capsid

the official newsletter of NoroCORE

volume 2 · issue 1 · july 2014

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

NoroCORE Gets Social

Since the project's inception, NoroCORE has been dedicated to translating sound scientific research into practical, appropriate, and specific solutions with lasting impacts on public health. Outreach and extension efforts represent the critical link between emerging knowledge and those who will implement this knowledge.

We broadly reviewed NoroCORE's extension and outreach efforts in the last issue of Capsid. In addition to engaging stakeholders in related government agencies and industry sectors, NoroCORE sets out to reach the general public with important messages related to foodborne viruses, particularly noroviruses.

To accomplish this, we are launching a comprehensive collection of social media campaigns spearheaded by the NoroCORE Social Media Team at North Carolina State University (NCSU). Dr. Benjamin Chapman, a NCSU professor and food safety specialist with extensive experience using social media to communicate about food safety, leads the team.

Other team leaders include Dr. Elizabeth Bradshaw (NoroCORE Postdoctoral Research Scholar), Catharine Gensel (NoroCORE Administrator & Communications Director), and Dr. Rebecca Goulter (NoroCORE Associate Director of Scientific Affairs). Graduate student Katie Overbey and undergraduate

Connect with us!

NoroCORE.com & barfblog.com

/NoroCORE & /safefoodblog

@NoroCORE, @barfblog

@NoroCORE, @barfblog

barfblog Ben

NoroCORE (USDA-NIFA Food Virology Collaborative), Group & Company pages

NoroCORE Gets Social (...continued)

NoroCORE's Facebook Page. Help us reach 100 likes!

students Natalie Seymour and Jeremy Faircloth, also of NCSU, will be assisting the team with the projects.

We chose to develop our social media presence because it provides a unique opportunity to engage with the greater community, open a dialogue with real people to address real concerns, and establish NoroCORE as a reliable source and active voice for information related to noroviruses. While the NoroCORE mission is to reduce the burden of foodborne viral illness, we are also interested in preventing enteric virus transmission by other routes, such as person-to-person. A fundamental component of our success will be helping to prevent the spread of noroviruses through behavior modification, which requires that we successfully reach you (and everyone you know) by sharing interesting and engaging content. We also hope that our social media strategy, and the lessons we learn as we move forward, will serve as a model for other groups to communicate public health information via this emerging means.

Our social media campaigns are intended to not only increase awareness and share resources related to noroviruses and foods, but also to establish venues of conversation both within and external to NoroCORE. NoroCORE is working towards recognition by the public, researchers, and our stakeholders as a credible resource for relevant information and practical solutions. NoroCORE maintains a presence on its blog, Facebook, Twitter, LinkedIn, Instagram, YouTube, and Google+. We also share a collaborative presence with Barfblog via the Barfblog posts and Barfblog on Pinterest, as well as with various auxiliary member accounts on multiple platforms, and we welcome the opportunity for new connections.

In addition to broadening our social media presence, we will also be engaging in several specific campaigns. Projects to engage mommy bloggers, who represent a key audience for risk and message amplification; an analysis of food safety discussions already taking place on social media; and a review of social media's potential to serve as a tool to combat foodborne illness, are already underway.

Here are the new initiatives we are working on for the 2014-2015 norovirus season:

- A redesign of the NoroCORE website to improve usability, accessibility, and integration with social media, expected to roll out in fall 2014
- Development of an app to engage users and collect data on norovirus-like cases from "citizen scientists"
- Creation of an online "home" for people to share their norovirus experiences and to interact with our expert collaborators
- A survey to identify current needs, then create and distribute new web-based educational materials for schools and public health entities regarding the management and prevention of norovirus outbreaks

Stay tuned for news, videos, podcasts, infographics, and more, all relating to noroviruses. Future pieces will cover how viruses and bacteria are different and why this matters to preventing their spread; how to engage in proper hand hygiene; how these viruses impact different groups, including you and your family; what to do if your child is sick and goes to daycare; and much, much more. Our goal is to link relevant information to the specific audiences who seek it!

Social media team leaders Dr. Benjamin Chapman (back), Dr. Elizabeth Bradshaw (left), Katie Gensel (center), and Dr. Rebecca Goulter (right) meet to strategize NoroCORE's social media presence.

NoroCORE Update

In this third issue of Capsid, we provide a snapshot of our Capacity Building Efforts, which comprise our sixth core function (the other five were described in the first two issues of Capsid).

The field of food virology requires trans-disciplinary training and access to specific, often limited resources, be it unique reagents, specialized protocols, or specific equipment. Before the NoroCORE project, there had been no previous coordinated effort to increase capacity in this discipline. Additionally, much of the existing knowledge and solutions that apply to controlling bacterial pathogens in the food chain are not readily extensible to viruses, despite viruses now being recognized as the leading cause of foodborne illness. Therefore, it is increasingly important that we fill gaps in training and resources. Specific activities in this Core can be summarized as follows:

Core 6 Activities

- ***Activity 6.1:*** Create a mechanism to foster reagent, protocol and information exchange
- ***Activity 6.2:*** Expand professional capacity in food virology with a focus on producing a "critical mass" of trained professionals
- ***Activity 6.3:*** Develop a graduate level interdisciplinary curriculum in food virology

NoroCORE is taking a multi-faceted approach to building the necessary scientific and human capacity to support increased and sustained efforts in food virology. Towards this end, we have established mechanisms for information and reagent exchange, including a comprehensive, publicly accessible literature database; formalized mechanisms to facilitate scientific collaboration; and an online community page for the sharing of technical expertise. The Collaborative has also established competitive internship and fellowship programs, and is developing an online graduate curriculum in food virology. The efforts of this core are led by Dr. Lee-Ann Jaykus of North Carolina State University and Dr. Liju Yang of North Carolina Central University, but rely heavily on the cooperation of all members in the Collaborative. Drs. Robert Atmar and Mary Estes of Baylor College of Medicine, as well as Dr. Jan Vinjé of the CDC, are particularly active in their efforts to facilitate reagent exchange.

One of our earliest successes, the NoroCORE Food Virology Literature database (norocorelit.com), is an online, searchable database dedicated solely to food virology publications, with almost 2800 articles from 1992 onward. It is updated regularly to remain current with emerging research. In keeping with copyright law, full articles are available only to our collaborative team, but an abstract-only version is open to the public.

NoroCORE has also developed a formalized mechanism to facilitate reagent and protocol exchange among collaborative partners. Specific partner institutions develop and supply reagents that are available to the team at large, ensuring consistent experimental results and providing specialized resources to institutions that might not otherwise have access to them. This greatly expands opportunities for research and collaboration.

Our partners at the University of Georgia have also established an OpenWetWare wiki page (Winter Vomiting Lab) online to further foster sharing of technical expertise, including experimental protocols, troubleshooting notes, demonstration videos, links, and other resources. Team members may also share key information via a private member portal on the NoroCORE website. Taken together, these resources put the information and expertise of the Collaborative as a whole at the fingertips of every team member.

From a traditional educational standpoint, NoroCORE has established competitive internship and fellowship programs to help develop a cohort of highly qualified and diverse M.S. and Ph.D. scientists trained in the interdisciplinary, collaborative model. An undergraduate summer internship program is offered in cooperation with North Carolina Central University's Biomanufacturing Research Institute and Technology Center of Excellence. To date, five undergraduate interns have completed the program with four ongoing internships in Summer 2014. NoroCORE's graduate fellowship program offers a one-year fellowship award to highly qualified graduate students working with NoroCORE investigators. Five students are current fellows, with the selection process underway for 2014 applicants. Recipients represent a variety of fields and institutions, all with projects related to NoroCORE research objectives. Through both programs, students participate in exciting research, gain access to the best scientists in the world, and get exposed to a diverse set of disciplines, all relevant to food virology.

The NoroCORE team is also developing an online graduate curriculum in Food Virology, with modules on Molecular Virology, Detection, Epidemiology & Risk Analysis, and Prevention & Control. We are working closely with collaborative partners from New Mexico State University's Media Productions team to develop video and other visual educational materials to support the text-based portion of the curriculum. These materials will also be adapted for other audiences, including educators and the general public.

NoroCORE is banking on the fact that these efforts and others will improve our ability to tackle the foodborne virus problem, eventually resulting in improved public health.

Collaborator

Dr. Jeanne Gleason
Director of Media Productions
New Mexico State University

"When we joined NoroCORE, I really didn't know much about the norovirus but I was very curious and fascinated. What I have learned has been more amazing than I could have ever imagined."

Dr. Jeanne Gleason is the Director of Media Productions at New Mexico State University (NMSU). The Media Productions team at NMSU partners with national and international programs, as well as with NMSU's own extension services, to develop media for educational and outreach purposes. Gleason shared that the "big bag" for her career journey occurred in the 4th grade, when her father taught her how to make a pinhole camera out of a coffee can for her science fair project. After her father walked her through making the camera, taking a photo, developing the film, and making a contact print (all at home!), Jeanne went on to win a trip to her state's science fair. This marked the "*launch of [her] life-long career in using creative media to help people understand science.*"

Jeanne earned dual undergraduate degrees at NMSU, with a B.A. in Journalism and a B.S. in Home Economics, followed by a Master's degree in family counseling and a K-12 teaching certification. She learned skills and gained perspective that she uses today developing educational materials for teachers. Jeanne went on to complete a doctorate in instructional design at Virginia Polytechnic Institute's (VPI) College of Education with a dissertation on creating touchscreen informational kiosks for public venues. While at VPI she worked with a Kellogg-funded Interactive Design and Development team to coordinate a nation-wide Extension effort to create USDA's very first multimedia CD-ROM, a tool so innovative at the time that USDA held a ribbon cutting ceremony on the day of it's release! Gleason then worked as Extension faculty for NMSU, writing about agricultural research and extension projects and teaching communications techniques. In the early '80s, the dean of her college approached her about starting a video production studio, and from a small one-time investment, Jeanne proceeded to build what is currently the Media Productions program.

In terms of her day-to-day work, Jeanne functions in three main roles: instructional designer, project manager, and department head. She is involved in a variety of activities, including forging new partnerships, writing grant proposals, and holding Design Summits to analyze client needs and formulate project plans. The best parts of her job are managing and developing the people on her team, whom she describes as their most valuable asset, and she enjoys working with her staff and clients to overcome challenges and find creative solutions.

Jeanne loves the atypical nature of her work, noting that it is never boring. It has taken her to 37 different countries, from Fiji and the Bahamas to China and Afghanistan. She chose academia over industry and government because she holds close the ideal of making a difference in people's lives through education. She also loves the freedom and creativity she enjoys in her career. As she put it, "*I just never could get excited about making a car commercial or another boy-meets-girl movie. The money might be good but who wants to spend their life doing what has already been done?*" Her best advice to those who wish to pursue a similar career is to learn to think and question and wonder about the world; to express ideas in a number of channels and media; and to work to bring out the best in people. "*The job that people are going to end up happiest in probably doesn't exist when they graduate. Create a job you like. Look underneath the job title and identify what would make you happy.*"

Dr. Gleason became involved with NoroCORE thanks to a previous collaboration with NoroCORE partners and an interest in learning about norovirus. Food safety education has been one of her team's biggest focus areas in the past 10 years and they felt norovirus is an issue that is here to stay. The team decided to join the Collaborative and is currently developing visual media for use in the NoroCORE graduate curriculum and in NoroCORE outreach efforts. When asked what she most hopes to gain from their interaction with NoroCORE, Jeanne replied, "*In the end, it's all about people- people we help, people we influence, and people we work with. I want to get to know more of the scientists on the NoroCORE team. I just love our annual meetings and I find the research summaries fascinating.*"

Dr. Hilary Thesmar
Vice President Food Safety Programs
Food Marketing Institute

"We've been thrilled with working with NoroCORE and we think that the outreach and communications received from the Collaborative have been great."

Dr. Hilary Thesmar is the Vice President of Food Safety Programs for the Food Marketing Institute (FMI). FMI is a trade association that serves the needs of the retail food industry by providing education and resources related to food safety, industry relations, research, and many other topics.

Dr. Thesmar earned her undergraduate degree in Food Science at Clemson University, followed by a Master's degree in Nutrition at Winthrop. She then returned to Clemson to complete her doctorate in Food Technology. When she finished her degree, Hilary knew she wanted to work in industry but wasn't sure specifically what she wanted to do, expecting she'd be back in academia within a few years. But, after working with a trade association in her second job, Hilary "*was hooked and hasn't gone back*." She describes her career path as a series of doors opening and closing. Hilary loves helping industry members with challenging issues they may not have the resources to handle themselves, as well as tackling challenging scientific and regulatory issues. She finds it very rewarding and loves the variety of people she has the opportunity to work with.

Her favorite part of her job is its variety. On a day-to-day basis, Dr. Thesmar's tasks are pretty variable, but everything is related to food safety. Her responsibilities are a mixture of technical support and managing ongoing programs/projects. Her tasks support food retailers, providing information to them about food safety, helping them solve current problems, anticipating future problems, and working with the FMI Foundation on research. Hilary receives a lot of questions by phone and email and spends significant time presenting at scientific meetings throughout the year. She also writes for newsletters and publications and handles other member communications. An example issue she helps retailers navigate is a recall situation involving human illnesses, which she says are the most challenging type to work through, personally and professionally. She likes knowing that she has helped both the retailer and public health as a whole by facilitating the process of handling such a recall.

Dr. Thesmar chose food safety because she feels that it's a field where you can really make a difference. The science is interesting, challenging, and evolving, with amazing progress in recent decades. She particularly likes food microbiology. While she enjoyed her experience in nutrition, she found the pace slower and the results less tangible. By comparison, if food isn't safe, there is an immediate impact, so improvements can make an immediate and tangible difference. Dr. Thesmar chose a career in industry because she likes the fast paced, rewarding work, which has immediate results and a variety of strong opportunities that present themselves. Her best advice to those pursuing similar careers is to "*Find what you love, pursue it, and don't be afraid to ask questions about it.*" She has found that most people in the food industry are willing to network and share what they do, as well as what they like about it.

Dr. Thesmar originally heard about NoroCORE when the project was first announced. When NoroCORE began looking for industry collaborators, it made sense to FMI to be involved for its members' benefit and to help provide retail partners to NoroCORE. Dr. Thesmar understood that norovirus is something food retailers have struggled with as an industry and that it is important to have scientific answers to the questions they've had for a long time. FMI hopes to help with the progress of NoroCORE, including providing connections to members of the industry. It is important to Dr. Thesmar and her organization to have scientific answers to support or rethink current practices, such as cleaning and sanitizing methods at the retail level when there is a contamination event. Many of the current procedures are based only on best-estimates due to limited data on norovirus-specific research. NoroCORE researchers are tackling these challenges with novel approaches and technology, and what they find will directly benefit the foodservice industry. Dr. Thesmar's main hope for FMI's interaction with NoroCORE is to help the overall study achieve its goals, then to specifically help the retail industry reduce the incidence of norovirus outbreaks in retail. "*If we can improve and reduce the public health impact of NoV in the industry sector that's a win for us. We are thrilled to be working with NoroCORE.*"

Science Spotlight

Using surveys to understand consumer knowledge of noroviruses

Publication: Cates, S.C., Kosa, K.M., Brophy, J.E., Hall, A.J., and Fraser, A. 2014. Consumer Education Needed on Norovirus Prevention and Control: Findings from a Nationally Representative Survey of U.S. Adults. [under review]

Objective & Rationale:

Noroviruses (NoV) are the most common cause of foodborne disease in the United States. The number of cases of illness could decrease if consumers knew how to prevent and control a NoV infection.

The CDC has published guidelines on how consumers can protect themselves and others. These guidelines include: practicing proper handwashing, not preparing food for others when sick with typical gastrointestinal symptoms, using safe water for drinking and washing produce, cooking shellfish thoroughly, and using bleach to disinfect surfaces. What we don't know is how much of this information is reaching and informing U.S. consumers. A research team, based out of RTI International, Clemson University, and the CDC, sought to understand what consumers currently know about NoV.

Method:

A total of 1,051 English-speaking adults 18 years of age and older were selected from a Web-enabled panel designed to be nationally representative of the U.S. non-institutionalized adult population. The survey consisted of questions to assess consumers' knowledge of NoV, including 22 True/False questions, and respondents were asked to not consult outside materials when completing the survey.

The survey was designed to assess respondents' general knowledge about NoV infection, transmission, its prevention and control, safe food handling practices, how susceptible people think they are to getting NoV, and the severity of NoV infection.

Examples of True/False statements from the survey:

- It is safe for people infected with NoV to prepare food for others. *[FALSE]*
- People can become infected with NoV many times in their life. *[TRUE]*
- Washing your hands with soap and water can prevent the spread of NoV. *[TRUE]*

Results:

Highlights of the survey findings are summarized below:

- 80% of U.S. adults knew that contamination of food by microbes can cause food poisoning. They were most familiar with bacterial pathogens like *Salmonella* (93.7%) and *E. coli* (92.9%), while only 46.8% of respondents had heard of NoV.
- 85% had heard of "cruise ship virus, "the stomach bug," or the "stomach flu," nontechnical terms often used to describe a NoV infection.
- Of those who knew of NoV by some name, 22.7% had heard or read about NoV in the past year, mostly pertaining to outbreaks.
- 36% answered 11 or more of the 22 True/False questions correctly, but 43% put "don't know" for 11 or more questions or left the questions blank.
- Most U.S. adults knew the common NoV symptoms of diarrhea (75.8% of respondents), vomiting (73.9%), nausea (70.0%), and abdominal cramps (68.1%), but less than half (43.5%) knew fever was also a symptom.
- 50.6% incorrectly believed there was a NoV vaccine.
- 19% believed they had acquired a foodborne disease during their lifetime from food prepared in a restaurant.
- Less than half of U.S. adults knew the main mode of transmission for NoV was fecal-oral or that contact with infected people, their vomit, or contaminated surfaces could transmit the virus.
- 15.9% incorrectly thought meat and poultry were important sources of NoV.
- There were four important areas where respondents tended to answer correctly:
  1. NoV affect the general population, not only the young or elderly.
  2. People can be infected with NoV multiple times.
  3. Washing hands with soap and water can prevent the spread of NoV.
  4. Household bleach is the best option for sanitizing surfaces contaminated with NoV.

Significance:

The survey results suggest the U.S. adult population has limited knowledge about NoV. Particularly lacking is knowledge on NoV transmission, prevention, and control.

Less than half of U.S. adults had heard of NoV. While most seemed to know that NoV can infect anyone, they erroneously believed that bacteria, not NoV, are the most common cause of foodborne disease in the United States.

These findings revealed several important gaps in consumer knowledge and highlight the need to educate consumers about NoV. Although there is a wealth of food safety education materials available on the Internet, most focus on bacteria and not viruses.

The findings of this study will help guide revisions of online materials intended to educate consumers about food safety, with additions focused on NoV prevention and control.

Noro in the News: Blog Highlights

The CDC's new Vital Signs report on noroviruses

June 4th, 2014

The news media was abuzz the week of June 4th following a new Vital Signs report released by the CDC that focuses on noroviruses, particularly preventing their spread at food service settings. In our blog post, we broke down what this report means and why it is important.

Here are some of the highlights:

- Among foodborne norovirus outbreaks in the U.S. that were connected with the preparation of food, 64% of them occurred in restaurant settings.
- Of outbreaks associated with contaminated food, food workers were implicated 70% of the time.
- Bare-handed contact with ready-to-eat foods was found in over half of these food worker-implicated outbreaks.

Foodborne transmission in food service settings is important because noroviruses are the leading cause of foodborne illness and one infected person handling food has the potential to impact a large number of people. There are specific steps that can be taken to avoid spreading the virus through foods, such as good hand hygiene and exclusion of ill food service workers.

Norovirus outbreak in Japanese schools linked to workers at a bread factory

January 21st, 2014

A large norovirus outbreak led to the closing of at least thirteen elementary schools in Japan earlier this year, and it was a really fascinating case.

The closings began after at least 905 students and 40 staff from the different schools reported vomiting and diarrhea, and the virus was detected in multiple samples from across the schools. School lunches were considered as a common factor because so many people became sick at once, and a couple days into the outbreak, a bread-making company was identified as the likely source. The city closed the company's plant after the virus was detected in the facility. Some of their bread had been delivered to the schools earlier in the week, and three of the plant's 23 workers tested positive for norovirus, who had also been in direct contact with the bread that had been shipped to the schools. They were sent home for three days as a precaution, and the company recalled its products. What was most interesting is that these three workers had not shown any symptoms and may have been serving as asymptomatic carriers of the virus.

The passing of a legend in virology: Dr. Albert Kapikian

March 3rd, 2014

It was with sadness and great respect that we reported on Dr. Albert Z. Kapikian, MD, a pioneer in the field of virology, who passed away on February 24, 2014 at the age of 83.

In addition to being known as a kind and generous person, Dr. Kapikian is credited as being the discoverer of Norwalk virus (the archetypal human norovirus), when in 1972 he and others at the National Institutes of Health visualized the virus particles for the first time using immune electron microscopy. They later demonstrated the virus's relationship with acute gastroenteritis in humans. Dr. Kapikian and his colleagues would also identify hepatitis A virus and rotavirus, the former another foodborne virus of note. His research led to the development of a safe, effective rotavirus vaccine that has saved thousands of lives. His dedicated study into the identification of these viruses earned him recognition as "the father of human gastroenteritis virus research" and his extensive body of work would pave the way for many scientists in the field, including those in the NoroCORE Collaborative.

Norovirus on Explorer of the Seas

January 28th, 2014

Although cruise ships only account for about 1% of norovirus outbreaks, they catch the spotlight due to the large number of people that are usually affected. Cruise outbreaks for this past norovirus season started appearing in the news around September 2013 and would continue through April 2014. Royal Caribbean's Explorer of the Seas experienced one of the largest cruise ship disease outbreaks the CDC has seen in the last twenty years, with 16% of those on board falling ill with norovirus. The ship was on a 10-day cruise to the U.S. Virgin Islands and 645 (595 passengers and 50 crew) became sick. This is one of the larger Royal Caribbean vessels, and was reported to have 3,050 passengers and 1,165 crew onboard. Passengers with clinical signs were asked to stay in their rooms and the company promised compensation for lost vacation time. Investigators from the CDC were on board to investigate the source and verify norovirus as the cause, and to oversee deep cleaning of the vessel.

announcements

news

• NoroCORE welcomes two new collaborative partners. The Interstate Shellfish Sanitation Commission, lead by Dr. Ken Moore, will be joining the NoroCORE team to work on extension and outreach efforts for the molluscan shellfish industry. Dr. Suri Iyer of Georgia State University will be joining the team to develop glycan arrays for human norovirus detection and diagnostics.

• Congratulations are in order for NoroCORE Executive Board member Dr. Aron Hall of the U.S. Centers for Disease Control and Prevention, who received the 2013 Presidential Early Career Award for Scientists and Engineers (PECASE) in January. Dr. Hall was one of 102 researchers to receive the award, which is the highest honor bestowed upon a scientist or engineer in the early years of their careers. He even got to shake hands with President Obama!

• The NoroCORE Collaborative is currently featured in an article in the June/July 2014 issue of Food Safety News magazine. The article, titled "Food Virology Collaborative: NoroCORE Tackles Foodborne Viruses," provides an overview of the NoroCORE program and research goals.

mark your calendars!

The 2014 NoroCORE Full Collaborative & Stakeholder meeting will be held October 30-31, 2014, in Dallas, TX. This two-day event will be much like our 2012 meeting, and will include all PIs, interested graduate students, post-docs, and staff, as well as significant representation from many of our stakeholders. Further details are coming soon to the NoroCORE website (norocore.com).

Key Publications

As the NoroCORE program enters its fourth year, we'd like to take the opportunity to highlight some of the key publications emerging from the project. These are simply a snapshot of the many publications produced by our research partners, and by no means an exhaustive list. A more comprehensive list of our publications will soon be available on our website.

Molecular Virology

- Atmar, R.L., Opekun, A.R., Gilger, M.A., Estes, M.K., Crawford, S.E., Neill, F.H., Ramani, S., Hill, H., Ferreira, J., and Graham, D.Y. 2013. Determination of the 50% human infectious dose for Norwalk virus. *J Infec Dis*, Dec 13 [epub ahead of print].
- Tan, M., and Jiang, X. 2014. Histo-blood group antigens: a common niche for norovirus and rotavirus. *Experts Mol Med* 16:e05 [epub].

Detection

- Hida, K., Kulka, M., and Papafragkou, E. 2013. Development of a rapid total nucleic acid extraction method for the isolation of hepatitis A virus from fresh produce. *Int J Food Microbiol* 161:143-150.
- Rogers, J.D., Ajami, N.J., Fryszczyn, B.G., Estes, M.K., Atmar, R.L., and Palzkill, T. 2013. Identification and characterization of a peptide affinity reagent for the detection of noroviruses in clinical samples. *J Clin Microbiol* 51:4803-1808 [epub].

Epidemiology & Risk Analysis

- Hall, A.J., Lopman, B.A., Payne, D.C., Patel, M.M., Gastanaduy, P.A., Vinjé, J., and Parashar, U.D. 2013. Norovirus disease in the United States. *Emerg Infect Dis*, 19(8):1198-1205.
- Barclay, L., Park, G.W., Vega, E., Hall, A., Parashar, U., Vinjé, J., and Lopman, B. 2014. Infection control for norovirus. *Clin Microbiol Infect*, May 11. 4(Suppl. 1):S3. DOI: 10.1111/1469-0691.12674 [pub ahead of print].

Prevention & Control

- Escudero-Abarca, B.I., Rawsthorne, H., Goulter, R.M., Suh, S.H., and Jaykus, L.A. 2014. Molecular methods used to estimate thermal inactivation of a prototype human norovirus: More heat resistant than previously believed? *Food Microbiol*, 41:91-95.
- Tian, P., Yang, D., Quigley, C., Chou, M., and Jiang, X. 2013. Inactivation of the tulane virus, a novel surrogate for the human norovirus. *J Food Prot* 76(4):712-8.

Education & Outreach

- Fraser, A., Arbogast, J., Jaykus, L.A., Linton, R., and Pittet, D. 2012. Rethinking Hand Hygiene in the Retail and Foodservice Industries: Are Recommended Procedures Based on the Best Science and Practical under Real-world Conditions? *Food Prot Trends* 32(12):750-759.
- Cates, S.C., Kosa, K.M., Brophy, J.E., Hall, A.J., and Fraser, A. 2014. Consumer Education Needed on Norovirus Prevention and Control: Findings from a Nationally Representative Survey of U.S. Adults. [under review]

General

- Mermelstein, N.H. 2013. Targeting Norovirus. *Food Technol*, 67(1):64-67.
- Gensel, C., Simmons, O., and Jaykus, L.A. 2014. Food Virology Collaborative: NoroCORE Tackles Foodborne Viruses. *Food Safety Magazine* 20(3):68-74.