of the population will come into contact with the virus. It is thought this population response puts evolutionary pressure on the norovirus, and those viruses that acquire novel mutations can break out of this herd immunity and act almost as a new virus, reaching newly susceptible host populations (because our bodies have not "seen" it before).

We have learned that GII.4 Sydney is quite different from the previous major strains, GII.4 Minerva (2006) and GII.4 New Orleans (2009). This was found through observing antibodies made against virus-like particles (VLPs) that mimicked the appearance of these older norovirus forms (VLPs are used because we cannot propagate the actual viruses in cell culture). Remember the reference that was made earlier to the virus changing its appearance? In general, antibodies made to the Minerva and New Orleans VLPs were found to not bind well to VLPs of the GII.4 Sydney strain because of at least two major differences in the capsid, specifically where it interacts with our cells. The research suggested that people with antibodies to these older versions would not be well-protected against GII.4 Sydney.

Understandably, the big question last winter was "What would Sydney do?"

To answer this question, the Centers for Disease Control and Prevention (CDC) utilized its two surveillance systems that acquire norovirus-related information: the National Outbreak Reporting System (NORS), which covers all enteric disease outbreaks, and CaliciNet, which generates and stores genetic sequence information for norovirus strains. Using these tools, the CDC analyzed data from five representative states, as well as integrated emergency room data from one of the states, then compared it to data for the two previous seasons.

The CDC selected five states to serve as sentinels- Minnesota, Ohio, Oregon, Tennessee, and Wisconsin- because they were spread across the country, accounted for a little over 10% of the US population, and historically had the highest per capita reporting rates for norovirus outbreaks. The states provided information about suspected norovirus outbreaks to the CDC, which sped up the linking of strain sequences to disease events. These pieces, along with the addition of data from the NORS for the previous two seasons, created an overall picture of the 2012-2013 norovirus season in the US.

In very concise terms, the analysis indicated that our most recent norovirus season looked a lot like the previous two seasons. Three of the states had a higher number of outbreaks, one was essentially unchanged, and one had a decrease in outbreaks. Of the

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announcements

our team

The NoroCORE administrative team has changed substantially. Mr. Malakai Erskine (former Administrative Director) and Ms. Joyce Cole (former Administrative Assistant) have both moved on to the next phases of their lives. We have reshuffled positions as follows: Dr. Rebecca Goulter (from Dr. Jaykus' laboratory) will be promoted to include financial responsibilities for NoroCORE in her job duties; Ms. Katie Gensel will move into Malakai's position; and we have hired a brand new post-doc, Dr. Elizabeth Bradshaw (jack of all trades, and master of all as well!) who will round out our administrative team. Please welcome them!

our students

NoroCORE would like to congratulate the recipients of its Project Year 2 Graduate Fellowship Awards. We welcome Hannah Bolinger of Rutgers University, Rita Czako of Baylor College of Medicine, Erin DiCaprio of the Ohio State University, and Kelly Wahl of Emory University. One fellowship slot for Project Year 3 has already been awarded; two more fellowships will likely be available for academic year 2014-2015. More information on application for Year 3 fellowships will be available soon on the NoroCORE website.

mark your calendars!

The 2014 NoroCORE annual meeting will be held in November 2014, location TBD. This two-day event will be much like our 2012 meeting, and will include all PIs; interested graduate students, post-docs, and staff; and significant representation from many of our stakeholders. A final date and venue will be announced in early 2014.

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Epi. Profile: GII.4 Sydney

Sydney quickly became the predominant NoV strain in the US last year, but it was not associated with more outbreaks of disease.

It is thought novel norovirus strains come about through acquiring mutations that allow the virus to break out of herd immunity generated by the human population.

GII.4 Sydney went from being associated with 8% of norovirus outbreaks in September 2012 to 82% of the outbreaks in March 2013.

GII.4 Sydney was slightly more associated with diarrhea and less with vomiting, fever, and abdominal cramps than the previous major strains.

GII.4 Sydney occurred most frequently in hospitals and long-term care facilities, and was more prevalent among the elderly.

outbreaks that had sequence data, 63% of them were attributed to GII.4 Sydney, and Sydney became the predominant strain in the U.S. in December, 2012, accounting for 66% of the outbreaks in that month. Essentially, though Sydney ultimately caused more outbreaks than other strains did, it did not cause more outbreaks than would be expected in an average norovirus season.

As for what the population experienced, patients in GII.4 Sydney outbreaks reported diarrhea a little more frequently, and vomiting, fever, and abdominal cramps less frequently than patients believed to be affected by the other strains. The number of outpatient visits was higher for patients in Sydney-based outbreaks, but the number of hospitalizations and ER visits were roughly the same. Deaths were slightly more frequent in GII.4 Sydney outbreaks, but the overall mortality rate was still very low. There was a higher incidence of GII.4 in the elderly, but it may have been related to the fact that GII.4 Sydney outbreaks occurred more frequently in long-term care facilities and hospitals. These things combined indicated that while Sydney became the predominant strain circulating in the U.S. this past year, it did not cause more outbreaks than its historical counterparts.

If you want to read more, this article was based on:

•Leshem, E., et.al. (2013). Effects and Clinical Significance of GII.4 Sydney Norovirus, United States, 2012–2013. Emerging Infectious Diseases 19(8): 1231-1238.

•Debbink, K., et.al. (2013). Emergence of New Pandemic GII.4 Sydney Norovirus Strain Correlates With Escape From Herd Immunity. The Journal of Infectious Diseases Aug 27. [Epub ahead of print].