Public Health Reporting and Surveillance of *Vibrio* Infection in Massachusetts

Johanna Vostok, MPH
Epidemiologist
Massachusetts Department of Public Health
Bureau of Infectious Disease
Overview

- Reporting of *Vibrio*
- *Vibrio* case investigation
- Incidence in the United States & Massachusetts
- *Vibrio parahaemolyticus* and oysters in Massachusetts
- Traceback investigation
- Preventing infection
Reporting of Vibrio
Nationally Reportable Condition

- *Vibrio cholera* has been reportable in Massachusetts since 1964
- Vibriosis (non-cholera) became a nationally reportable disease in 2007
  - Reported through the National Notifiable Diseases Surveillance System (NNDSS)
Reporting *Vibrio* in Massachusetts

Healthcare providers and clinical laboratories are required by law to report infectious diseases to public health

– Chapter 105, Code of Massachusetts Regulations (CMR), Section 300.00: Reportable Diseases, Surveillance, and Isolation & Quarantine Requirements

Reporting is lab-based

– Primarily occurs through electronic laboratory reporting (ELR)
Illness reported to public health

Laboratory identifies pathogen

Laboratory tests for pathogen

Specimen submitted for testing

Person seeks medical care

Iceberg of public health reporting
<table>
<thead>
<tr>
<th>Disease Agents</th>
<th>Percentage change in 2013 compared with 2006–2008</th>
<th>2013 rate per 100,000 Population</th>
<th>2020 target rate per 100,000 Population</th>
<th>CDC estimates that...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Campylobacter</td>
<td>🙁 13% increase</td>
<td>13.82</td>
<td>8.5</td>
<td>For every Campylobacter case reported, there are 30 cases not diagnosed</td>
</tr>
<tr>
<td>Escherichia coli O157</td>
<td>No change</td>
<td>1.15</td>
<td>0.6</td>
<td>For every E. coli O157 case reported, there are 26 cases not diagnosed</td>
</tr>
<tr>
<td>Listeria</td>
<td>No change</td>
<td>0.26</td>
<td>0.2</td>
<td>For every Listeria case reported, there are 2 cases not diagnosed</td>
</tr>
<tr>
<td>Salmonella</td>
<td>No change</td>
<td>15.19</td>
<td>11.4</td>
<td>For every Salmonella case reported, there are 29 cases not diagnosed</td>
</tr>
<tr>
<td><strong>Vibrio</strong></td>
<td>🙁 75% increase</td>
<td>0.51</td>
<td>0.2</td>
<td>For every <em>Vibrio parahaemolyticus</em> case reported, there are 142 cases not diagnosed</td>
</tr>
<tr>
<td>Yersinia</td>
<td>No change</td>
<td>0.36</td>
<td>0.3</td>
<td>For every Yersinia case reported, there are 123 cases not diagnosed</td>
</tr>
</tbody>
</table>

For more information, see [http://www.cdc.gov/foodnet/](http://www.cdc.gov/foodnet/)

Preliminary FoodNet 2013 Data

April 2014
Vibrio Case Investigation
Vibrio Case Investigation

• Conducted using the state’s case management system, the Massachusetts Virtual Epidemiologic Network (MAVEN)

• Responsibility of case investigation falls on the state’s 351 local boards of health
Management of cases in Massachusetts: Massachusetts Virtual Epidemiologic Network (MAVEN)

---

**Event Summary**

<table>
<thead>
<tr>
<th>Basic Information</th>
<th>Notes (Add/Edit/Mine)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Event ID: 100024160</td>
<td>05/04/2015 11:25 AM (Generic) - Johanna Vostok [vostoktest]</td>
</tr>
<tr>
<td>Event: Vibrio sp.</td>
<td>Interviewed case this morning. He reported consuming six raw oysters as an appetizer at the Broad Street Restaurant on Saturday. He chose which types of oysters he wanted from the menu. 3 Wellfleet oysters and 3 Duxbury oysters.</td>
</tr>
<tr>
<td>Person: John Snow 05/04/2015 10:45 AM (Generic) - Johanna Vostok [vostoktest]</td>
<td>Birth Date: 03/15/1913 (Male)</td>
</tr>
<tr>
<td>Phone: (617) 500-0000</td>
<td>Event Date: 08/09/2014</td>
</tr>
<tr>
<td>Investigation Status: Open</td>
<td>Event Status: Suspect</td>
</tr>
<tr>
<td>Linked Events/Contacts: 0 linked event(s)/contact(s) (View)</td>
<td>Event Type: Symptom Onset Date Age at time of event: 101.39</td>
</tr>
<tr>
<td>Attachments: 0 attachment(s) (Add)</td>
<td>Age unit: Years</td>
</tr>
<tr>
<td>Notifications: Event Date: 08/09/2014</td>
<td>From May 1 - October 31, 2015, Vibrio parahaemolyticus cases are being treated as immediate events in MAVEN to allow for expedited interview of cases and prompt traceback of seafood. Please interview the case as soon as possible to identify any</td>
</tr>
</tbody>
</table>

---

**Event Information**

**Lab Results**

**Question Packages**

<table>
<thead>
<tr>
<th>QUESTION PACKAGE</th>
<th>PERSON</th>
<th>LAST UPDATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Administrative</td>
<td>Event</td>
<td>10/07/2014</td>
</tr>
<tr>
<td>2. Demographic</td>
<td>John Snow</td>
<td>10/08/2014</td>
</tr>
<tr>
<td>3. Clinical</td>
<td>John Snow</td>
<td>10/08/2014</td>
</tr>
<tr>
<td>4. Vaccine and IG Information</td>
<td>John Snow</td>
<td>10/07/2014</td>
</tr>
<tr>
<td>5. Risk/Exposure/Control &amp; Prevention</td>
<td>John Snow</td>
<td>05/04/2015</td>
</tr>
<tr>
<td>6. Epi-linked and Outbreak Information</td>
<td>John Snow</td>
<td>10/07/2014</td>
</tr>
<tr>
<td>7. Traceback</td>
<td>John Snow</td>
<td>11/10/2014</td>
</tr>
</tbody>
</table>

---
<table>
<thead>
<tr>
<th>Lab No.</th>
<th>Specimen Date</th>
<th>Specimen Number</th>
<th>Specimen Source</th>
<th>Test</th>
<th>Result</th>
<th>Lab</th>
<th>Ordering Facility</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>07/16/2014</td>
<td>20140001</td>
<td>Stool</td>
<td>Microorganism: Prld: Pt: xxx: Nom: Culture</td>
<td>Vibrio parahaemolyticus</td>
<td>South Shore Hospital Inc - ...</td>
<td>South Shore Hospital Inc - ...</td>
</tr>
<tr>
<td>2</td>
<td>07/16/2014</td>
<td>14EN0001</td>
<td>Stool</td>
<td>Microorganism: Prld: Pt: xxx: Nom: Culture</td>
<td>Vibrio parahaemolyticus</td>
<td>William A Hinton State Labo...</td>
<td>South Shore Hospital Inc - ...</td>
</tr>
</tbody>
</table>

[Add Lab Result] [Update Lab Result] [Delete Lab Result]
### MAVEN Clinical Question Package

<table>
<thead>
<tr>
<th>Diagnosis date:</th>
<th>07/17/2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Did case have symptoms?</td>
<td>Yes</td>
</tr>
<tr>
<td>Symptom onset date:</td>
<td>07/14/2014</td>
</tr>
<tr>
<td>Symptom onset time:</td>
<td>04:00</td>
</tr>
<tr>
<td>Duration of symptoms:</td>
<td>4</td>
</tr>
<tr>
<td>Abdominal cramps:</td>
<td>Yes</td>
</tr>
<tr>
<td>Bloody Stool:</td>
<td>No</td>
</tr>
<tr>
<td>Bullae:</td>
<td>No</td>
</tr>
<tr>
<td>Cellulitis:</td>
<td>No</td>
</tr>
<tr>
<td>Diarrhea:</td>
<td>Yes</td>
</tr>
<tr>
<td>Max # of stools in 24 hours:</td>
<td>12</td>
</tr>
<tr>
<td>Fever:</td>
<td>No</td>
</tr>
<tr>
<td>Headache:</td>
<td>Yes</td>
</tr>
<tr>
<td>Muscle aches/pains (myalgia):</td>
<td>Yes</td>
</tr>
<tr>
<td>Nausea:</td>
<td>No</td>
</tr>
<tr>
<td>Shock:</td>
<td>No</td>
</tr>
<tr>
<td>Vomiting:</td>
<td>Yes</td>
</tr>
<tr>
<td>Other symptoms (specify):</td>
<td></td>
</tr>
<tr>
<td>Does patient have underlying illness?</td>
<td>Yes</td>
</tr>
<tr>
<td>Please specify:</td>
<td>Heart disease</td>
</tr>
</tbody>
</table>
### MAVEN Risk Question Package

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Did case travel out-of-state or out-of-country during incubation period?</td>
<td>No</td>
</tr>
<tr>
<td>Have close contacts had similar illness during incubation period?</td>
<td>No</td>
</tr>
<tr>
<td>Did the case consume any high-risk animal products during incubation period?</td>
<td>Yes</td>
</tr>
</tbody>
</table>

#### Product type: Oysters
- **When purchased:** 07/13/2015
- **When consumed:** 07/13/2015
- **Time consumed (i.e., 09:30 AM):** 05:00 PM
- **Amount consumed:** 6
- **Was it harvested by the case or a friend of the case?** No
- **Where purchased/obtained:** Broad Street Restaurant
  - **Type of location where purchased:** Oyster bar or restaurant
  - **Contact Name/Address/Phone # for purchase location:**
    - Broad Street Restaurant
    - 10 Elm Street
    - Boston, MA
    - (617) 555-0000

| Where did the product originate from:                                   | 3 Welfleet oysters, 3 Duxbury oysters |
| How was it prepared after purchase?                                    | Raw |
High-risk materials include bodies of water, drippings from raw or live seafood, or other marine or freshwater life.

During incubation period, was case's skin exposed to any high-risk materials? **Yes**

Exposure type: Body of water

Specify: Boston Harbor

Date: 07/12/2015

Time: 3:00

Activity at time of exposure:

- [x] Boating/skiing/surfing
- [ ] Construction/repairs
- [ ] Handling/cleaning seafood
- [x] Swimming/diving/wading
- [ ] Walking on beach/shore/fell on rocks
- [ ] Other

Water type: Brackish

Did the patient sustain a wound or have a pre-existing wound? **No**
Incidence in the United States & Massachusetts
Confirmed *Vibrio* cases in Massachusetts by species
May 1 – October 31

Data current as of October 19, 2015
Data source: Bureau of Infectious Disease.
“Other” Vibrio species
2008-2015

• Includes Vibrio cholerae, Vibrio vulnificus
  – 0-3 cases of Vibrio vulnificus reported annually
    • 52% associated with out-of-state travel
  – 0-8 cases of Vibrio cholerae reported annually
    • 50% associated with out-of-state travel
Vibrio parahaemolyticus and Oysters in Massachusetts
Vibrio parahaemolyticus

• Naturally inhabits coastal waters of the US and Canada
• Present in higher concentrations during the summer
• Normally present in many types of raw seafood
  – Not all strains are pathogenic
  – Gastrointestinal illness is commonly associated with raw oyster consumption
Why oysters?

Oysters are filter feeders
  – Feed on particles (algae) in surrounding seawater by filtering water through gills
  – Each oyster filters 50 gallons of water per day
  – Oysters can accumulate *Vibrio* as they filter water
    • May result in concentrations 100 times greater than those found in surrounding seawater
Why oysters?

• *Vibrio parahaemolyticus* levels in oysters are influenced by environmental conditions, harvest methods, and handling after harvest
  – Time-temperature abuse promotes growth of bacteria
• Commonly consumed raw
  – No opportunity for *Vibrio* to be killed
Vibrio Traceback Investigation
Lab-confirmed *Vibrio* infection identified → DPH Bureau of Infectious Disease notified → Case interviewed → Consumed oysters → Shellfish tags collected → Retail/wholesale establishment visited → DPH Bureau of Environmental Health notified → Division of Marine Fisheries notified → Harvest area/grower visited
Preventing Infection
Preventing Infection: *Vibrio parahaemolyticus* Control Plan

- First implemented in 2012 due to warming air and water temperatures
- Developed by the Division of Marine Fisheries and DPH Bureau of Environmental Health
- Aims to:
  - Manage time-temperature conditions relative to oyster harvest and handling
  - Prevent/limit post-harvest growth of *Vibrio parahaemolyticus* in oysters
Confirmed *Vibrio* cases in Massachusetts by species, May 1 – October 31

Data current as of October 19, 2015
Data source: Bureau of Infectious Disease.
Confirmed *Vibrio parahaemolyticus* cases in Massachusetts, 2013: week reported to MDPH vs. week of seafood consumption

Data current as of May 2015
Data source: Bureau of Infectious Disease.

5 cases with oyster exposure and no consumption date; 18 with no or unknown seafood consumption.
Bacterial outbreak roils Mass. oyster industry

Published September 16, 2013 • Associated Press

BOSTON – A mystery of sorts threatens to stunt Massachusetts’ small but growing oyster industry after illnesses linked to bacterial contamination forced the state to shut down beds for the first time ever.

The culprit is the Vibrio parahaemolyticus bacterium, which has occurred in state waters since the 1960s. Theories abound about the recent increase in illnesses linked to Massachusetts, but those are only theories.

“This marks the first time the state has closed specific oyster beds...”

“...this year's closures affect about 14 percent of Massachusetts growers...”
Preventing Infection: Improved Communication

• Changes made after 2013 season:
  – Vibrio Working Group established
  – Improved training and guidance for local public health nurses
  – Improved management of information using MAVEN
Vibrio Working Group

- First meeting April 15, 2014
- Discuss new cases under investigation
- Aggregate traceback information across cases
  - Discuss possible closures of harvest areas
- Work to improve Vibrio investigation in Massachusetts
PUBLIC HEALTH FACT SHEET

Vibrio parahaemolyticus Infection

What is Vibrio parahaemolyticus?

V. parahaemolyticus is a germ (a bacterium) in the same family as the bacteria that causes cholera. This germ naturally lives in coastal waters in the United States and causes an infection of the bowel.

What are the symptoms of V. parahaemolyticus infection?

A person may have watery diarrhea, often with stomach cramps, nausea, vomiting, and abdominal pain. Symptoms usually appear within 24 hours of swallowing the germs. Illness usually lasts from one to four days. People with weakened immune systems or chronic liver disease are at a higher risk of being infected.

How does infection with V. parahaemolyticus occur?

V. parahaemolyticus must be swallowed to cause illness in most cases. This usually happens by eating food or drinking water that is contaminated with the germs. Most people become infected by eating raw or undercooked shellfish, particularly oysters. Illness can also occur by eating undercooked clams or shrimp. Less commonly, this germ can cause an infection in the skin when an open wound comes in contact with warm seawater. It is not spread from person to person.

How is V. parahaemolyticus infection diagnosed and treated?

Your doctor, nurse, or health center must send a stool, wound, or blood sample to a laboratory to test for V. parahaemolyticus. Treatment is usually not needed because the illness usually goes away on its own in two to five days. In some cases, antibiotics may be prescribed. There is no evidence that antibiotics decrease the length of the illness. People usually recover on their own in two to five days.

How can V. parahaemolyticus infection be prevented?

Most infections caused by V. parahaemolyticus in the United States can be prevented by not consuming raw or undercooked shellfish. When an outbreak is traced back to an oyster or other shellfish bed, health officials may close the bed until the salt and temperature conditions are less favorable for this germ. People should not consume oysters self-harvested from closed or contaminated oyster or clam beds. Wound infections can be prevented by avoiding exposure of open wounds to warm seawater.

Preparing oysters and other shellfish in the shell:

- **Before cooking:** Discard any with open shells
- **During cooking:** Boil for 3-5 minutes after shells open
- **After cooking:** Discard any with shells that did not open

Preparing shucked oysters:

- **Boil or simmer for at least 3 minutes or until the edges curl**
- **Fry at 375 degrees Fahrenheit for at least 3 minutes**
- **Broil 3 inches from heat for 3 minutes**
- **Bake at 450 degrees Fahrenheit for 10 minutes**

Are there any health regulations for people with V. parahaemolyticus?

Yes. Health care providers are required by law to report cases of illness to the local board of health. In order to protect the public, workers at food-related businesses diagnosed with V. parahaemolyticus infection are advised not to return to work until their diarrhea is gone. Food-related businesses include restaurants, sandwich shops, hospital kitchens, supermarkets, dairy or food-processing plants. This also includes workers in schools, residential programs, day-care and health care facilities who feed, give mouth care or give medicine to clients.
### MAVEN Traceback Question Package

<table>
<thead>
<tr>
<th>Question Area</th>
<th>Information Provided</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distributor (name, address, phone)</td>
<td>Oyster Lovers LLC, 100 Main St, Wellfleet MA 508-222-0000</td>
</tr>
<tr>
<td>Distributor certification number</td>
<td>165 982</td>
</tr>
<tr>
<td>Was an inspection completed for this distributor?</td>
<td>Yes</td>
</tr>
<tr>
<td>Distributor inspection date</td>
<td>05/06/2015</td>
</tr>
<tr>
<td>Original Shippers Certification Number</td>
<td>123 456</td>
</tr>
<tr>
<td>Implicated food item</td>
<td>Oysters</td>
</tr>
<tr>
<td>How was product distributed to retail outlet?</td>
<td>Shellstock</td>
</tr>
<tr>
<td>Name of retail establishment</td>
<td>Broad Street Restaurant</td>
</tr>
<tr>
<td>Was an inspection completed for this retail establishment?</td>
<td>Yes</td>
</tr>
<tr>
<td>Establishment inspection date</td>
<td>05/06/2015</td>
</tr>
<tr>
<td>Date retail outlet received product</td>
<td>05/01/2015</td>
</tr>
<tr>
<td>MA harvest location</td>
<td>Cape Cod Bay, CCB11 - Wellfleet Harbor</td>
</tr>
<tr>
<td>Designated Shellfish Growing Areas</td>
<td></td>
</tr>
<tr>
<td>Was seafood imported from another country?</td>
<td>Yes</td>
</tr>
<tr>
<td>Are shipping tags available from the suspect lot?</td>
<td>Yes</td>
</tr>
<tr>
<td>Harvest Date</td>
<td>04/20/2015</td>
</tr>
<tr>
<td>Are physical characteristics of the harvest area available?</td>
<td>Yes</td>
</tr>
<tr>
<td>Maximum ambient temperature</td>
<td>90</td>
</tr>
<tr>
<td>Surface water temperature</td>
<td>60</td>
</tr>
<tr>
<td>Salinity (ppt)</td>
<td>35</td>
</tr>
<tr>
<td>Total rainfall (inches in previous 5 days):</td>
<td>1.2</td>
</tr>
<tr>
<td>Fecal coliform count</td>
<td>5</td>
</tr>
<tr>
<td>Was there evidence of improper storage, cross-contamination, or holding temperature at any point?</td>
<td>No</td>
</tr>
</tbody>
</table>

#### Designated Shellfish Growing Areas
- No
- Yes

#### Harvest Date
- 04/20/2015
Confirmed *Vibrio parahaemolyticus* cases in Massachusetts, 2015: week reported to MDPH vs. week of seafood consumption

Data current as of October 5, 2015
Data source: Bureau of Infectious Disease.

1 VP case with seafood exposure and no consumption date; 8 with no or unknown seafood consumption.
Summary
In Summary...

• *Vibrio* case investigation begins with report of a positive clinical laboratory result

• Approximately 70% of *Vibrio* cases reported in Massachusetts are *Vibrio parahaemolyticus*

• Each case of *Vibrio parahaemolyticus* with reported oyster consumption is investigated by three state agencies
  – Case information is aggregated to inform public health action
Thank you

Questions?
Johanna.Vostok@state.ma.us

DPH Bureau of Infectious Diseases
Kevin Cranston
Dr. Larry Madoff
Dr. Al DeMaria
Pat Kludt
Scott Troppy
Sue Soliva
Emily Harvey

DPH Bureau of Environmental Health
Suzanne Condon
Michael Moore
Eric Hickey
Julian Cyr
Kim Foley

Brandi Hopkins
Mike Antaya
Steve Rice
Marc Correia
John Racioppi
Erich Garger

Division of Marine Fisheries
Mike Hickey
Chris Schillaci
Tom Shields

Office of Law Enforcement
Len Roberts
Patrick Moran