

Diving into Vibriosis



Laurie Stewart, MS

- Foodborne and Waterborne Disease Epidemiologist
- Washington State Department of Health





Welcome!

- Washington State Integrated Food Safety
 Center of Excellence
- Established 2019
- Collaboration between Washington State Department of Health and University of Washington Department of Epidemiology
- Western Region: AK, CA, Guam, HI, ID, NV, OR, WA



Who We Are



The Washington Integrated Food Safety Center of Excellence serves as a resource for other state and local public health partners to help:

- Strengthen & Improve foodborne illness surveillance and response
- Evaluate & Analyze the effectiveness of outbreak detection and investigation
- Train & Educate the public health workforce about best practices for foodborne outbreak response
- Disseminate & Communicate tools and resources relating to foodborne and enteric illnesses



Today's Presenter:

Laurie Stewart, MS

- Foodborne and Waterborne Disease Epidemiologist
- Washington State Department of Health



Overview



This training focuses on:

The organisms that cause vibriosis

Vibriosis illness syndromes

Typical components of a vibriosis illness investigation:

- Illness Investigation
- Environmental Health assessment
- Seafood trace-back

Identifying vibriosis clusters and outbreaks

This training is primarily for:

Public health staff (epidemiology/environment al health) who investigate vibriosis cases and/or conduct environmental health assessments in response to vibriosis cases or outbreaks.



Learning Objectives



By the end of this training you will be able to:

- Identify the three Vibrio species most likely to cause human disease in the US
- Describe three interview questions that can be used to elicit a detailed shellfish history
- Explain how shellfish traceback information is used to identify vibriosis outbreaks

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14 Vibrio species and 2 non-Vibrio organisms cause vibriosis

These organisms prefer warm salt or brackish water

Does not include toxigenic *Vibrio cholerae* O1 or O139 which causes the disease "cholera"





Organism

Grimontia hollisae

Non-toxigenic Vibrio cholerae (non-O1, non-O139)

Photobacterium damselae subsp. damselae

Vibrio alginolyticus

Vibrio fluvialis

Vibrio furnissii

Vibrio harveyi

Vibrio metschnikovii

Vibrio mimicus

Vibrio parahaemolyticus

Vibrio vulnificus





Organism

Grimontia hollisae

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Vibrio metschnikovii

Vibrio mimicus

Vibrio parahaemolyticus

Vibrio vulnificus



	7	
		7
×		

Rank	Organism		
1	Vibrio parahaemolyticus		
2	Vibrio alginolyticus		
3	Vibrio vulnificus		
4	Non-toxigenic <i>Vibrio cholerae</i> (non-O1, non-O139)		
5	Vibrio fluvialis		
6	Vibrio mimicus		
7	Grimontia hollisae		
8	Photobacterium damselae subsp. damselae		
	Vibrio furnissii		
Approximately Tied	Vibrio metschnikovii		
1100	Vibrio harveyi		
Rare	V. campbellii, Vibrio cincinnatiensis, V. metoecus, V. navarrensis		



Cases by Vibrio spp. in US 2014*



Rank (US)	Organism	Cases
1	Vibrio parahaemolyticus**	605
2	Vibrio alginolyticus**	239
3	Vibrio vulnificus**	123



^{*} Centers for Disease Control and Prevention (CDC). Summary of Human Vibrio Cases Reported to CDC, 2014. Atlanta, Georgia: US Department of Health and Human Services, CDC, 2016.

^{**} Single species infection only

Hospitalization by *Vibrio* spp. in US 2014*

Organism	Hospitalization
Vibrio parahaemolyticus**	15% (86/575)
Vibrio alginolyticus**	14% (32/222)
Vibrio vulnificus**	79% (97/123)



^{*} Centers for Disease Control and Prevention (CDC). Summary of Human Vibrio Cases Reported to CDC, 2014. Atlanta, Georgia: US Department of Health and Human Services, CDC, 2016.

^{**} Single species infection only

Mortality by Vibrio spp. in US 2014*



Organism	Deaths
Vibrio parahaemolyticus**	1% (4/389)
Vibrio alginolyticus**	0
Vibrio vulnificus**	18% (21/117)



^{*} Centers for Disease Control and Prevention (CDC). Summary of Human Vibrio Cases Reported to CDC, 2014. Atlanta, Georgia: US Department of Health and Human Services, CDC, 2016.

^{**} Single species infection only

Vibriosis Illness





Vibriosis Illness: Three Syndromes



Gastroenteritis

Skin, wound or ear infections

Septicemia



Vibriosis: Gastroenteritis



Exposure	Consuming raw or undercooked seafood, foods cross-contaminated with raw or undercooked seafood or cooked shellfish stored in sea water					
Incubation period	4 to 96 hours (typically within 24 hours)					
Symptoms	Watery diarrhea, often with abdominal cramping, nausea, vomiting, fever (can progress to septicemia)					
Duration	Days to weeks					
Transmission	Not transmitted person-to-person,					
Most likely cause	V. Parahaemolyticus (non-toxigenic V. cholerae, V. fluvialis)					



Vibriosis: Skin, wound or ear infections



Exposure	Swimming, working, fishing, etc. in salt or brackish water, especially with pre-existing wounds
Incubation period	Usually within 7 days of exposure
Symptoms	Pain, redness, swelling (can progress to necrotizing fasciitis and septicemia)
Duration	Days to weeks
Transmission	Not transmitted person-to-person
Most likely cause	V. alginolyticus, V. vulnificus



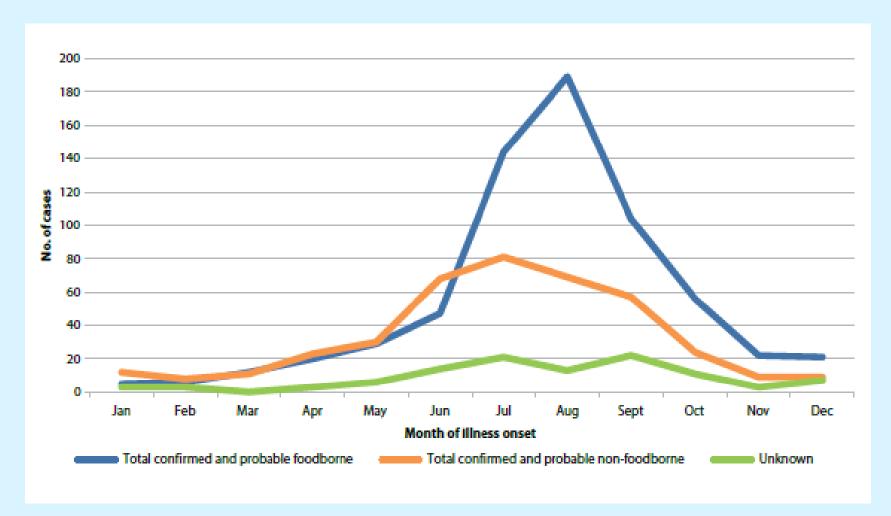
Vibriosis: Septicemia



Exposure	 Consuming raw or undercooked seafood, foods cross-contaminated with raw or undercooked seafood or cooked shellfish stored in sea water Swimming, working, fishing, other recreation in salt or brackish water, especially with pre-existing wounds
Incubation period	12 to 72 hours
Symptoms	Fever, chills, dangerously low-blood pressure, blistering skin lesions (bullae)
Duration	Days to weeks
Transmission	Not transmitted person-to-person
Most likely cause	V. vulnificus



Domestically acquired vibriosis cases, by month of illness onset or specimen collection date and transmission route, 2014 (N=1,162*) — CDC COVIS Annual Summary 2014





Vibriosis Illness: Diagnosis



Culture (stool, wound or ear swab, blood):

 Stool culture requires special media (not always included in stool panel for diarrheal illness)

Culture-Independent Diagnostic Testing (CIDT):

- Included in some enteric pathogen PCR panels
- Currently only available for stool samples
- Disadvantage is that no isolate results from CIDT testing



Risk Factors for Infection or Complications



Risk Factors for Infection or Complications
Liver disease (including alcoholic cirrhosis)
Cancer
Diabetes
Immunosuppressive therapy
Hematological disease
Reduced stomach acid
Kidney disease
Increased age
Immunosuppressive disease (HIV)



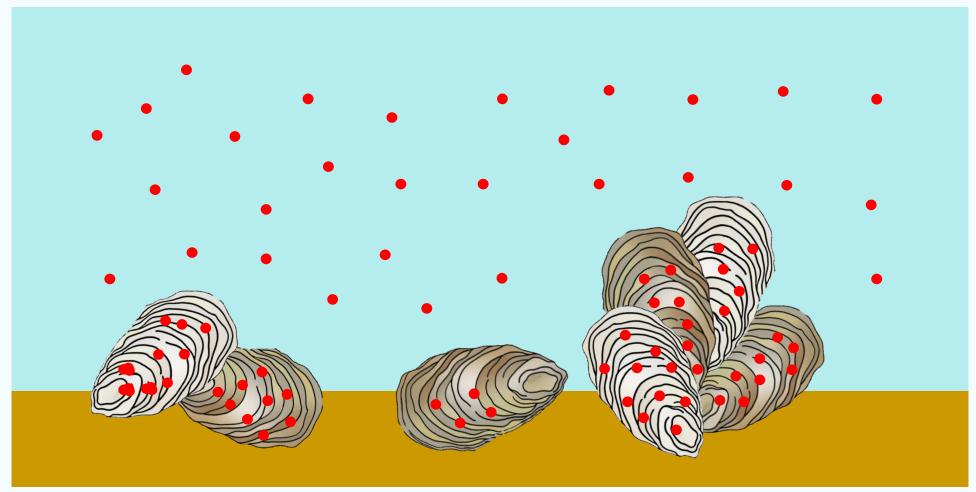


Vibriosis Case Investigations



Focus on Molluscan Bivalves







Harvester Shellfish Tag



HARVESTER IDENTIFICATION NO .: HARVEST DATE: HARVEST LOCATION: TYPE OF SHELLFISH: QUANTITY OF SHELLFISH: THIS TAG IS REQUIRED TO BE ATTACHED UNTIL CONTAINER IS EMPTY AND THEREAFTER KEPT ON FILE FOR 90 DAYS.



Vibriosis Case Investigation



Case Investigation Steps:

Case

Interview

Field investigation

Seafood Traceback

3

Identify clusters and outbreaks

Report



Vibriosis Case Investigation: Interview



- Interview all cases using a standardized questionnaire
- Complete the CDC Cholera and other Vibrio Illness Surveillance Form (COVIS) (see <u>Resources</u> section)

REPORTING HEALTH DEPARTMENT					State will	PLETED REPORT TO STATE INFECTION CONTI
State City			County/Paris	h	covisresponse@cdc.gov E-Tax: 404-235-1735 Center for Disease Control a d Prevention Enteric Eleases Epidemiology Branch 1000 Ciliton Road, MG CE9 Atlanta, GA 30333	
L. PATIENT CASE INFORMATIO	N					
 First 3 letters of patient's last n 	ame:			2. Sex: 🗆 N	□F	□ Unk
3. Date of birth (MM/DD/YYYY): _		4. Age:	MONTHS	3. NNDSS ca	se ID	4. Case state ID (required)
i. Race: American Indian/Alask	a Native □ Whit			6. Ethnicity:	☐ Hispani	c/Latino
□ Black or African Ameri	can Othe	r		☐ Not Hisp	anic/Latino	☐ Unknown/not provided
■ Native Hawaiian or oth Islander	her Pacific Unkn	nown/not provide	d	7. Occupation	on:	
. LABORATORY INFORMATIO						
V. Choleree non-O1, non-O139—CHN V. furnissil—FUR V. vulniflous—VUL detected case (no lab results) Laboratory results (if more than one specimen is tested, complete one row per specimen. If more than two specimens were						Multiple species—MUL (Specify below) ipidemiologically linked to a laboratory intented executor link equility.
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Vibriosis Case Investigation: Interview



Shellfish interviewing tips for restaurant meal:

- Look up the restaurant menu online
- What was the date and time of meal?
- Which meal (dinner, brunch, happy hour)?
- Which menu (dinner menu, special oyster menu, happy hour)?
- What is the name and description of the item?
- How many varieties and how much did they eat?
- Do they have receipts, photos, etc.?





Vibriosis Case Investigation: Interview



Shellfish interviewing tips: Seafood stand or grocery store

- What is date and time of purchase?
- What is date and time of consumption?
- How was product handled between purchase and consumption?
- Do they have receipt? If not, did they use a "shopper card"?
- How was seafood purchased?
 - In the shell
 - Pre-shucked (do they have packaging including lid)





Which Seafood Should be Investigated?



5. SEAFOOD INVESTIGATION (Please complete one copy of this page for each type of seafood ingested and investigated, and identify			
investigation page number below. Completion of this page is optional for probable cases.)			
Seafood Investigation page of			
Product information			
1. Type of seafood being investigated: 2. Date consumed (MM/DD/YY):			
3. Amount consumed (e.g., 6 oysters, 1 filet, 5oz, etc.) :			
4. How prepared: ☐ Fully cooked ☐ Undercooked ☐ Raw ☐ Unknown			
5. Additional relevant information on product preparation (e.g., specific variety of seafood consumed and plating:			
6. Was this fish or shellfish harvested by the patient or a friend of the patient? 🗖 Yes 🗖 No 🗖 Unknown			
If yes, skip to source information questions. If no, complete entire page as possible.)			

see Vibrio Toolkit in Tools and Resources section for full version of form



How to Prioritize Seafood for Investigation

Priority	Seafood Type and Preparation	Examples
1	Raw bivalve molluscan shellfish	Raw oysters, mussels, clams, scallops
2	Cooked bivalve molluscan shellfish	Cooked oysters, mussels, clams, scallops
3	Other raw seafood	Raw tuna, salmon, shrimp, crab, octopus
4	Cooked fish	Cooked tuna, salmon, octopus
5	Cooked crustaceans	Cooked shrimp, crab, lobster, crayfish/crawfish





	Checklist
	Confirm approved source
	Collect shellfish tags and invoices
	Identify any risks associated with receiving, storage, preparation, cooking and temperature control practices
	Evaluate consumer advisory
	Implement control measures
	Communicate findings/complete COVIS form





	Checklist
	Confirm approved source
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Environmental Assessment



	Checklist
	Confirm approved source
	Collect shellfish tags and invoices
	Identify any risks associated with receiving, storage, preparation, cooking and temperature control practices
	Evaluate consumer advisory
	Implement control measures
	Communicate findings/complete COVIS form



She Sells Seashells: Sample Menu



MENU / She Sells Seashells

1 Tide Place, Ocean Sound, WA 11111 135-71-1317

www.soundofseashells.com

		l, shellfish
3.25	Sumo Kumo Winter's Tale, WA	3.5
3.75	Shigoku Comedy of Errors, WA	3
3.75	Hama Hama Midsummer Night's Dream, WA	3.75
	3.25 3.75	3.75 Winter's Tale, WA Shigoku Comedy of Errors, WA Hama Hama



Environmental Assessment



	Checklist
	Confirm approved source
	Collect shellfish tags and invoices
	Identify any risks associated with receiving, storage, preparation, cooking and temperature control practices
Y	Evaluate consumer advisory
	Implement control measures
	Communicate findings/complete COVIS form



Environmental Assessment



Checklist
Confirm approved source
Collect shellfish tags and invoices
Identify any risks associated with receiving, storage, preparation, cooking and temperature control practices
Evaluate consumer advisory
Implement control measures
Communicate findings/complete COVIS form



Complete COVIS Form: Vendor Info



Commercial vendor Information (only complete if product consumed at a	commercial establishment)
1. Name of restaurant, oyster bar, or food store:	
Address:	Tel:
City/State:	
2. Type of establishment: Oyster bar or restaurant	☐ Seafood market ☐ Unknown
	□ Other (specify):
☐ Food store	
3. Date restaurant or food outlet received seafood (MM/DD/YY):	
4. Was the seafood imported from another country? Yes No Unkn	own
If yes, name of country:	
5. Was a restaurant or outlet environmental assessment conducted?	□ No □ Unknown
6. Was there evidence of improper handling or storage? Yes No Ur	nknown
If yes (check all that apply): 🗖 Holding temperature violation 🗖 Cross-contan	nination Co-mingling of live and dead shellfish
☐ Improper storage ☐ Other:	
7. If oysters, clams, or mussels were eaten, how were they received by the retail ou	utlet?
☐ Live shellstock ☐ Processed animal with shell attached ☐ Shucked meat ☐ U	Unknown 🗖 Other (specify):

see Vibrio Toolkit in Tools and Resources section for full version of form



Complete COVIS Form: Source



Source information				
1. Were seafood tags, invoice	es, or labels available	e? 🗖 Yes 🗖 No 🗖 Unknow	n (If yes, please attach to form)	
2. List shippers and associate	ed certification numb	pers if on tags:		
3. If harvest areas are known	1:	Harvest area classification (if kn	own):	
Area 1:	Date :	☐ Approved ☐ Conditionally approved ☐ Conditionally restricted ☐ Restricted ☐ Prohibited	Product harvested:	Harvest State:
Area 2:	Date :	☐ Approved ☐ Conditionally approved ☐ Conditionally restricted ☐ Restricted ☐ Prohibited	Product harvested:	Harvest State:
☐ Check if additional harves	t area page is attach	ed		
Person completing section 5		Date comp	oleted (MM/DD/YY):	
Title/Agency:		Tel:		

see Vibrio Toolkit in Tools and Resources section for full version of form



Vibriosis Case Investigation: Shellfish Traceback



Notify shellfish regulatory agency in the jurisdiction where the shellfish was harvested

Send information about the illness and exposure:

- Send entire CDC COVIS form with identifiers redacted
- Alternatively, send "page 5" of the COVIS form (redact case initials) and add:
 - Testing status (culture positive or CIDT positive)
 - Onset date

Include all tags collected (including tags for product harvested in other states)

Include invoices, if available



Vibriosis Cluster and Outbreak Detection





Cluster and Outbreak Detection



Positive

: Individual cases rather than clusters of illness spur product traceback

Negative

: Difficult to attribute illness to just one product because cases consume multiple products or don't recall what they ate

Best case scenario for identifying clusters is a single source exposure

Same shellfish, same growing area, same harvest date

Whole genome sequencing (WGS) useful in certain situations but there are challenges:

- Shellfish are moved around before and during season
- Certain strains may predominate in one region
- Oysters from multiple areas sometimes share wet storage





	Iliness	Murribet 726	Meal Date	Onset	Date Juliure	Ost Harves	Harvest Date	Juing Area	Size Specie	Product TVP	Harvester
1	а	8/11	8/12	Υ	N	8/5	Buckley Inet	Pacific Xs	Ss	Gilligan	Ross
1	b	8/11	8/12	Υ	N	8/8	Barney Canal	Olympia	Ss	Ginger	Monica
1	С	8/11	8/12	Υ	N	8/3	Oscar Passage	Pacific Xs	Ss	Thurston	Phoebe
1	d	8/11	8/12	Υ	N	8/8	Luly Bay	Pacific Xs	Ss	Mary Ann	Chandler
2	а	8/12	8/13	Υ	N	8/6	Wanda Beach	Olympia	Ss	Skipper	Joey
2	b	8/12	8/13	Υ	N	8/8	Luly Bay	Pacific Xs	Ss	Mary Ann	Chandler
3	a	8/10	8/12	N	N	8/8	Luly Bay	Pacific Xs	Ss	Mary Ann	Chandler
4	a	8/14	8/15	Υ	N	8/8	Luly Bay	Pacific Xs	Ss	Mary Ann	Chandler





	Iliness	Murnber 126	Meal Date	Onset	Jate Juliure	Ostitured Ostitures	Harvest Date	Juing Area	size specie	Product TVP	e Harvester
1	а	8/11	8/12	Υ	N	8/5	Buckley Inet	Pacific Xs	Ss	Gilligan	Ross
1	b	8/11	8/12	Υ	N	8/8	Barney Canal	Olympia	Ss	Ginger	Monica
1	С	8/11	8/12	Υ	Z	8/3	Oscar Passage	Pacific Xs	Ss	Thurston	Phoebe
1	d	8/11	8/12	Υ	Ν	8/8	Luly Bay	Pacific Xs	Ss	Mary Ann	Chandler
2	а	8/12	8/13	Υ	Ν	8/6	Wanda Beach	Olympia	Ss	Skipper	Joey
2	b	8/12	8/13	Υ	N	8/8	Luly Bay	Pacific Xs	Ss	Mary Ann	Chandler
3	a	8/10	8/12	N	N	8/8	Luly Bay	Pacific Xs	Ss	Mary Ann	Chandler
4	а	8/14	8/15	Υ	Ν	8/8	Luly Bay	Pacific Xs	Ss	Mary Ann	Chandler





	IIness	Murribet 126	Meal Date	Onset	Jate Juliure	ost Harvest	Harvest Date	Juing Area	size Specie	Product TVP	Harvester
1	а	8/11	8/12	Υ	N	8/5	Buckley Inet	Pacific Xs	Ss	Gilligan	Ross
1	b	8/11	8/12	Υ	N	8/8	Barney Canal	Olympia	Ss	Ginger	Monica
1	С	8/11	8/12	Υ	Z	8/3	Oscar Passage	Pacific Xs	Ss	Thurston	Phoebe
1	d	8/11	8/12	Υ	Ν	8/8	Luly Bay	Pacific Xs	Ss	Mary Ann	Chandler
2	а	8/12	8/13	Υ	Ν	8/6	Wanda Beach	Olympia	Ss	Skipper	Joey
2	b	8/12	8/13	Υ	N	8/8	Luly Bay	Pacific Xs	Ss	Mary Ann	Chandler
3	a	8/10	8/12	N	N	8/8	Luly Bay	Pacific Xs	Ss	Mary Ann	Chandler
4	a	8/14	8/15	Υ	N	8/8	Luly Bay	Pacific Xs	Ss	Mary Ann	Chandler





	IIness	Aurinber 136	Meal Date	Onset	Jate Juliure C	ontirned of the state of	Abuse Date	Juing Area	size Specie	Product TVP	e Harvester
1	а	8/11	8/12	Υ	N	8/5	Buckley Inet	Pacific Xs	Ss	Gilligan	Ross
1	b	8/11	8/12	Υ	N	8/8	Barney Canal	Olympia	Ss	Ginger	Monica
1	С	8/11	8/12	Υ	Ν	8/3	Oscar Passage	Pacific Xs	Ss	Thurston	Phoebe
1	d	8/11	8/12	Υ	Ν	8/8	Luly Bay	Pacific Xs	Ss	Mary Ann	Chandler
2	а	8/12	8/13	Υ	N	8/6	Wanda Beach	Olympia	Ss	Skipper	Joey
2	b	8/12	8/13	Υ	N	8/8	Luly Bay	Pacific Xs	Ss	Mary Ann	Chandler
3	а	8/10	8/12	N	N	8/8	Luly Bay	Pacific Xs	Ss	Mary Ann	Chandler
4	а	8/14	8/15	Υ	N	8/8	Luly Bay	Pacific Xs	Ss	Mary Ann	Chandler



WGS for Cluster Detection



In July 2018, CDC identified 116 *Vibrio parahaemolyticus* isolates that were highly related via cgMLST*

60 cases had documented raw oyster exposure

- 32 had reliable traceback data
 - 9/32 consumed oysters from a particular Washington State growing area which was closed for shellfish harvesting
 - 19/32 consumed oysters from a variety of growing areas
 - 4/32 consumed only oysters harvested on the east coast (US and Canada)

*cgMLST: Core genome multilocus sequence typing



Vibriosis: Reporting



COVIS form should be submitted to CDC for all cases

For outbreaks, the following two forms should be completed:

- National Outbreak Reporting System (NORS) form
- National Environmental Assessment Reporting (NEARS) form





Tools & Resources



Tools and Resources



- Vibrio Toolkit (https://foodsafety.uw.edu/resources/vibrio-toolkit)
- Centers for Disease Control and Prevention (CDC) (<u>www.cdc.gov/vibrio/surveillance</u>)
- Washington State Department of Health
 (www.doh.wa.gov/ForPublicHealthandHealthcareProviders/NotifiableConditions/Vibriosis)
- WA Integrated Food Safety Center of Excellence (https://foodsafety.uw.edu)





