Norovirus Illness Prevention & Control Guidance for the U.S. Fleet

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Introduction. Noroviruses (NoVs) are the predominant cause of gastrointestinal (GI) outbreaks worldwide. They cause approximately 50% of all reported outbreaks based on studies from the U.S. and Europe, and illnesses caused by NoVs are the most costly, pathogen-known, food-related illness in the U.S. in terms of the number of cases occurring and the number of hospitalizations. They are also likely to be the single most important cause of disease-outbreak related morbidity aboard ships in the U.S. Navy; Appendix 1 summarizes the burden. This document supplements recently published guidance from the U.S. Centers for Disease Control (CDC) in MMWR Vol70/No.3. Use both to inform your efforts to prevent or eliminate disease transmission. Additional information about the virus, the illness it causes, and its epidemiological characteristics are also available from the U.S. Centers for Disease Control at http://www.cdc.gov/ncidod/dvrd/revb/gastro/norovirus.htm.

Transmission. New information from recent surveillance data reported to the U.S. CDC indicates that the majority of NoV outbreaks primarily involve person-to-person transmission, and this mechanism of spread is also most important in the shipboard environment. It may occur directly by the fecal-oral route or by the inhalation and ultimate ingestion of aerosolized vomitus. It may also occur indirectly when one's hands contact environmental surfaces/materials that have been contaminated by feces or aerosolized vomit. Contaminated hands can spread the virus to environmental surfaces or deposit the virus in ones mouth. Studies of re-occurring outbreaks in cruise ships, hotels, and hospitals have shown that contaminated fomites are the most likely factor responsible for sustaining a succession of outbreaks, and ship's heads are very important spaces where vomiting, diarrhea, and environmental contamination are likely to occur and contribute greatest to person-to-person spread. Medical, berthing, foodservice, and other spaces where persons gather may also become contaminated and important sources of new infections.

Foodborne and waterborne transmission may also be important aboard ships. Foodborne sources of the infection may originate from port visits or upstream in the food distribution system through contamination of food by human waste as has been reported in outbreaks involving raspberries and oysters. A most important food-related transmission source aboard Navy ships is likely to be the infected food handler. Waterborne transmission of NoV aboard ship is also possible but less likely to occur. Waterborne illnesses may occur if the drinking water distribution system becomes contaminated with sewage by cross connections or sewage system leaks, or if the sewage system malfunctions or backs-up and subsequently contaminates the environment. Waterborne transmission could also occur if contaminated water is taken aboard from an unapproved/contaminated source.

Prevention and Readiness Guidance. Because person-to-person transmission is a very important mechanism of spread in the shipboard environment, you must work to limit exposures and slow transmission among your crew by raising their awareness and enlisting their help. Do

this by discussing the NoV threat and prevention measures during command indoctrination, and leave them with standard educational fact sheets/flyers which are available from the U.S. CDC website at http://www.cdc.gov/ncidod/dvrd/revb/gastro/norovius.htm. Add notes to the ship's plan of the day, and provide educational lectures on the ships closed network televisions prior to port visits, during safety stand-downs, and as needed to maintain high awareness of the threat by your crew. Also, ensure your crew knows to notify medical soonest when illnesses are occurring. Early detection is important to successful disease control.

One study of the cruise ship industry indicates that simple daily cleaning of all toilet area surfaces touched by individuals using them may significantly reduce the likelihood that a ship will experience a disease outbreak from a NoV. Therefore, instruct your command's leadership on the importance of instituting a routine program to clean all ships heads daily and ensuring that all toilet area surfaces (toilet seats, flush handles/ buttons, toilet stall handholds, toilet stall inner door handles plus latching devices, and door knobs/watertight door levers, hand dryer buttons, sink valve knobs etc.) are cleaned at least daily with a detergent and water-soaked cloth/sponge or a commercial cleaning wipe. Also, stress the importance of making adequate hand washing supplies available in all heads during routine habitability inspections, and educate your command's leadership of the importance of the same.

There are a number of actions you can take to prevent food from becoming the source of NoV infections. First, verify that all food service managers/employees are trained and competent about the causes of foodborne illnesses and the preventive actions required of them by OPNAVINST 4061 and the NAVMED P-5010 Manual of Naval Preventive Medicine, Chapter 1. Do this during routine food safety inspections, and remember to test their knowledge with short questions and answers as you inspect. Remember that it is important for foodservice workers not only to report when they are ill, but also to report when they believe they have been exposed to an outbreak of GI illnesses in out-of-work settings. Also, urge command leaders to recertify food service managers/employees who are unable to demonstrate requisite knowledge. Second, educate your crew to ensure that all food brought aboard is from approved sources only as is described in the Manual of Naval Preventive Medicine chapter 1. Inspect shipboard food storage facilities & refrigeration units for food that has been smuggled aboard after port visits, and instruct your crew to avoid this activity. Also, prohibit the consumption of seafood that has been caught by the crew from the ship. Third, routinely test ice bins for fecal contamination, and follow guidance in the NAVMED P-5010 Chapters 1 and 6 to decontaminate them and restore them to service if you discover that they have become contaminated. Finally and most importantly, exclude ill food service workers (FSWs) from working in the galley until they have been symptom-free for 48 to 72 hours if they exhibit vomiting or diarrhea, and consider excluding those known to be exposed during an outbreak while off the ship even if they are without symptoms.

To prevent water from becoming a source of infections, conduct a potable water surveillance program as defined in Chapter 6 of NAVMED P-5010. This should include monitoring of halogen residuals and testing for total and fecal coliforms. Do both activities to detect potable water system contamination. Also, inspect the system for cross connections to other systems while taking samples, inspecting the galleys, and performing habitability inspections. Evaluate and approve/disqualify water sources (barges and pier side) prior to allowing bunkering of water onboard. Training to successfully execute a shipboard potable water surveillance program is available on the Navy Knowledge Online (NKO) e-learning web site. The course title and code are *Water Sanitation Afloat* NMCPHC-WSA-1.0.

Medical Surveillance

Monitor for surges in GI illnesses while conducting disease and non-battle injury (DNBI) surveillance to detect NoV outbreaks earliest. This is especially important on larger ships where the crew is cared for by multiple providers. Also, ensure that your ship's medical division/department personnel are knowledgeable, equipped, and trained to report outbreaks of disease to their chain of command and to the Navy's disease surveillance hub via the Disease Reporting System Internet (DRSi). Obtain more guidance for both obtaining a DRSi account and reporting to that system by clicking here. Be sure your staff know how and when to consult the Navy's expert disease outbreak investigators from a Navy Environmental & Preventive Medicine Unit (NEPMU). Also, know that the U.S. Food and Drug Administration (FDA) has recently approved for marketing R-Biopharm's Ridascreen Norovirus 3rd Generation EIA assay. It is approved for use in outbreak situations when a number of people have simultaneously contracted gastroenteritis and there is a clear avenue for virus transmission, such as a shared location or food. It may be used to test a sample of your affected patients for NoV.

Disease Control. One gram of feces may contain up to 5 billion infectious doses (10-18 viral particles) during peak shedding. This is partly why NoV has caused numerous large explosive disease outbreaks aboard both commercial and U.S. Navy ships as well as in similar closed populations and health care settings. During these events cumulative attack rates sometimes approach or exceeded 40%, and studies show that frequent *handwashing alone will not be enough to prevent transmission*. When a surge of (GI) illnesses occurs among your crew, the likelihood that the outbreak is of viral origin is increased when more than 50% of the reported ill are vomiting and the average duration of illness is (short) within 12 to 60 hours.

If NoV illnesses are suspected take the following actions soonest to limit/control the spread:

Crew Awareness

1) Raise the crew's awareness and request their help. Do this by adding notes to the ship's plan of the day, providing educational guidance via the ships closed network televisions, and by providing educational command leadership briefs.
    a. Instruct the crew of:
        i. Signs and symptoms.
        ii. The need to perform frequent, effective, handwashing.
        iii. Effective handwashing procedure.
        iv. The need for them to report to medical all episodes of vomiting which miss the commode (including space where this occurred).
        v. The highly infectious nature of the organism and its high resistance to common disinfectants and survivability in extreme temperatures.
        vi. How to clean contaminated spaces where vomiting has occurred.
        vii. How to handle contaminated laundry safely.
        viii. How and when to clean frequently touched surfaces in spaces where ill persons have been.
        ix. Your guidance/recommendations to cohort ill persons and limit their movement.

Managing Food Service Workers (FSWs)/Food Safety

2) Identify any/all ill or exposed FSWs, and exclude all ill FSWs from working in the galley until they have been symptom free for 48 to 72 hours.
3) Ensure all excluded FSWs are cleared by medical before they return to handling food.
4) Ensure all remaining FSWs wash their hands frequently as trained, and use gloves to handle any ready to eat foods and utensils.
5) If manpower is available, step up the frequency of informal food safety inspections.
6) Eliminate all self-service practices from the galleys/food service lines until the illness rates return to base line levels.

Managing the Ill and Exposed

7) If operationally feasible, instruct command leaders to cohort ill persons together in specific berthing spaces or parts of them until 48 hours after the illness of these groups subsides. Studies show that only 10 to 20% of the ill persons will seek medical care during outbreaks, so it is important to identify the others and consider cohorting them if possible.

8) Designate specific heads or portions of them for use by ill/cohorted persons only.
9) Limit movement about the ship of all ill, likely exposed, and recovering persons as much as operationally feasible to limit environmental contamination. For example you may want to have food/boxed lunches brought to them, and have contaminated laundry picked up from these spaces.
10) Remove and wash clothing or linens that may be contaminated with vomit or fecal matter. Ensure that those who handle soiled items do so carefully—without agitating them—to avoid spreading the virus. Soiled items should be laundered with detergent at the maximum available cycle length and then machine dried.
11) Ensure all well crew (who must enter areas designated for cohorting) wear gloves and gown/apron/Tyvek coveralls which must be left in a plastic trash bag in the space before they leave. Ensure that all wash their hands thoroughly and immediately after they depart these areas.
12) Limit unnecessary group activities or group gatherings, and consider closing access to spaces where this occurs such as workout spaces, etc.

Handwashing During outbreaks, the use of soap and water is the preferred method of hand hygiene. All aspects of proper handwashing (scrubbing, rinsing, and drying) are important to reduce microbial transients on the hands. Friction and water have been found to play the most important role. The amount of time (20 seconds minimum) spent scrubbing is critical to effective handwashing.

13) Ensure all personnel wash before and after each meal, and after each visit to the head.
14) Ensure all FSWs wash their hands in accordance with guidance in Chapter 1 of the Manual of Naval Preventive Medicine.
15) Ensure all medical personnel perform handwashing according to standard precautions (i.e. prior contact with patients, medication preparation, preparation or consumption of food, insertion of invasive devices, etc.

Environmental Contamination After an episode of illness, such as vomiting or diarrhea, it is critical to immediately clean and disinfect the affected areas. Cleaning of contaminated surfaces to remove visible debris (organic loads) such as fecal material or vomit should be performed first before disinfection with bleach.

16) Handle vomiting which misses the commode similar to spills of infectious medical waste as described in OPNAV's *Afloat Medical Waste Management Guide*:
    a. Limit access to the space to trained cleaning personnel.
    b. Use recovered, trained personnel if possible to clean and disinfect the contaminated space.

c. Ensure those cleaning the area wear clothing and PPE as defined in the waste management guide (disposable coveralls, rubber boots, rubber gloves, and a face shield).
d. Use a spill containment cleanup kit with absorbent materials (i.e. cat litter, paper towels, etc.).
e. Clean and disinfect all washable surfaces in the space within six feet of the the vomiting or fecal accident.
    i. Pools of vomit should be cleaned with an absorbent material first while minimizing agitation.
    ii. Use the 5000 ppm sanitizing solution described later in this guide to disinfect areas where vomiting or fecal accidents have occurred. Wait 5 minutes after applying the disinfectant before rinsing it away.
    iii. Important surfaces include but are not limited to toilet seats, flush handles/ buttons, toilet stall handholds, toilet stall inner door handles plus latching devices, and door knobs/watertight door levers, hand dryer buttons, sink valve knobs, light switches, hand railings, phones, etc.
    iv. Use appropriate sanitizing solutions as described below.
f. Clean and disinfect soiled cloth furniture and carpeting.
    i. Visible pools/debris should be cleaned with an absorbent material while minimizing agitation. Next clean with hot water and detergent followed by steam cleaning (158F for five minutes or 212 F for 1 min) for complete inactivation of the virus.
    ii. Do not dry vacuum.
g. Upon completion of the clean-up, have personnel removed contaminated clothing and place it in a double plastic bag for sterilization (if possible) or laundering.
h. Dispose of used vomit/fecal absorbed cleaning materials containing NoVs as infectious waste according to OPNAV's *Afloat Medical Waste Management Guide*.
i. Ensure clean-up personnel take a hot shower immediately afterward, using plenty of soap and hot water.

17) Routinely clean/disinfect frequently touched environmental surfaces (door handles plus latching devices, and door knobs/watertight door levers, light switches, hand railings, phones, etc.) and equipment in cohorting areas, clinical areas, and high traffic areas. Use the 1000ppm sanitizing solution described below for this purpose.

Sanitizing Solutions/Disinfectants The stability of the virus in relatively high concentrations of chlorine, and its stability in a wide range of temperatures, facilitates its spread.

However, the effectiveness of chlorine bleach, in concentrations of 1000ppm to 5000ppm, has been demonstrated and is widely recommended for environmental decontamination. Its use is critical to interrupt the spread of NoV infections.

Chlorine is available for shipboard use as calcium hypochlorite also known as High Test Hypochlorite (HTH). It's a granular solid which provides 65-70% available chlorine and comes in a six ounce bottle. It is most frequently used in the fleet because of its relatively long shelf life and reduced storage space requirements. Common household bleach (unscented) in a 5.25% solution of sodium hypochlorite may also be available.

18) To prepare a 1000 ppm batch of sanitizing solution from HTH, dissolve 0.2 oz (1-2 teaspoons) of HTH powder into one gallon of warm water (80°F to 100°F) and allow the suspended matter to settle out. Next pour off the supernatant into plastic spray bottles or like dispersal equipment. Ensure the solution is made by personnel wearing proper PPE in a well ventilated space absent of any flammable liquids/materials. To prepare a 5000 ppm batch of sanitizing solution from HTH, dissolve 1.0 oz. (2 tablespoons) of HTH powder into one gallon of warm water.
19) To prepare a 1000 ppm batch of sanitizing solution from standard unscented liquid bleach add 1/3 cups of 5.25% liquid bleach to one gallon of water. To prepare a 5000 ppm batch add 1 and 2/3 cups of 5.25% liquid bleach to one gallon of water.
20) Prepared solutions should be made daily. If this is impractical you can double the concentration to 2000 ppm vs. 1000 ppm and then store the solution in dark (light-proof) containers which should be discarded after 30 days.

Contaminated/Suspected Foods

21) Discard all food items believed to be contaminated. Save, refrigerate and place on medical hold samples of suspicious food items in sterile urine specimen cups stored in plastic bags and away from all other food items. Seek guidance on specimen handling and submission from your nearest NEPMU.

Medical Event: Reporting and Assistance

22) Submit an "Urgent" Navy Medical Event Report following guidance in BUMEDINST 6220.12 directive to alert the Navy's public health experts at the nearest Navy Environmental and Preventive Medicine Unit (NEPMU). Note these experts can assist your investigation to determine the source/organism, and aid your efforts to obtain laboratory testing. Contact information for the NEPMUs appears in appendix 2. To aid your efforts in completing required medical event reports maintain a line list of patients meeting your case definition for the disease outbreak. Make sure to record the following for each patient: (Name, rank, date seeking care, age, gender, Dept, Div, workspace, Berthing space, Galley used most often.

Appendix 1
Burden of NoV Infections on U.S. Fleet

NoV outbreaks are a problem occurrence for populations in close quarters worldwide, and the likelihood that your ship will experience such an event during your tour is high. The limited evidence we have of the burden of Nov infections on the U.S. fleet comes from Navy medical event reports (MERs), disease non-battle injury reports DNBI, media reports, and reports from disease outbreak investigations. During the 24 month period from 01 Jan 2009 to 31 Dec 2010 we estimate there were about 21,840 unique health care (HC) visits for complaints of gastroenteritis from all etiologies in the U.S. Fleet of 285 war ships. We also estimate that 158 outbreaks of GI illnesses may have occurred causing about 12,000 of the unique HC visits for GI illnesses of which roughly 80 (causing 6000 unique HC visits) might be attributed to NoV infections. Our assumptions appear in the bullet list below.

- RIVGI = Reported, Unique, Initial-Health-Care-Visits for GI illnesses
- AIVGI = Actual, Unique, Initial-Health-Care-Visits for GI illnesses
- Fraction of all reported GI outbreaks attributable to NOVs [1] (Gi_f) = 50%
- Actual reported GI outbreaks[2] 2009-2010 (e) = 65
- Duration of reported outbreaks: 1-8 weeks. Avg. 3 weeks.
- Cumulative reported attack rates during outbreaks 1.85% to 47.37%. Mean 8.6%.
- Mean weekly fleet Population (P) 109,200[3]
- Mean weekly person weeks surveilled/reported 2009-2010 (μ) = 44,395
- RIVGI in US fleet 2009-1010 (R) = 10,025
- RIVGI during outbreaks[2] (A) = 4927
- Mean weekly incidence of RIVGI in the US fleet 2009-2010 (i) = 0.20%
- Mean % of P monitored during 2009-2010 (%P) = μ/P = 41% = Ironically, the mean % of all fleet units actually reporting each week.
- % of RIVGI occurring during outbreaks[2] = (A/R)*100 = 49%
- Estimated AIVGI 2009-2010 (V_1) = i * P = 21,840
- Estimate of the mean AIVGI per outbreak event (IOe_2) = A/e =76
- Estimate of, AIVGI during outbreaks[2] = e* IOe_2 = 12,008
- Estimate of actual # of GI outbreaks[2] 2009-2010 (ae) = e/(%P) = 159
- Fraction of ae that might be attributable to a norovirus = ae* Gi_f = 80
- # of AIVGI attributable to NOV outbreaks. V_1 * Gi_f ≈ 6000
- Estimated SIQ from NoV outbreaks ≈ 3060
- Estimate basic pay lost to NoV-SIQd sailors 2009-2010 ≈ $8,573,632.26

1. U.S. Centers for Disease control reports that Norovirus is the predominant cause of GI outbreaks worldwide, and that it causes approximately (36%- 59%) 50% of all reported outbreaks based on studies from the U.S. and Europe.
2. We defined an outbreak as an event reported as such by Navy MER or by the press, or as an event where the GI-illness attack rates from DNBI reports had exceeded 3% in any 3 week period. The 3% threshold rate is based on a similar arbitrary assumption employed by the U.S. Centers for Disease Control (CDC) to monitor the cruise ship industry
3. Estimated from active ship inventory and some assumptions not listed here about their average crew strengths.

Burden of NoV Infections on U.S. Fleet

Experience from 1999 Study of GI outbreaks on Aircraft Carriers.

- Cumulative attack rates ranged from 8% to 18% i.e.
- 8% of crew sought medical care for acute GE or 4-10% of each Dept on the ship.
- Peak incidence/day was 8/1000 15 days into the outbreak
- Of subjects reporting illness in questionnaire (87%) Nausea, (82%) vomiting, (82%) watery stools, (61%) feverishness
- Outbreak cases were defined as anyone presenting with vomiting/diarrhea & anyone diagnosed with gastroenteritis by a provider.
- Most notable association: Persons in large berthings holding 50 or more personnel were 2 to 3 (OR 2.2-2.8) times more likely to become ill
- 58% of all identified cases sought medical care
- 51% of all identified cases missed at least one day of work
- Median duration of illness was two days
- All supplies of intravenous fluids were depleted.
- Outbreaks placed strong demand on ships medical departments

Appendix 2

Navy Environmental and Preventive Medicine Unit Contact Information

1. Officer in Charge
Navy Environmental and Preventive Medicine Unit TWO
1285 West D Street, Bldg. U-238
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