Public Health on the High Seas

An Overview of CDC’s Vessel Sanitation Program (VSP)

InFORM 2013, San Antonio, TX

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CDC/NCEH/VSP
Mission

- Prevent the introduction, transmission, or spread of communicable diseases into the United States

- Assist cruise ship industry in developing and implementing comprehensive sanitation programs to minimize the risk for gastrointestinal illnesses
VSP Program Components

- Operational Inspections
- Construction
- Training & Consultation
- GI Surveillance & Outbreak Investigations
VSP Staff

- **Atlanta**
  - 4 Environmental Health Officers
  - 1 Epidemiologist
  - 1 Admin Assistant
  - 1 IT Specialist

- **Ft. Lauderdale**
  - 5 Environmental Health Officers
  - 1 Admin Assistant
VSP History

1970
- Routine sanitation inspections of all arriving vessels
- Significant risk associated with cruise ships
- WHO Guide to Ship Sanitation

1975
- First overseas consultation on construction
- Inspections results available to the public
- Compliance to maintain minimum levels of sanitation and minimize threat of GI illness

1987
- In compliance with congressional directive, VSP reestablished with following components:
  - Unannounced inspections
  - Follow-up inspections
  - Construction consultation
  - Investigation of outbreaks
  - Biweekly publication of inspection scores
  - Inspection reports on request

1988
- Inspections discontinued & industry “encouraged” to develop program of self-inspection using Vessel Sanitation Inspection Manual
- User fees charged to support 100% of VSP budget

Cost for 2002 = $0.03/passenger/day
### Inspection Fees/Fiscal Years 2006–Present

<table>
<thead>
<tr>
<th>Vessel Size</th>
<th>Gross Registered Tons</th>
<th>Fee</th>
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</thead>
<tbody>
<tr>
<td>Extra Small</td>
<td>&lt;3,001</td>
<td>$1,300</td>
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<tr>
<td>Small</td>
<td>3,001–15,000</td>
<td>$2,600</td>
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<tr>
<td>Medium</td>
<td>15,001–30,000</td>
<td>$5,200</td>
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<td>Large</td>
<td>30,001–60,000</td>
<td>$7,800</td>
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<td>Extra Large</td>
<td>60,001–120,000</td>
<td>$10,400</td>
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<tr>
<td>Mega</td>
<td>&gt;120,001</td>
<td>$15,600</td>
</tr>
</tbody>
</table>
**Allure of the Seas**

- **Length**: 360 m
- **Size**: 225,282 GRT
- **Passengers**: 5,400
- **Crew**: 2,165

**Oasis of the Seas**

- **Length**: 50 m
- **Size**: 91 GRT
- **Passengers**: 40
- **Crew**: 8

**Arabella**
Jurisdiction

- **Cruise vessels that**
  - Carry 13 or more passengers
  - Have an international itinerary
  - Call on U.S. ports

- **2013**
  - 200+ vessels
  - 15+ million passengers*

* Estimate by Florida-Caribbean Cruise Association (FCCA)
Legal Authority

- **Public Health Services Act**
  - 42 U.S.C. Section 264. Quarantine & Inspection
    - Regulations to control communicable disease
  - 42 U.S.C. Section 71.41. General Provisions, Foreign Quarantine
    - Requirements Upon Arrival at US Ports: Sanitary Inspection

- **No fines, enforcement, or civil or criminal litigation**
VSP & Cruise Ship Industry

- **Joint Collaboration**
  - Manuals
  - Training
  - Annual meetings
  - Consultation
    - new concepts, technology

- **Economic Cost of Outbreaks**
  - Per day delayed embarkation: $1.3 million to cruise line
  - Per no sail day: $5 million to cruise line
  - Media & residual impact
VSP Program Components

- Operational Inspections
Operational Inspections

- Majority of Program’s Work
- Twice a year
- Unannounced
- Maximum score of 100
- Minimum passing score is 86
Based on

- Previous VSP Ops Manual
- Current FDA Model Food Code
- WHO Guide to Ship Sanitation
- Extensive References
Operational Inspections

- GI Surveillance
- Potable Water
- Recreational Water
- Food Safety
- Pest Management
- Housekeeping / Infection Control
- Child Activity Centers
- HVAC Systems
Potable Water
Recreational Water
Children’s Center & Housekeeping
Ships vs. Shoreside Restaurants

- **Massive food outlets**
  - storage, preparation, cooking, service buffets

- **Time in lieu of temperature**

- **Self sustaining**
  - team of engineers to fix issues

- **Financial backing**

- **State of the art equipment**
  - blast chillers, dishwashers, cold storage

- **Construction**
  - Stainless; hard, durable, easy to clean surfaces

- **Paid sick leave**
## Vessel Sanitation Program

### Inspection Detail Report

- **Cruise Ship:**
- **Cruise Line:**
- **Inspection Date:** 09/28/2011
- **Inspection Score:** 86

This cruise ship inspection report lists the deficiencies found during the inspection. Additional information corresponding to each item number is available in the latest editions of the CDC [VSP Operational Manual](#).

### Item No.: 03
**Site:** Potable Water-Bunkering

**Violation:** According to the records, the free residual halogen during bunkering was less than 2 ppm on 6 dates since the last inspection. On 25 June, the free residual halogen from 1200 to 1900 was less than 2 ppm. On 3 August, bunkering began at 0930, and 2 ppm was not reached until 1200. On 10 August, bunkering began at 0925, and 2 ppm was not reached until 1400. On 12 August, bunkering began at 0918, and 2 ppm was not reached until 1200. On 31 August, bunkering began at 0912, and 2 ppm was not reached until 1200. On 6 September, bunkering began at 0845, and the free residual halogen did not reach 2 ppm during the entire bunkering process, which ended at 1900. According to the staff, the bunkering samples were taken from the shoreside, and not after the bunkering halogenation system. There were no records of samples after the bunkering halogenation.

**Recommendation:** Ensure that a free halogen residual of 2 ppm is reached with 30 minutes of the start of bunkering.

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## CORRECTIVE ACTION AND FOLLOW UP LOG

The following information is provided regarding items which were defective. Additional information corresponding to each reference number is available in the Guide to Ship Sanitation, World Health Organization 1967, and the Center Disease Control Recommendation on Sanitation October 7, 1974.

<table>
<thead>
<tr>
<th>#</th>
<th>REFER ITEM NO.</th>
<th>POINTS</th>
<th>REPAIR VESSEL</th>
<th>AREA MENTIONED</th>
<th>RESULTS AND RECOMMENDATION</th>
<th>COMPLETED</th>
<th>DATE</th>
<th>CORRECTIVE ACTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6</td>
<td>0</td>
<td></td>
<td>Potable Water</td>
<td>The four monthly random E.coli tests were conducted at the same location on the vessel from December 2005 to March 2006.</td>
<td>YES</td>
<td>4/2/2006</td>
<td>During the inspection the officer in charge was advised &amp; a written note has been made onto the form “E.coli test log - COMM / POZ / NT” to use different locations.</td>
</tr>
<tr>
<td>2</td>
<td>41</td>
<td>0</td>
<td></td>
<td>Ventilation</td>
<td>A written plan for the inspection, cleaning, and maintenance for the heating, ventilation, and air conditioning system was not maintained on the vessel. Staff stated that the air conditioning units are cleaned on a monthly basis, however, it is not recorded.</td>
<td>YES</td>
<td>4/2/2006</td>
<td>A written plan for the inspection, cleaning, and maintenance has been done.</td>
</tr>
<tr>
<td>3</td>
<td>22</td>
<td>0</td>
<td>Bar Passenger LEIO POOL BAR</td>
<td>The sanitizing solution for the three bucket system in the pantry was very cloudy.</td>
<td>YES</td>
<td>4/2/2006</td>
<td>Corrected during inspection.</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>26</td>
<td>0</td>
<td>Bar Passenger CASING BAR Pantry DECK 2</td>
<td>Several previously cleaned glasses were soiled and stored as clean.</td>
<td>YES</td>
<td>4/2/2006</td>
<td>Corrected during inspection. Glasses removed from the rack and washed.</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>26</td>
<td>0</td>
<td>Galley Passenger Leio CLEAN POTS STORAGE</td>
<td>One previously cleaned large mixing bowl was excessively soiled with food residue and stored as clean.</td>
<td>YES</td>
<td>4/2/2006</td>
<td>Corrected during inspection. Bowl removed and washed again.</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>27</td>
<td>0</td>
<td>Galley Passenger Leio DECK 6 AFT</td>
<td>The top of the conveyer belt in the pizza area was soiled with food debris. This area had not been in use the day of the inspection.</td>
<td>YES</td>
<td>4/2/2006</td>
<td>Corrected during inspection. Oven conveyor has been cleaned.</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>28</td>
<td>2</td>
<td>YES</td>
<td>Buffet Passenger Leio DECK 5 AFT</td>
<td>Two trays of plastic glasses were stored upside down and not being used, allowing proper air drying. These glasses were set out for service near the coffee station.</td>
<td>YES</td>
<td>4/2/2006</td>
<td>Corrected during inspection. Glasses removed and placed for air drying.</td>
</tr>
<tr>
<td>8</td>
<td>28</td>
<td>2</td>
<td>YES</td>
<td>Food Service General Leio DECK 5 AFT</td>
<td>Plates and bowls were not stored covered or inverted. This was noted in several areas and in the Lido that were not in service for the breakfast buffet such as the salad bar counter, dessert area, and cold counter.</td>
<td>YES</td>
<td>4/2/2006</td>
<td>It was 11:30am and we were ready for lunch service/corrected during inspection.</td>
</tr>
<tr>
<td>9</td>
<td>20</td>
<td>0</td>
<td>Galley Passenger Main BUFFET PANTRY</td>
<td>A waste receptacle was not provided at the handwash sink.</td>
<td>YES</td>
<td>4/2/2006</td>
<td>Corrected during inspection.</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>21</td>
<td>0</td>
<td>Galley Passenger Main SOUP AREA</td>
<td>A long electrical line was noted between the control and the bottom of the left kettle near the window. The line draped the deck making cleaning difficult.</td>
<td>YES</td>
<td>4/6/2006</td>
<td>Line has been placed in a junction box.</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>21</td>
<td>0</td>
<td>Galley Passenger Main SOUP AREA</td>
<td>The label was peeling at the right kettle near the tilt pan, making cleaning difficult.</td>
<td>YES</td>
<td>4/6/2006</td>
<td>Corrected.</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>21</td>
<td>0</td>
<td>Food Service General</td>
<td>Peeling sealant was noted along edges of several kettles and tilt pans, making cleaning difficult.</td>
<td>YES</td>
<td>4/17/2006</td>
<td>All steam kettles and tilting pan sealant has been replaced.</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>19</td>
<td>0</td>
<td>Galley Passenger Main CENTER GALLEY</td>
<td>A pan of beans and a pan of tortillas were not stored covered.</td>
<td>YES</td>
<td>4/2/2006</td>
<td>Corrected during inspection.</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>26</td>
<td>0</td>
<td>Galley Passenger Main CENTER GALLEY</td>
<td>A plastic container with soiled omelet pans was noted on the shelf, clean paper towels were noted between each pan. It appeared that the pans were stored here for use and were not identified as soiled. The station was closed.</td>
<td>YES</td>
<td>4/2/2006</td>
<td>Corrected during inspection. Pans were removed from the area and placed for washing.</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>34</td>
<td>0</td>
<td>Galley Passenger Main PANTRY</td>
<td>The drain at the upper wall was clogged.</td>
<td>YES</td>
<td>4/2/2006</td>
<td>Corrected during inspection.</td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>33</td>
<td>0</td>
<td>Galley Passenger Main ROAST AREA</td>
<td>Dish racks were used to store display items on the deck, making cleaning of the deck difficult.</td>
<td>YES</td>
<td>4/2/2006</td>
<td>Corrected during inspection.</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>14</td>
<td>0</td>
<td>Galley Passenger Main</td>
<td>One food handler was wearing a watch and another was wearing a rubber bracelet. This was corrected during the inspection.</td>
<td>YES</td>
<td>4/2/2006</td>
<td>Corrected during inspection.</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>34</td>
<td>0</td>
<td>Galley Passenger Main POTWASH AREA</td>
<td>The handwash sink was not working near the sink.</td>
<td>YES</td>
<td>4/2/2006</td>
<td>Corrected during inspection. Battery was replaced.</td>
<td></td>
</tr>
</tbody>
</table>
Construction

- New builds
- Renovations
- Plan reviews
- Yard Inspection
- Final inspection
- Equipment reviews
# Vessel Sanitation Program

**2011 Construction Guidelines**

## Acknowledgments

VSP would like to acknowledge the following organizations and companies for their cooperative efforts in the revisions of the *VSP 2011 Construction Guidelines*.

**Cruise lines**
- AIDA Cruises
- Carnival Corporation & PLC
- Carnival Cruise Line
- Carnival UK (P&O Cruises and Cunard)
- Disney Cruise Line
- Holland America Line
- Norwegian Cruise Line

**Shipyards**
- Fincantieri Cantieri Navali Italiani SpA
- Meyer Werft GmbH

**Other Organizations**
- ALMACO Group, SAS
- Bill Aleman, Inc.
- Culligan Italia S.p.A.
- Cruise Lines International Association (CLIA)
- D. Marine Solutions, Inc.
- DL Forsey Consulting
- DL SERVICES
- Ecolab
- EU SHIPSAN
- Health Canada
- HOBART Global Marine
- Ialcatering (MSC Cruises)

- MSC Cruises
- Prestige Cruise Holdings (Oceania and Regent Seven Seas Cruises)
- Princess Cruises
- Royal Caribbean Cruises Ltd. (Royal Caribbean International, Celebrity Cruises, and Azamara Cruises)
- STX Europe (France and Finland)
- T. Mariotti SpA
- JP Schnoor Consulting
- MEIKO Maschinenbau GmbH & CO KG
- MEIKO USA
- MKS GmbH & Co.
- O.T. Srl
- Preceti SpA
- Prescott Consulting
- SeaKing Ltd.
- TGMG, Inc.
- Turtle Training Institute
- Walt Disney Imagineering
- World Health Organization

The cover art was designed by Carrie Green.
Plan Review/Construction Inspections
VSP Program Components

- Training and Consultation
Training

- Train-the-trainer course for cruise ship supervisors
- Six times per year
- Miami and Seattle
- 700 industry personnel per year
VSP – International Consultation

Egypt – Nile Cruises
SYDNEY GAMES 2000 ~10-12 cruise vessels: floating hotels

ATHENS GAMES ~ 2004 mandate for VSP inspection before arrival in Piraeus

EU SHIPSAN: project to standardize Europe on ship sanitation inspections
VSP – International Consultation
VSP Program Components

- GI Surveillance & Outbreak Investigations
Gastrointestinal Illness (GI) Log

- The main document of the VSP surveillance system:
  - Listing of all REPORTABLE GI illness cases who reported to the ship’s medical staff
  - Gather information to report cases to the VSP
  - Data for outbreak investigations

- Maintained for each cruise/voyage
**Acute Gastroenteritis (AGE) Surveillance Log**

Note: The Header/Banner section of the AGE Surveillance Log must be completed for EVERY voyage, even if the case counts are zero for both passenger and crew. Even if there is an underlying illness, there may be justification in reporting the patient as portable. This should be based on sound clinical judgment and based on medical practice. Enter none if there is no underlying illness.

<table>
<thead>
<tr>
<th>Patient ID</th>
<th>Report to Medical</th>
<th>Last Name</th>
<th>First Name</th>
<th>Age</th>
<th>Sex</th>
<th>Pax or Crew</th>
<th>Total No. of Pax</th>
<th>Total No. of Crew</th>
<th>Underlying Illness (Specify)</th>
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<td>28</td>
<td>M</td>
<td>C</td>
<td>149</td>
<td>14</td>
<td>None</td>
</tr>
</tbody>
</table>
Reportable Case

Diarrhea (3 or more episodes in a 24-hrs or what is above normal for the individual)

- OR -

Vomiting + one other symptom (24-hrs)
- One or more loose stool
- Abdominal/stomach cramps
- Headache
- Muscle aches (myalgia)
Fever (≥38°C or 100.4°F)
GI Surveillance

- Report 24 hours before arrival at a U.S. port
- Submit a 4-hour update
- Submit a special report when gastrointestinal illness reaches 2% and again at 3%
- Use electronic reporting system
  - MIDRS
GI Questionnaires

- Demographic information
- Activities before embarkation
- Excursions & activities/meals ashore
- Shipboard meals and activities for 72 hours
Isolation

- **Crew**
  - **Food employee**
    - 48-hour minimum isolation period from last symptom
  - **Non-food employee**
    - 24-hour minimum isolation period from last symptom

- **Passengers**
  - Advised to remain isolated in cabins until well for a minimum of 24-hours from last symptom
  - Corporate Policy
Outbreak Prevention and Response Plan

- Pre-determined triggers and actions
- Immediate reduction in GI cases
  - Removal of virus particles from surfaces
  - Limit movement of ill crew and passengers
  - Separation of ill and well crew members
- Prevent spread to next cruise
Levels of Outbreak Response

- CDC Epi-Aid
- VSP epidemiological investigation
- Targeted environmental health assessment
- Consultation and assessment
Outbreak Updates for International Cruise Ships

Cruise ships participating in the Vessel Sanitation Program are required to report the total number of gastrointestinal (GI) illness cases (including zero cases) evaluated by the medical staff before the ship arrives at a U.S. port when sailing from a foreign port. A separate notification is required when the GI illness count exceeds 2% of the total number of passengers or crew onboard. The data below were obtained from these surveillance reports and from CDC-led investigations. The GI illness cases reported are totals for the entire voyage and do not represent the number of active (symptomatic) GI cases at any given port of call or at disembarkation.

Cruise ship outbreak updates are posted when they include the following criteria:

- fall within the purview of VSP (see about VSP);
- are sailing on voyages from 3 to 21 days;
- are carrying 100 or more passengers, and
- are cruise ships in which 3% or more of passengers or crew reported symptoms of diarrheal disease to the ship's medical staff during the voyage, and
- are gastrointestinal illness outbreaks of public health significance.

The following links provide additional resource information about gastrointestinal illness outbreaks on land and at sea.

- Outbreak Investigation Overview
- Norovirus Activity — United States, 2006–2007
- Molecular and Epidemiologic Trends of Caliciviruses Associated with Outbreaks of Acute Gastroenteritis in the United States, 2000–2004
- Are Noroviruses Emerging?
- Norovirus Activity — United States, 2002
- Food-Related Illnesses and Death in the United States

CDC has not verified all of the case numbers represented in the following updates.

<table>
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<tr>
<th>Year</th>
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<td>Cruise Line</td>
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<td>Dawn Princess</td>
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<td>Norovirus</td>
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<td>06/24-06/21</td>
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<td>Carnival Glory</td>
<td>08/08-08/11</td>
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</tr>
<tr>
<td>Princess Cruises</td>
<td>Sun Princess</td>
<td>07/08-07/21</td>
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<td>02/26-03/04</td>
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<td>02/04-02/05</td>
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<td>Norovirus</td>
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<table>
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<th>Causative Agent</th>
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<tr>
<td>Holland America Line</td>
<td>Ms Mazdam</td>
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<td>Norovirus</td>
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<td>Norwegian Spirit</td>
<td>12/19-12/25</td>
<td>Norovirus</td>
</tr>
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<td>Rymdam</td>
<td>12/11-12/18</td>
<td>Norovirus</td>
</tr>
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<td>Celebrity Cruises</td>
<td>Celebrity Solstice</td>
<td>12/20-12/21</td>
<td>Norovirus</td>
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<td>Holland America Line</td>
<td>Rymdam</td>
<td>11/03-11/20</td>
<td>Norovirus</td>
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<td>Princess Cruises</td>
<td>Sia Princess</td>
<td>05/30-06/09</td>
<td>Norovirus</td>
</tr>
<tr>
<td>Lindblad Expeditions</td>
<td>National Geographic Sea Lion</td>
<td>05/21-05/28</td>
<td>Unknown</td>
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<tr>
<td>Princess Cruises</td>
<td>Sea Princess</td>
<td>05/20-05/30</td>
<td>Norovirus</td>
</tr>
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<td>Celebrity Millennium</td>
<td>05/20-05/27</td>
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<td>Coral Princess</td>
<td>05/04-05/19</td>
<td>Norovirus</td>
</tr>
<tr>
<td>Princess Cruises</td>
<td>Coral Princess</td>
<td>04/24-05/04</td>
<td>Enterotoxigenic E coli (ETEC)</td>
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<tr>
<td>Oceania Cruises</td>
<td>MV Marina</td>
<td>02/28-03/15</td>
<td>Enterotoxigenic E coli (ETEC)</td>
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<tr>
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<td>Celebrity Solstice</td>
<td>01/20-02/04</td>
<td>Norovirus</td>
</tr>
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</table>
Investigation Update on the Dawn Princess

Cruise Line: Princess Cruises
Cruise Ship: Dawn Princess
Voyage Dates: August 21 - September 13, 2012
Number of passengers who have reported being ill during the voyage out of total number of passengers onboard: 114 of 1,778 (6.41%)
Number of crew who have reported being ill during the voyage out of total number of crew onboard: 11 of 851 (1.29%)
Predominant symptoms: vomiting, diarrhea
Causative agent: Norovirus
Actions: In response to the outbreak, Princess Cruises and the crew aboard the ship have taken the following actions:
- Increased cleaning and disinfection procedures according to their outbreak prevention and response plan.
- Made announcements to notify onboard passengers of the outbreak, encourage case reporting, and encourage hand hygiene.
- Collected stool specimens from ill passengers and crew, tested the specimens onboard using a rapid Norovirus test, and made plans to send them to the CDC lab.
- Made twice daily reports of gastrointestinal illness cases to the VSP,
- Has deployed a public health officer from the corporate office to supervise implementation of the ship’s response plan,
- Is consulting with CDC on plans for their super sanitation procedures in Seward, AK.

Two CDC Vessel Sanitation Program environmental health officers will board the ship on arrival in Juneau, AK on September 7, 2012 to conduct an environmental health assessment and evaluate the outbreak and response activities. Stool specimens will be sent to the CDC lab for confirmatory testing and genome sequencing.
Outbreak Response
Trends and Drivers for Outbreak Investigations

- Increased incidence of GI illness
- Increasing rate of AGE outbreaks
- Industry concerns about outbreak trends
- Public concerns for health and safety (including vulnerable populations)
- Public health obligation and expectation
Reasons for Investigating Outbreaks

- **Primary**
  - Eliminate exposure to sources of infection *(Stop spread!)*
  - Develop strategies for control *(Recommendations)*
  - Describe new diseases/learn more about existing diseases

- **Secondary**
  - Evaluate existing prevention strategies
  - Teach/learn epidemiology
  - Address public concern about the outbreak
Documents to Review for “Person” Link

- Manifests of large groups traveling together
- List of non-revenue passengers who may be high risk (i.e., priests, dance instructors)
- All menus for high risk foods
- AGE logs/epi curves for previous voyages
- AGE 72-hour food/activity histories
- Manifest of in-transit passengers
- Public vomiting/diarrhea logs
Documents to Review for “Place” Link

- Dining room seating maps
  - With AGE cases indicated
  - With waiters and assistant waiter’s stations indicated
- Vessel map of cabins with AGE cases
- Vessel’s itinerary
- List of shore excursions and manifests, including meals served
- Public vomiting/diarrhea logs
- Records of pipe maintenance for current and previous voyages
Documents to Review for “Time” Link

- Dining room seating maps
- Itinerary
- Shore excursions
- SeaPass security logs for ports of call of particular epidemiologic interest, based on:
  - Epidemic curve peak
  - Incubation period of suspected pathogen
Other Documents to Review During an Outbreak Response

- Outbreak Prevention Response Plan
- Potable water bunkering, production, and distribution logs
- Potable water bacteriological testing records
- Potable water maintenance records
- RWF logs, including PVI/PDI logs
- Cooling logs for PHF
- Vessel daily newsletter indicating offered activities
Epidemic curve of all cases reported to medical crew by illness onset, Ship A

- Embarkation, Venice, Italy
- Casablanca, Morocco
### Comparison of symptoms by onset date

<table>
<thead>
<tr>
<th>Symptom</th>
<th>Onset before October 19</th>
<th>Onset after October 19</th>
<th>( x^2 )</th>
<th>p-value</th>
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<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
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<tr>
<td>Vomiting</td>
<td>47</td>
<td>59.5</td>
<td>48</td>
<td>31.2</td>
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<tr>
<td>Nausea</td>
<td>49</td>
<td>63.6</td>
<td>67</td>
<td>43.5</td>
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<tr>
<td>Abdominal cramps</td>
<td>27</td>
<td>35.5</td>
<td>85</td>
<td>52.2</td>
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<tr>
<td>Diarrhea</td>
<td>70</td>
<td>82.4</td>
<td>159</td>
<td>90.3</td>
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<tr>
<td>Fever</td>
<td>7</td>
<td>9.7</td>
<td>25</td>
<td>17.0</td>
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<tr>
<td>Muscle aches</td>
<td>10</td>
<td>14.1</td>
<td>27</td>
<td>18.5</td>
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<tr>
<td>Bloody Diarrhea</td>
<td>2</td>
<td>2.7</td>
<td>3</td>
<td>2.1</td>
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</table>

**Indicative of two pathogens, viral and bacterial**
## Assessment of elevated risk of illness by shore activity in Casablanca, Morocco on October 18

<table>
<thead>
<tr>
<th>Shore excursion</th>
<th>III</th>
<th></th>
<th>Well</th>
<th></th>
<th>RR§</th>
<th>95% CI†</th>
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<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
<td></td>
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</tr>
<tr>
<td>100a</td>
<td>123</td>
<td>45.1</td>
<td>139</td>
<td>7.0</td>
<td>6.5</td>
<td>5.3, 8.0*</td>
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<tr>
<td>105a</td>
<td>26</td>
<td>9.5</td>
<td>213</td>
<td>9.39</td>
<td>0.9</td>
<td>0.6, 1.3</td>
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<tr>
<td>200a</td>
<td>26</td>
<td>9.5</td>
<td>381</td>
<td>19.1</td>
<td>0.5</td>
<td>0.3, 0.7*</td>
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<tr>
<td>205a</td>
<td>20</td>
<td>7.3</td>
<td>218</td>
<td>10.9</td>
<td>0.7</td>
<td>0.4, 1.0</td>
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<tr>
<td>290a</td>
<td>26</td>
<td>9.5</td>
<td>280</td>
<td>14.3</td>
<td>0.7</td>
<td>0.5, 1.0</td>
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<tr>
<td>Went ashore, no organized excursion</td>
<td>41</td>
<td>15.0</td>
<td>596</td>
<td>29.9</td>
<td>0.5</td>
<td>0.4, 0.7*</td>
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<tr>
<td>Did not go ashore</td>
<td>26</td>
<td>9.5</td>
<td>208</td>
<td>10.4</td>
<td>0.9</td>
<td>0.6, 1.3</td>
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</table>

§RR, Relative risk
†95% CI, 95% Confidence interval
*Statistically significant at p = .05
Assessment of elevated risk of illness by food consumption, Marrakesh shore excursion 100a on October 18

<table>
<thead>
<tr>
<th>Food Item</th>
<th>Ill</th>
<th>Well</th>
<th>RR $</th>
<th>95% CI†</th>
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<tr>
<td></td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Mint tea</td>
<td>61</td>
<td>41.8</td>
<td>65</td>
<td>16.0</td>
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<tr>
<td>Vegetables</td>
<td>87</td>
<td>72.5</td>
<td>68</td>
<td>50.0</td>
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<tr>
<td>Cabbage</td>
<td>52</td>
<td>43.3</td>
<td>42</td>
<td>30.9</td>
</tr>
<tr>
<td>Beets</td>
<td>66</td>
<td>55.0</td>
<td>56</td>
<td>41.2</td>
</tr>
<tr>
<td>Rice with spices</td>
<td>86</td>
<td>71.7</td>
<td>76</td>
<td>55.9</td>
</tr>
<tr>
<td>Couscous with vegetables</td>
<td>105</td>
<td>87.5</td>
<td>101</td>
<td>74.3</td>
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<tr>
<td>Chicken</td>
<td>112</td>
<td>93.3</td>
<td>112</td>
<td>82.5</td>
</tr>
<tr>
<td>Bread</td>
<td>114</td>
<td>95.0</td>
<td>117</td>
<td>86.0</td>
</tr>
<tr>
<td>Bottled water</td>
<td>83</td>
<td>69.2</td>
<td>88</td>
<td>64.7</td>
</tr>
<tr>
<td>Cookie</td>
<td>49</td>
<td>40.8</td>
<td>72</td>
<td>52.9</td>
</tr>
</tbody>
</table>

§RR, Relative risk
†95% CI, 95% Confidence interval
*Statistically significant at p=.05
Lab Results

- Eight clinical specimens sent to CDC's Calicivirus lab and Bacterial lab

- Positive for norovirus
  - 1st GII.4 Sydney outbreak at CDC

- All specimens after Oct. 19 also positive for ETEC
Case Studies

Case 2
Epidemic Curve of all cases reported to medical crew by illness onset, Ship B

Number of Cases

Date of Self-Reported Symptom Onset

Food provisioned in Peru

Crew

Passengers
Assessment of self-reported food consumption by cases in 48 hours prior to illness onset, Ship B

<table>
<thead>
<tr>
<th>Food Item</th>
<th>Date of onset</th>
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<th>Day before onset</th>
<th></th>
<th>48 hours before onset</th>
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<td>%</td>
<td>n</td>
<td>%</td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Greens</td>
<td>5</td>
<td>22.7</td>
<td>7</td>
<td>22.6</td>
<td>8</td>
<td>28.6</td>
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<tr>
<td>Mixed fruit</td>
<td>18</td>
<td>34.2</td>
<td>9</td>
<td>28.1</td>
<td>8</td>
<td>34.8</td>
</tr>
<tr>
<td>Lettuce</td>
<td>7</td>
<td>28.0</td>
<td>8</td>
<td>29.6</td>
<td>5</td>
<td>20.8</td>
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<tr>
<td>Tomatoes</td>
<td>5</td>
<td>20.0</td>
<td>9</td>
<td>33.3</td>
<td>5</td>
<td>20.8</td>
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<tr>
<td>Seafood</td>
<td>8</td>
<td>29.6</td>
<td>11</td>
<td>35.5</td>
<td>6</td>
<td>27.3</td>
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<td>Soup</td>
<td>10</td>
<td>37.0</td>
<td>12</td>
<td>38.7</td>
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<td>32.1</td>
</tr>
<tr>
<td>Orange/juice</td>
<td>11</td>
<td>29.0</td>
<td>14</td>
<td>43.8</td>
<td>10</td>
<td>34.5</td>
</tr>
</tbody>
</table>

*Note: These data are from cases only. There is not well comparison group to determine relative risk, so it is difficult to know which food items were just popular among both ill and well.
Lab Results

- Ten clinical specimens sent to CDC's Calicivirus lab and Bacterial lab
- Nine food samples sent to Bacterial lab
- Tested specimens were negative for norovirus and rotavirus
  - Tested for rotavirus based on reports of community level illness in port cities visited in South America
- Two clinical specimens positive for ETEC
- Romaine lettuce positive for ETEC
AGE Outbreaks by Pathogen and Year, January 1, 1994 to December 31, 2012
Questions?

www.cdc.gov/nceh/vsp
For more information please contact Centers for Disease Control and Prevention

Vessel Sanitation Program

LT Drew Kupper
JNQ2@cdc.gov
770-488-1554

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TTY: 888-232-6348

Email: vsp@cdc.gov / Web: www.cdc.gov/nceh/vsp

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.