

## **Stopping Norovirus in its Tracks – What Every Clinician Should Know**

**Moderator:** Leticia R. Davila

**Presenter:** Dr. Ben Lopman, PhD, MSc

**Date/Time:** January 17, 2013 2:00 pm ET

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**Coordinator:**

Welcome and thank you for standing by. At this time all participants are in a listen only mode. During the question-and-answer session please press star 1 on your touchtone phone. Today's conference is being recorded. If you have any objections you may disconnect at this time. And now I'd like to turn the meeting over to Ms. Leticia Davila thank you.

**Leticia Davila:**

Thank you and good afternoon. We apologize for the inconvenience. We had some technical difficulties. We have a new Webinar link. You can access that by going to our Website page at [emergency.cdc.gov/coca](http://emergency.cdc.gov/coca). On the COCA main page you can find the new link to get access to the Webinar.

Good afternoon I am Leticia Davila and I representing the Clinician Outreach and Communication Activity COCA with the Emergency Communication System at the Centers for Disease Control and Prevention. I am delighted to welcome you to today's COCA Webinar "**Stopping Norovirus In Its Tracks: What Every Clinician Should Know.**"

We are pleased to have with us today Dr. Ben Lopman from the Centers for Disease Control and Prevention to discuss the burden of norovirus outbreaks, review diagnostics and surveillance tools, and share resources to promote the prevention and control of norovirus infections.

You may participate in today's presentation by audio only, via Webinar, or you may download the slides if you're unable to access the Webinar. The PowerPoint slide set and the Webinar link can be found on our COCA Website at [emergency.cdc.gov/coca](http://emergency.cdc.gov/coca). Click on COCA Calls. The Webinar link and the slide set can be found under the call in number and call pass code. At the conclusion of today's session the participant will be able to 1) describe the basic epidemiology of norovirus including burden of disease and diagnostics and surveillance in the United States; 2) define the role of norovirus in food borne disease in the US; 3) identify community groups and healthcare settings most susceptible to severe outcomes from

norovirus gastroenteritis; and 4) list the infection control measures and resources available for the control of norovirus.

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At the end of the presentation you will have the opportunity to ask the presenter questions. On the phone dialing star 1 will put you in the queue for questions. You may submit questions through the Webinar system at any time during the presentation by selecting the Q&A tab at the top of the Webinar screen and typing in your question.

Today's presenter Dr. Ben Lopman is an Infectious Disease Epidemiologist with the Viral Gastroenteritis Team, in the Division of Viral Diseases at CDC. He is also an Adjunct Assistant Professor in the Departments of Global Environmental Health and Epidemiology at Emory University. Dr. Lopman's research is directed at understanding the epidemiology and transmission of viral gastroenteritis, mainly norovirus and rotavirus, as well as developing effective methods for their control. He has authored over 90 peer-reviewed publications in addition to invited editorials, book chapters and conference presentations.

Again the PowerPoint slide set and the Webinar link are available on our COCA Web page at [emergency.cdc.gov/coca](http://emergency.cdc.gov/coca). At this time please welcome Dr. Lopman.

**Ben Lopman:**

Thank you very much for that introduction and thank you all for joining the call and for your patience with the technical hiccups in getting everything set but we are going now and we'll do our best to keep the seminar on time so we'll have time for some questions at the end before three o'clock.

So this seminar this Webinar couldn't come at a better time than norovirus in the calendar year since norovirus is circulating widely now and really at the peak of the norovirus season. So winter is really the time for many viral infections and we've heard a lot about the early flu season and the high levels of flu activity.

But the noro season has also certainly kicked off and on this slide is a selection some of the news stories throughout the world media about outbreaks about the circulation of norovirus and in hospitals from cruise liners and sports stars who have been affected.

So let's give a brief outline to what I'm going to talk about in the next half hour or so. I'll first start with the kind of basic introductions, norovirus 101, in terms of both the epidemiology and the virology of this infection. And then we're going to hone in on groups susceptible to severe outcomes including hospitalization and death and what the kind of reasons for and the data we have in terms of those outcomes. And then we'll talk a little bit about the role of norovirus in food borne disease. And I'll finish by directing you towards some infection control measures and resources that are available.

So noroviruses were first discovered in 1972 by this gentleman here Dr. Albert Kapikian from the NIH and he first saw noroviruses under the electron microscope, picture that's in there, from samples from an outbreak from an elementary school that had occurred four years earlier in Norwalk, Ohio.

So this is the source for the original name for noroviruses, the Norwalk Virus, and over the years noroviruses has been known as various things including Norwalk-like viruses, small round structure viruses and now the agreed upon name: noroviruses. And these are in fact a family of viruses not a single virus. The prototype, the Norwalk Virus, is kind of the original strain but we know recognize that there's a whole range of diverse group of noroviruses that circulate and can cause gastroenteritis. And we now recognize that these are the most common cause of gastroenteritis in the community and they're also the most common cause of gastroenteritis outbreaks in the United States.

So a lot of the our program here at CDC over the last couple of years has been focused on determining quite the extent of the burden of norovirus in the community in the United States. And this slide here shows a summary of the healthcare burden at different levels in terms of severity and healthcare utilization.

So we can see the bottom of the pyramid of a number of community cases that occurred and our estimates, our current estimates for the for community cases that are 21 million cases per year in the United States. Now about ten percent of those individuals require some sort of medical care including 1.7million outpatient visits, about 400,000 visits a year in the emergency room, about 70,000 hospitalizations and around 800 deaths per year.

Now those deaths are highly focused in elderly populations so the majority of those deaths are occurring amongst individuals age 65 years and over.

Another important thing to keep in mind is that norovirus is not static, so this is kind of the average burden of disease per year, but we have bigger norovirus years and I'll talk a little bit later about the reasons for that. But in those years we have an increase in activity you can see increases by as much as 50% in these annual estimates. So what disease does norovirus cause? Well it causes acute gastroenteritis.

So after an incubation period a relatively short incubation period of around 12 to 48 hours the, there's an acute onset of symptoms including vomiting and/or diarrhea and vomiting often is the first cardinal symptom that presents and often begins with no prodrome with no warning. And for this reason you often see public vomiting events, people becoming ill in public in crowds and this is obviously a very effective way for the virus to begin transmission.

So typically diarrhea follows and it's watery and on bloody stools and other general symptoms associated with gastroenteritis and general viremia including abdominal cramps nausea low grade fever. And most otherwise healthy individuals will recover after 12 to 72 hours, which generally is short lived and self-limiting illness. But about 10% of individuals require medical attention, and the more severe cases often resulting from dehydration can require hospitalization and fluid therapy either oral or intravenous rehydration therapy. And more severe illness and even death is possible particularly amongst the elderly and those with other underlying health conditions.

Now something we've recognized increasingly over the last few years is that a lot of infections are asymptomatic; as much as 30% of infections are, don't show any symptoms. Now we still don't quite understand the role of asymptomatic infection in terms of disease transmission, but what is clear is that at any given time there's quite a few people in the population who are shedding virus who are not showing any symptoms.

So viruses shed both in stool but also in vomitus, and as I mentioned in the last slide that shedding and vomit might be quite important and a kind of unique feature of norovirus in terms of how it's transmitted. Now although the clinical illness is quite short in that it's 12 to 48 hours, 12 to 72 hours -- excuse me -- shedding can occur for much longer on the order of two to three weeks and in immuno compromised individuals can occur for much longer than that. There have been documented cases of shedding for over one year.

Now the peak of shedding occurs about four days after exposure, so the peak of shedding can actually be after symptoms have subsided. And virus is shed in really copious amounts. At the peak of shedding there's around ten to the tenth viral copies per gram of feces. So really phenomenal amounts of virus is being shed particularly when you consider how small the infectious dose to norovirus is.

So our current estimates are that around 18 to 1000 viral particles are sufficient to cause infection. So if you consider their ten to the tenth particles in a gram of stool it's clear there are thousands of potentially infectious doses in a single gram of stool.

So what's - one thing that limits our understanding of norovirus is that we don't have a cell culture system or an infectivity assay so you can't grow the virus in the lab, which means that it's hard for us to know if when we see virus if it's actually alive and infectious or not. And so for this reason it's been difficult to determine what the infectivity of shed virus is and the role of asymptomatic shedding in transmission.

Another unique feature of norovirus is that immunity is incomplete and short-lived. Most of the understanding of immunity to norovirus comes from the human volunteer studies these challenge studies that were originally done in 1970s. There's been another series that have been done recently and in some of these studies individuals were challenged and then some time later they were challenged again with the exact same virus. And it was found that after 6 to 12 months individuals were susceptible again to infection with the exact same virus.

So from these we know that immunity's short lived it doesn't protect individuals for life. And so people are susceptible to reinfection throughout the course of their life. This is a unique feature of norovirus in that we see disease in children but we also see it in adults and the elderly.

And we also know from these challenge studies that there's little cross protective immunity. As I mentioned and we'll talk a bit more in a moment noroviruses are a diverse groups of viruses and becoming infected with one doesn't necessarily protect you against other types.

Another area that we have of susceptibility and resistance to norovirus that's been understood increasingly over the last couple of years is that there's a genetic component as well. And this is moderated by the expression of the histo-blood group antigens so the A B and O antigens that are expressed. And those antigens line the wall of the intestine.

And there's a gene called fucosyltransferase which expresses an enzyme called in this case fucosyltransferase two (FUT2). And this enzyme basically transports the histo-blood group antigen onto the lining of the gut.

And people who are secreting negative therefore don't express this gene they don't have the antigens on their gut and they're not susceptible at least to some of the noroviruses that are circulating that's kind of the good news. The bad news is that actually very relatively small proportion of the population are so called secretor negative so most of us are susceptible to norovirus.

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So now turning to the genetic classification of these viruses. They are a diverse group of single stranded RNA viruses. And the majority of human infections are caused by Genogroup I or Genogroup II viruses. There's actually six Genogroups in total but most human infections are caused by Genogroup I or II. And you can see the all the human infections on this slide are highlighted and the black text. Other animal pathogens are in other colors.

Now the most important of these Genogroups into the human infection the Genogroup IIs. They cause between 75% and 90% of all disease. And there's a particular genotype amongst this Genogroup that is really predominate and this is the Genogroup II type 4. Which you can see on the kind of top one of the top branches of the Genogroup II cluster.

And the Genogroup II type 4 cause about three quarters of all the Genogroup II infections so it's really the predominant strain and it also seems to have somewhat of a different epidemiology to some of the other noroviruses. To an extent this Genogroup II type 4 norovirus behaves a little bit like influenza A viruses in the sense that every couple of years a new Genogroup II type 4 virus emerges. This seems to be happening into response to population immunity so there's a - the virus is evolving to escape a build-up of immunity in the population.

And sometimes when these new strains emerge we see a major increase in outbreak activity in the US but also worldwide. And it's another interesting phenomenon about these emerging strains is that when they emerge they seem to emerge pretty quickly globally. And when the Genogroup II type 4 strains emerge they over a couple of months will replace the previous Genogroup II type 4.

So this slide here shows the series of GII.4 strains that have emerged over the last 15 years or so. And the first of these was recognized in 1995. We don't have great data going back from there but at least since 95 the GII.4 strains have been predominate and you can see very couple of years a new strain has emerged.

And in some of these years, for example in 95 in 2002 and 2006 this increase has been related to excuse me this emergence has been related to an increase in outbreak activity, but in other years such as 2004 and 2009 that wasn't necessarily the case. We had a new strain but no real kind of major impact on the normal disease burden.

Now this year [2012/13] a new GII.4 has emerged it was first detected in Australia in 2012 and for that reason it's named Sydney GII.4. This virus is now recognized to be causing outbreaks in the US and in fact is now the predominant cause of outbreaks in the US.

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It's a little bit early in the year to be able to say definitively whether this is leading to an outbreak or leading to an increase or not but we're keeping a close eye on outbreak activity and community activity of norovirus to so we'll know in a couple of months whether this new strain has actually has caused a major increase in disease or not.

But what is clear at this stage is that it's the predominant strain causing outbreaks in the US right now. So all state public health laboratories are now able to diagnose norovirus using real time PCR and the most widely used assays are real time assay. It's sort of semi-quantitative and it provides estimates of viral load. And like I said all public health laboratories across the US are now equipped to do these diagnostics. Conventional PCR is used for sequence analysis and genotyping.

There are also [enzyme] immunoassays (EIAs) that are available. There's one that's cleared by the FDA; however, because of this great genetic diversity of norovirus it's been difficult to develop an EIA that has sensitivity to capture the full range of viruses that are circulating at any given time.

So they're not particularly sensitive, and they're not recommended for diagnosis of individual patients. They [EIAs] can be useful in diagnosing outbreaks when there are multiple specimens available.

Okay so this slide here just kind of summarizes a lot of what I've discussed already about the basic epidemiology and virology of norovirus. So the norovirus can be transmitted through a number of different routes including environmental route the food borne transmission and through waterborne transmission or directly from person-to-person.

But what this flow diagram captures is that even through these routes, essentially all norovirus transmission is person-to-person right. There are no animal reservoirs aside from the aside from humans. So only humans can become infected with human norovirus.

So there are a number of factors that kind of may determine how transmittable an individual is whether they're symptomatic or asymptomatic whether they've had vomiting in particular they vomited in the presence of other people. And there's things they can do as well to minimize their transmissibility including hand-hygiene, social distancing and not handling food is the way to reduce transmission risk.

And the same sort of factors apply to unaffected people, people who are at risk of becoming infected. And is there's other factor related to susceptibility so there is acquired immunity as mentioned already.

Immunity doesn't last for very long but it may play a role for some people at least. And then there's the issue of genetic susceptibility some with fraction of the population is resistant genetically resistant to norovirus. And there are a range of behaviors of course as well that can individuals can now practice to reduce their risk of infection.

Okay so turning now to disease burden. And I first want to highlight just to reiterate again quite how common this infection is and quite how a big a burden is in the community. So there are very few community-based studies in norovirus given all the challenges of studying them but this is one kind of classic study from the UK that generated age specific incidence estimates.

And what you can see here is that the overall incidences around four and a half percent in the population so about 1 in 20 people becomes ill with norovirus every year but much higher rates in young children. So around one in four children becomes infected every year.

So there's a really high burden in the community. Now again most of these individuals will recover after 24 - 36 hours, but that's not always the case amongst vulnerable individuals.

So what's presented here are data from a large study in healthcare facilities that were affected by norovirus outbreaks, and this includes care staff nursing home residents as well as hospital patients.

And what this slide shows are the proportion of individuals remaining ill after a certain number of days after the onset other illness. And what you can see that hospital staff or nursing home staff or even residents in nursing homes tend to recover pretty much on the trajectory that I talked about earlier. Whereas more vulnerable individuals and hospitals have a longer duration of illness about a quarter of them are still ill after four days and about ten percent are still ill after one week.

So this is kind of some first evidence to show you that the course of illness can be more severe at least more protracted in certain populations. And one question that's been difficult to tackle for norovirus is what determines the severity of norovirus disease. Is it the setting and where outbreaks occur in the community or healthcare facilities?

Is it how people get infected in terms of do they get infected from person-to-person transmission or through food and water, or is it the strain that determines severe disease?

So we recently conducted a review of over 800 outbreaks and we found that yes outbreaks that occur in healthcare facilities tend to have more severe outcomes in person-to-person transmitted outbreaks as well because they tend to occur in healthcare facilities. But even accounting for those factors we found



that the Genogroup II type 4 viruses were more likely to result in severe disease in terms of hospitalizations. And the same is true this figure this slide here now shows the same review you're looking at mortality. And the same is true for death although here both the setting in terms of healthcare facility outbreaks and the genotype the Genogroup II type 4 outbreaks were more likely to result in deaths. But as you can see the death rates are much, much higher in outbreaks occurring in healthcare facilities amongst already vulnerable patients.

If you're still unconvinced that norovirus can cause severe disease and death, have a look at the data on this slide here.

So this figure shows data from the study from nursing home residents in three states in the US. And the top figures show hospitalization and the bottom two figures show deaths.

So if you look on the left these are number of hospitalizations these are all cause hospitalizations not just gastroenteritis but all cause hospitalizations occurring relative to the start of an outbreak.

So we can see here is that when an outbreak begins in a nursing home there is an increase in overall numbers of hospitalizations in the first and the second week of an outbreak. And just looking down right below that you can see the same pattern in for mortality. So there's a little bump in numbers of deaths that occur in nursing homes during the first week that an outbreak has occurred. And those are statistically significant results :there's an increase in all cause gastroenteritis hospital -- excuse me -- all cause hospitalizations and all cause deaths during outbreaks.

And these outbreaks can really have substantial economic burden as well. So in terms of the burden of endemic disease so community acquired disease norovirus is estimated the cost of a total of five and a half billion dollars a year.

About \$500,000,000 of that is a resulting from the cost associated with hospitalization. But most studies actually quantify the cost of outbreaks. So one example comes from a large outbreak that occurred in a nearly thousand bed hospital in the US and the cost of that single outbreak was estimated at \$650,000.

A study in the UK estimated that in the course of one year these not just norovirus outbreaks but gastroenteritis outbreaks in general cost the English National Health Service in the range of \$180 million per year. And that makes norovirus and gastroenteritis outbreaks one of the costliest healthcare associated infections.

So I'll turn now to describing some of the surveillance activities that we have in the US for monitoring norovirus outbreaks. And the first of these are the epidemiological surveillance and that is the National Outbreak Reporting System or NORS as it may be known to some of you.

So NORS is a comprehensive national surveillance system it's actually for all enteric disease outbreaks in the US. It captures disease caused by all range of pathogens as well as all modes of transmission.

And this new system was launched in February of 2009. And the main objective of NORS is to provide an assessment of the national burden as well as the temporal trends of outbreaks. It's general information that's useful for understanding epidemiology of these infections, so NORS data are used to identify priority settings in populations that are potential targets for interventions.

And so we use these data to characterize outbreaks in terms of, you know, what are pathogens causing gastroenteritis outbreaks, where they're occurring, and what is the mode of transmission.

So I'll show you some early data from the National Outbreak Reporting System. So in this slide you'll see all gastroenteritis outbreaks reported to NORS from 2009 to 2010. And in blue are the monthly numbers of reported norovirus outbreaks in red are the non-norovirus outbreaks and the green are unknown.

So first of all what you see is there's a strong seasonality to these outbreaks both overall numbers of outbreaks but especially the norovirus outbreaks and in blue. You also see there's probably some variation from year to year there's slightly fewer in the 2009 - 2010 peaks at least in the earlier and later peak.

And you also see there's a similar seasonality amongst the unknown cause-unknown outbreaks as there is with the norovirus outbreaks and so we suspect that probably a number of these outbreaks are either caused by norovirus or other enteric viruses that have a similar seasonality to norovirus but it just wasn't possible to get laboratory confirmation on them.

In terms of mode of transmission person-to-person transmission is the most common route through which norovirus is spread accounting for about two thirds of all outbreaks. But food borne transmission is also important and causes about if the primary mode of transmission is about a quarter of all outbreaks.

And healthcare facilities are the most common settings for outbreaks. So amongst those 1500 or so outbreaks that were reported in these two years 60% are from long-term care facilities.

You can see a whole range of other settings reported outbreaks including the sort of typical food borne outbreaks occurring in restaurants and banquets but also schools and daycare settings and private homes and a range of other settings.

There's one sort of striking difference between what we see in the US and what's observed in Europe and a number of other industrialized countries.

And that is in proportion of outbreaks that are occurring in hospital settings. So like I showed on a previous slide, a small fraction say five percent of outbreaks in the US occur in acute care hospitals.

Whereas in European settings that number's much higher around 40% of outbreaks in total are reported from hospitals another 40% from long-term care facilities including nursing homes and a the remainder of the kind of typical food borne [outbreaks] or other settings.

So there's this big difference in terms of the burden in hospitals settings and it's something we are looking further into but it's not clear exactly why there's a much bigger reported burden at least in European settings compared to the US.

So I'd like to say a few things now about the burden of food borne norovirus.

So despite the fact that most norovirus is transmitted by person-to-person, because norovirus is so common it's still the most common cause of food borne disease in the US. So it causes an estimated 58% of all domestically acquired food borne illness from known agents. It's the number one cause of illness number two cause of food borne related hospitalization and number four cause of death.

And the food borne disease costs of norovirus are estimated to be around two billion dollars per year.

So you can see here this just kind of reiterates our last point, that norovirus is the most common cause of food borne disease outbreaks in this country and, in fact, the single pathogen of norovirus causes more disease and more outbreaks than in all bacterial pathogens combined.

So now turning to our second surveillance system: is a molecular surveillance system called CaliciNet which is modeled in the similar some ways to Pulse Net system that some of you may be more familiar with for the molecular surveillance of bacterial pathogens.

So the concept of this system is that data are shared between public health labs around the country and CDC. And the objective of CaliciNet is to link outbreaks and identify common sources where they occur linking between outbreaks and also to identify emergent variants.

So when new strains of a new norovirus emerge this system is a kind of tool for detecting their emergence. And this system [CaliciNet] was launched a similar time to NORS. It was implemented in March 2009. So as I mentioned all state public health labs now are equipped to perform molecular diagnostics for norovirus and many are also CaliciNet certified meaning that they generate sequences and submit them to CaliciNet.

Others are pending there's a whole quality assurance and proficiency testing that's involved so a number of states have are currently joining that system.

And the states that are unable to perform this typing work themselves send specimens to outbreak support centers to CaliciNet outbreak support centers which are highlighted in these red stars on your map. And so these network of labs and the link with CaliciNet performs the basis for the molecular epidemiological surveillance at CDC.

So that summarizes our surveillance activities. I'd like to turn now for the last few minutes of the call to prevention and control advice for norovirus.

So in terms of surveillance, engagement with health departments and rapid reporting response investigation is one of the central tenants of outbreak control.

And this involves identifying mode of transmission, the as well as source of the contamination and the collection of appropriate specimens. If you suspect an outbreak you should contact your local health department or state health department and they can assist with outbreak investigation.

Hand-hygiene is really one of the mainstays of norovirus prevention. And we recommend washing with soap and water for at least 20 seconds.

The efficacy of alcohol-based hand sanitizers has not been demonstrated for norovirus and there's reason to believe that it doesn't work as well as soap and water or they don't work as well as they do for some other viruses or for bacteria.

So for this reason water and soap is recommended. In addition prompt and thorough disinfection bleach solution is recommended for the decontamination of surfaces.

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And there's other there's a number of other EPA approved disinfectants, and you can find a list on EPA's Website of other approved products.

And the cohorting exclusion of ill persons is another tenant of norovirus outbreak management.

And this involves the exclusion of ill people for 24 - 72 hours after their symptoms resolve. And the reason for that of course is that they're shedding they tend to shed virus after symptom resolution.

I wanted to mention the couple of other prevention and control guidelines that are specific to healthcare settings. You can find much more information on these on our Website and guidelines, which I'll direct you to in a moment, but I'll just summarize some of the key ones here.

And those involve: patient cohorting so patients should be placed patients with norovirus should be placed on contact precautions for a minimum of 48 hours after the resolution of symptoms.

Healthcare workers during outbreaks should use personal protective equipment including gowns and gloves. Patient transfer should be restricted to when it's possible and ward closure can even be considered when outbreaks are if they become difficult to control.

Wards could be closed into admissions or transfers. Particular issue for environmental cleaning and healthcare settings is to consider changing privacy curtains routinely and upon patient discharge or when patients are transferred.

And the final thing I'd like to highlight is the importance of just keeping hydrated. Particular attention should be paid to children the elderly or otherwise vulnerable individuals that are in healthcare facilities.

You can find much more information on our Website. I'll give you the links for those below in the slides.

On our Website you can find lots more information. Read basic information about norovirus but also specific information for particular groups in terms of special information for food handlers, for healthcare providers, other health professionals including public health groups, epidemiology and lab data are available as well as the latest testing information.

And this information on our Website is regularly updated so I encourage you to come to it frequently or whenever you have questions about norovirus.

I'd also like to point to a toolkit that we've developed which is for toolkits specifically for the for dealing with outbreaks in healthcare facilities. And this toolkit contains this poster which you see here but also has a basic fact sheet and example communications framework, case reporting forms, a summary of infection control recommendations, the source of which I'll show you in a moment, and other general information about control and epidemiology of norovirus in healthcare settings.

We've recently published really two sets of guidelines. One is for basic outbreak management general guidelines and outbreak management and norovirus prevention.

This was published as an *MMWR Recommendation and Report* and you can find it the link here.

And secondly the Healthcare Infection Control Practices Advisory Committee (HICPAC) has produced a guideline for the prevention of outbreaks and controlled outbreaks in healthcare settings and again you can find the full report and information at the link below.

So I'd like to finish with on a hopefully a positive note and that is that it has been the recent progress in a norovirus vaccine.

There are a number of products in the pipeline, but the one furthest along is highlighted here on this slide. And this is a this was originally trialed as a intranasal vaccine based on Norwalk the original Norwalk Virus like particles.

And under a pretty controlled type of study where individuals were vaccinated and then challenged later by being fed infectious virus the vaccine was shown to be 47% effective against disease against gastroenteritis and about 26% effective against infection.

So this is in very early stage this is a real kind of proof of principal information, but at least it shows the vaccination is possible and other products are currently being trialed and hopefully we'll see some results from those studies in the near future.

So with that I would like to thank you all for joining the call. Thank you for your attention and I'll stop there and take questions if we have any time. Thank you.

**Leticia Davila:**

Yes thank you Dr. Lopman for providing our COCA audience with such a wealth of information. We will now open up the lines for the question-and-answer session.

And also remember you can submit questions through the Webinar system.

**Coordinator:**

Thank you we will now begin the question-and-answer session. If you would like to ask a question please press star 1. Please unmute your phone and record your name clearly when prompted.

Your name is required to introduce your question. To withdraw your request you may press star 2.

It'll be one moment for the first question please.

**Woman:**

(Colin Settings):

**Coordinator:**

We have a question from Dr. (Susan Seizick) your line is open.

**(Susan Seizick):**

Hi I just read about a test called xTAG T-A-G as a rapid way of identifying norovirus in a college setting. Do you can you recommend that test it's a commercial test though local labs.

**Ben Lopman:**

xTAG.

**(Susan Seizick):**

xTAG.

**Ben Lopman:**

Thanks for your question. Unfortunately I'm not at all familiar with that test and so I'm afraid I can't comment on it.

**(Susan Seizick):**

Just read about it.

**Ben Lopman:**

The only thing I can say is the only FDA cleared test is this ELISA that I mentioned but again it's not recommended for the diagnostics of individual patients.

The real time PCR is the kind of standard of standard diagnostic that's used.

**(Susan Seizick):**

Okay thank you.

**Leticia Davila:**

We do have one question from the Webinar system. Dr. Lopman can you talk about the environmental disinfection with foggers or bombs?

**Ben Lopman:**

Yes there's a whole range of fogging devices that have been trialed. Again none of these we don't particularly recommend any of them because the data are still kind of lacking in terms of their effectiveness in real world situations.

Part of this is because the challenges and determining the infectivity of virus so it's kind of difficulty in doing studies to determine how effective some of these foggers on disinfectants are.

But again I would recommend looking at the EPA Website for approved disinfectants and devices for that matter as well for dealing with outbreaks.

**Leticia Davila:**

Thank you.

**Coordinator:**

And our next question from the phone lines come from (Naha). Your line is open.

**(Naha):**

Hello. My question is about on alcohol-based hand sanitizer. I was just wondering so you do not recommend using them because they are not effective against noroviruses is that true?

**Ben Lopman:**

Correct. So what we recommend for norovirus is washing with soap and warm water for 20 seconds and this is really the only thing that's been clearly shown to be effective for against norovirus.

So alcohol based hand sanitizers generally work against envelope viruses they work by disrupting their lipid envelope of viruses that are present on other viruses or bacteria and this is how they generally work.



And noroviruses are non-envelope viruses so there's a reason to think that they would not be effective against norovirus because they have a mechanism of action that wouldn't doesn't apply to these bugs.

And again in under kind of laboratory conditions it's not it's there's not clear data that show alcohol-based hand sanitizers are effective whereas soap and water clearly is.

So for that reason in outbreak conditions we recommend use of soap and water.

**(Naha):**

Thank you.

**Coordinator:**

And our next questions comes from the (Teton) County Public Health. Your line is open.

**Woman:**

Yes we were wondering if there has been any norovirus outbreak associated with swimming pools or spas?

**Ben Lopman:**

There have been. I'm trying to think of examples off the top of my head. The one or two examples that I can recall are outbreaks that were related to insufficient chlorination of recreational waters.

So in the few instances when they're having outbreaks recognize they've always been linked to insufficient chlorination. Do you have any particular question about them?

**Man:**

Yes. If you had an associated outbreak in a swimming pool or spa how would you treat that?

**Ben Lopman:**

So in terms of outbreak control I mean the general approach would be to normal infection prevention measures in terms of, you know, treating the infected patients.

In terms of the pool this is which essentially comes down to the guidance of your local or state health department but they would typically recommend closing the pool and closing the recreational facility and the chlorination of the pool.

**Man:**

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I asked that because if it takes such a high concentration of bleach to denature the virus on a hard surface how that would be done in a pool when you're already bleaching out to 20 parts per million normally.

**Ben Lopman:**

Yes and typically pool will close for sometime as well and that things like a shock treatment is used I couldn't comment on it exactly how much chlorine this is required for to disinfect the pool.

**Man:**

Okay thank you.

**Coordinator:**

And our next question comes from (Jackie Hopkins) your line is open.

**(Jackie Hopkins):**

Hi yes I had a question about outbreak classification for surveillance purposes.

So for example you mentioned that the EIA test is not particularly helpful for individual diagnosis but in the context of an outbreak could be used.

So as an example would you call a norovirus outbreak confirmed if they had a long-term care setting you had two EIA positive specimens would that be sufficient.

And then the next question is just about classification in general. We are using a criteria whereby two confirmed is -- sorry -- two lab confirmed is a confirmed noro outbreak one lab confirmed is a probable and then based on clinical criteria alone would be a suspect.

**Ben Lopman:**

Yes so there's guidance in the National Outbreak Reporting System Website for what in terms of reporting are considered to be confirmed and suspected outbreaks.

But two or more positives like you call confirmed with either in EIA or real time PCR would be considered a confirmed outbreak...in terms of national surveillance standards.

And suspected outbreaks are again are just like you mentioned outbreaks that are consistent with the epidemiology of norovirus so, you know, high frequency of vomiting no other pathogens confirmed a short

incubation period, and those are considered to be suspected outbreaks if no laboratory confirmation is available.

**(Jackie Hopkins):**

Okay and then if you had one just one confirmed and say a long-term care compatible illness going on would you call that probable or what would you do with that?

**Ben Lopman:**

Yes in terms of how they reported it the National Surveillance I think one positive is considered to be a diagnosed outbreak a confirmed outbreak.

**(Jackie Hopkins):**

So just check the Website the NORS Website for this definition?

**Ben Lopman:**

Correct.

**(Jackie Hopkins):**

Thank you.

**Coordinator:**

And our next question comes from (Erin Buchanan) your line is open.

**(Erin Buchanan):**

Yes I was just wondering if people can get infected with the exact same virus immediately following their recovery from that virus...

**Ben Lopman:**

Yes it's a good question and there's obviously limited data on this.

So the volunteer and rechallenge studies that were done in the 1970s would suggested you cant be reinfected shortly after with the same strain.

So in these studies people were infected and then were challenged as little as two weeks after they recovered. And pretty much universally they did not become ill upon short rechallenge, but they did become infected on a slightly longer rechallenge period.

So six months or a year later they were susceptible.

I should say there are some real limitations about, you know, those highly unnatural studies of feeding people virus and how much that relates to kind of a natural exposure.

One of the limitations that we now know that now that we can quantify virus we know that the amount of virus people were being fed in those challenge studies was like ten to the sixth viral particles, which is much more than the infectious dose which as I mentioned is around 18 to a thousand virus particles.

So how much that relates to the kind of natural situation is not entirely clear but it does look like at short intervals you'll be have some level of acquired immunity.

**(Erin Buchanan):**

Okay thank you.

**Coordinator:**

And our next question comes from (Lei Chin) your line is open.

**(Lei Chin):**

Thank you. I have two questions. The first question could you please comment on the norovirus survivability outside of the host kind of on the different environment surfaces?

The second question is about handling of the public vomiting incidents and we having been dealing with norovirus also outbreaks in school settings.

So for the public vomiting incidence in the classroom or in the public places so we have you asking for following CDC guidelines for 25 foot radius cleaning.

But the things like for public vomiting incidents like in the toilet, you know, could you consider, you know, still consider public vomiting incident or, you know, how what's your comment about that two questions.

**Ben Lopman:**

Okay I'm going to take your first question about the stability of norovirus outside the host. It's a very stable outside the host.

There's anecdotal reports of outbreaks: from the a nice example from a in hospital outbreak that a unit was closed it was actually closed for two weeks because the unit was going to be decommissioned.

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And two weeks later some workers came in to work in the facility and became ill with norovirus within about 24 hours.

So is at least infectious in those kind of settings for two weeks at least from this kind of anecdotal report.

There's also been a nice recent study on the stability in ground water through the challenge studies. So these investigators spiked groundwater stored it away for couple of months and when they pulled the water back up and fed it to volunteers those individuals became ill.

So the virus was stable in groundwater for up to six months and in fact intact virus can be detected in the ground water for over two years.

So the virus is really highly environmentally stable.

In terms of, you know, what you consider to be a public vomiting incident. I mean I think it's a good point that, you know, we often think we use the phrase public vomiting as soon as you talk about an episode on a cruise ship for or, you know, or in a healthcare facility.

But actually even people they're using the toilet there's a real opportunity for the virus to become disseminated it become aerosolized and disseminated and cause lots of environmental contamination.

So I think that's a good point to even when the so called public vomiting or the vomiting occurs in bathrooms settings useful to follow the same sorts of approaches in terms of environment decontamination.

**(Lei Chin):**

Thank you.

**Leticia Davila:**

Operator how many people do we have on the line for questions?

**Coordinator:**

We have one last question.

**Leticia Davila:**

Okay we'll take that one last one.

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**Coordinator:**

And the last question comes from (Susan Frederickson) your line is open.

**(Susan Frederickson):**

Hi we recently had an outbreak at the end of the year where we had maybe two halls that had suddenly one evening vomiting and diarrhea two episodes which is our criteria for a GI outbreak.

And we had people tested nothing came back positive for norovirus yet it spread to the other side of the building. We had a number of people throwing up and vomiting and each maybe for one day.

How do we handle this as far as reporting and everything else? I later found out that, you know, three episodes of this sort of thing is what's criteria is now.

Is this actually a norovirus-like incident?

**Ben Lopman:**

So would be, be reported as an unconfirmed outbreak if you don't have laboratory confirmation...

((Crosstalk))

**(Susan Frederickson):**

We did do laboratory testing and everything came back negative.

**Ben Lopman:**

You did testing and right so this isn't this would be sort of a classic outbreak of unknown etiology, and it's very common even once specimens are taken they're still a large of, you know, a sizeable fraction of outbreaks that are never laboratory confirmed then maybe it could be for a number of reasons maybe the specimens weren't taken rapidly enough maybe the diagnostics are missing the particular strain that the cause the outbreak or maybe outbreak was caused by another pathogen although norovirus is most common, you know, a whole range of viral pathogens can cause outbreaks and they can be consistent with these types of symptoms so rotavirus outbreaks occur astrovirus outbreaks occur mainly in children a whole range of different viruses can cause viral gastroenteritis.

So, you know, this type of outbreak -- excuse me -- can be reported and it certainly qualifies as a gastroenteritis outbreak and it can be reported on to the health department and ultimately to the National Outbreak Reporting System as an outbreak of undetermined etiology.

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**(Susan Frederickson):**

Thank You.

**Leticia Davila:**

And Dr. Lopman we have one last question. Given what you told us about norovirus strain replacement would a norovirus vaccine have to be regularly updated like the flu vaccine?

**Ben Lopman:**

Yes it's a possibility. So as we mentioned earlier there's limited cross protection between norovirus strains are getting infected with one doesn't give you protection against all the others.

And another issue is that this common norovirus strain is GII.4 are constantly evolving.

So every couple of years we have a new strain and it might have be different immunologically than previous strains.

So it is a possibility that a norovirus vaccine would have to be regularly updated but the manufacturers of these vaccines are trying to develop strategies that would generate a vaccine we give broad across protection against current and hopefully future strains as well.

But that remains to be seen.

**Leticia Davila:**

Thank you. On behalf of COCA I would like to thank everyone for joining us today with a special thank you to our presenter, Dr. Lopman.

We invite you to communicate to our presenter after the Webinar. If you have additional questions for today's presenter please email us at [coca@cdc.gov](mailto:coca@cdc.gov).

Put January -- excuse me -- January 17th COCA call in the subject line of your email and we will ensure that your question is forwarded to him for a response.

Again that email address is [coca@cdc.gov](mailto:coca@cdc.gov).

The recording of this call and transcript will be posted to the COCA website at [emergency.cdc.gov/coca](http://emergency.cdc.gov/coca) within the next few days.

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**Coordinator:**

Thank you for your participation on today's call. The call has concluded you may disconnect at this time. Thank you.

END