

National Enteric Disease Surveillance: COVIS Annual Summary, 2013

Summary of Human *Vibrio* Cases Reported to CDC, 2013

The Cholera and Other *Vibrio* Illness Surveillance (COVIS) system is a national surveillance system for human infection with pathogenic species of the family *Vibrionaceae*, which cause vibriosis and cholera. The Centers for Disease Control and Prevention (CDC) maintains COVIS. Information from COVIS helps track *Vibrio* infections and determine host, food, and environmental risk factors for these infections.

CDC initiated COVIS in collaboration with the Food and Drug Administration and four Gulf Coast states (Alabama, Florida, Louisiana, and Texas) in 1989. Using the COVIS report form (available at http://www.cdc.gov/nationalsurveillance/PDFs/CDC5279_COVISvibriosis.pdf), participating health officials report cases of vibriosis and cholera. The case report includes clinical data, including information about underlying illness; detailed history of seafood consumption; detailed history of exposure to bodies of water, raw or live seafood or their drippings, or contact with marine life in the seven days before illness onset; and traceback information on implicated seafood.

Before 2007, only cholera, which by definition is caused by infection with toxigenic *Vibrio cholerae* serogroup O1 or O139, was nationally notifiable. In January 2007, infection with other serogroups of *V. cholerae* and other species from the family *Vibrionaceae* also became nationally notifiable, as vibriosis.

CDC requests that all state health departments send all *Vibrio cholerae* and *Vibrio mimicus* isolates to CDC for additional characterization. For *V. cholerae*, CDC identifies serogroups O1, O75, O139, and O141 and determines whether the isolate produces cholera toxin. For all *Vibrio* species (excluding *V. cholerae*), CDC accepts isolates for antimicrobial resistance testing and all outbreak isolates for identification. Although all *Vibrio* infections are nationally notifiable, many cases are likely not recognized because *Vibrios* are not easily identified on routine enteric media. A selective medium, such as thiosulfate citrate bile salts sucrose agar (TCBS), should be used.

This report summarizes human *Vibrio* infections occurring during 2013 reported to COVIS. Results are presented in two categories: (1) infection with pathogenic species of the family *Vibrionaceae* (other than toxigenic *Vibrio cholerae* serogroups O1 and O139), which cause vibriosis; this category includes infection with toxigenic *V. cholerae* of serogroups other than O1 and O139, and (2) infection with toxigenic *V. cholerae* serogroups O1 and O139, which cause cholera. While many *Vibrio* species are well-recognized human pathogens, the status of some species (including *Photobacterium damsela* subsp. *damsela* (formerly *V. damsela*), *V. furnissii*, *V. metschnikovii*, and *V. cincinnatiensis*) as human enteric or wound pathogens is less clear.

Understanding the routes by which infection is transmitted is essential for control. For vibriosis, cases are summarized by place of exposure (travel-associated vs. domestically acquired). Travel-associated cases are defined as infections in persons who reported international travel in the seven days before illness began; all other infections were defined as domestically-acquired cases. For domestically acquired vibriosis, transmission routes (foodborne, non-foodborne, and unknown) are determined based on reported patient exposures and specimen sites (see Appendix for classification method). For toxigenic *V. cholerae* (all serogroups), exposures are summarized by place of exposure (travel-associated vs. domestically acquired) and then, if information is available, by source (such as consumption of contaminated seafood).

I. Vibriosis

Pathogenic species of the family Vibrionaceae (excluding toxigenic V. cholerae O1 and O139)

In 2013, 1,176 *Vibrio* infections (excluding toxigenic *V. cholerae* O1 and O139) were reported to COVIS (Table 1). Among patients for whom information was available, 363 (35%) of 1,041 were hospitalized, and 43 (4%) of 1,042 died. The most frequently reported species was *V. parahaemolyticus*, which was isolated from 594 (51%) of patients. Of the patients infected with *V. parahaemolyticus* for whom information was available, 112 (21%) of 543 were hospitalized, and 4 (<1%) of 546 died. *V. alginolyticus* was isolated from 208 (18%) of the patients; of the patients for whom information was available, 37 (23%) of 137 were hospitalized; one death was reported. *V. vulnificus* was isolated from 137 (12%) of the patients; of the patients for whom information was available, 120 (94%) of 127 were hospitalized, and 32 (28%) of 115 died.

Table 1. Vibriosis cases by species, selected patient demographic characteristics, and outcomes, United States, 2013.

Genus and Species of <i>Vibrionaceae</i>	Cases			Demographic Characteristics				Outcomes			
	Age (years)		Sex	Hospitalizations		Deaths					
	N	%		Median	Range	Male (n/N)	%	n/N	%		
<i>V. parahaemolyticus</i>	594	51	48	0-95	383/590	65	112/543	21	4/546	<1	
<i>V. alginolyticus</i>	208	18	32	2-92	135/205	66	37/164	23	1/170	<1	
<i>V. vulnificus</i>	137	12	65	7-90	125/137	91	120/127	94	32/115	28	
<i>V. cholerae</i> (excluding toxigenic O1 and O139)*	72	6	48.5	1-96	43/72	60	31/69	45	4/67	6	
<i>V. fluvialis</i>	61	5	58.5	10-98	36/59	61	20/50	40	1/55	2	
<i>V. mimicus</i>	26	2	45.5	17-85	17/26	65	9/22	41	0/25	0	
<i>Grimontia hollisae</i> (formerly <i>V. hollisae</i>)	15	1	41	24-74	1/1	100	7/13	54	0/13	0	
<i>V. furnissii</i>	2	<1	70	60-80	1/2	50	0/2	0	0/2	0	
<i>V. metschnikovii</i>	2	<1	67.5	48-87	1/2	100	1/2	50	0/2	0	
<i>Photobacterium damsela</i> subsp. <i>damsela</i> (formerly <i>V. damsela</i>)	2	<1	54	35-73	2/2	100	2/2	100	1/2	50	
<i>V. harveyi</i>	1	<1	28	28	1/1	100	0/1	0	0/1	0	
<i>V. campbellii</i>	1	<1	8	8	1/1	100	1/1	100	0/1	0	
Species not identified	46	4	52	0-93	30/45	67	19/36	53	0/34	0	
Multiple species†	9	<1	43	6-96	6/9	67	4/9	44	0/9	0	
Total	1,176	100	49	0-98	795/1,166	68	363/1,041	35	43/1,042	4	

* Includes non-toxicogenic *V. cholerae* non-O1, non-O139 (61 cases), O1 (6 cases), and non-O1 (2 cases not tested for O139); 1 toxigenic *V. cholerae* O75; and no serogroup specified (2 cases).

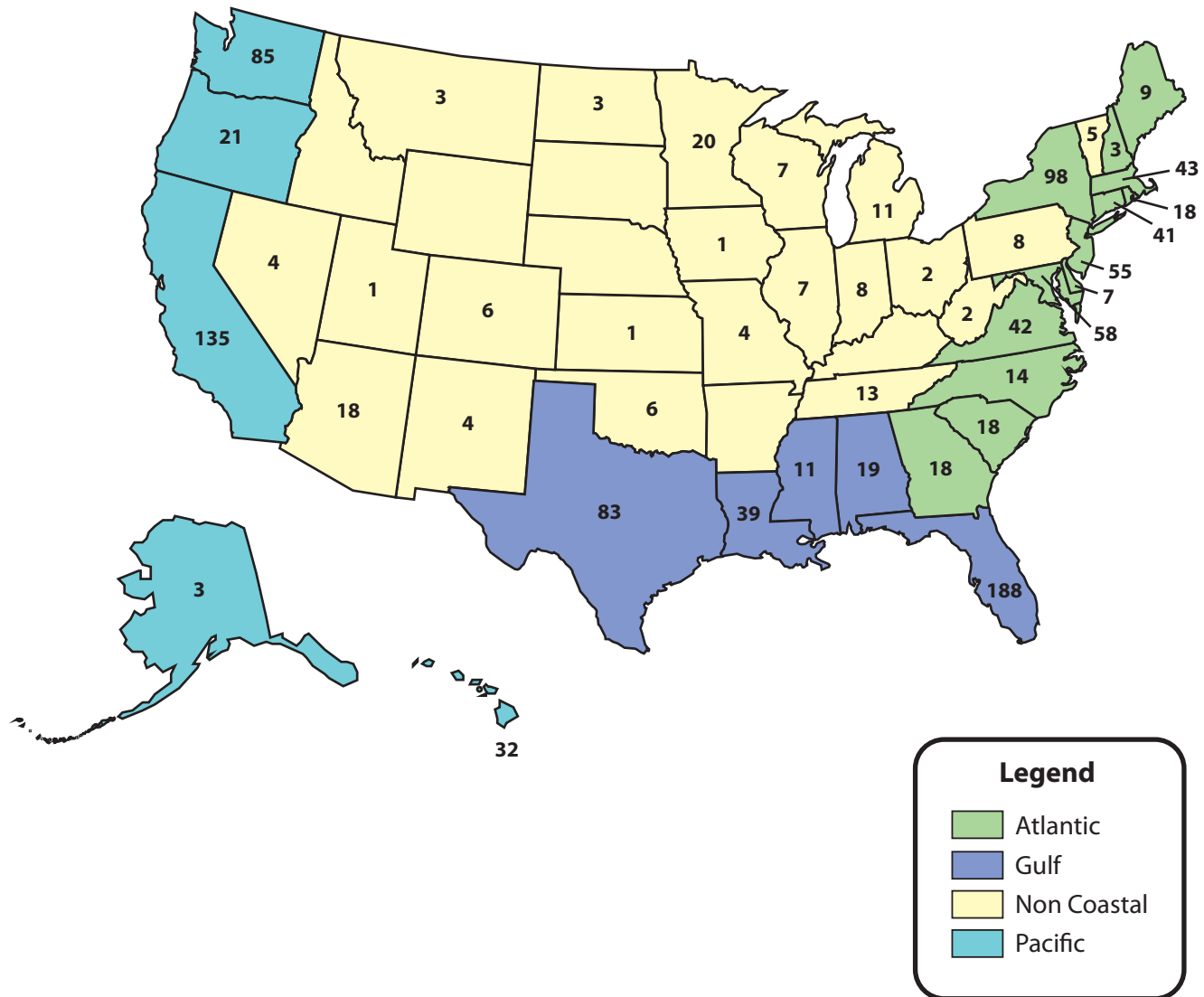
† The following combinations of *Vibrio* species were isolated from patients infected with multiple species: *V. alginolyticus*, *V. parahaemolyticus* (3 patients); *V. fluvialis*, *V. furnissii* (1 patient); *V. mimicus*, *V. fluvialis* (1 patient); *V. cholerae* non-O1, non-O139, *V. parahaemolyticus* (1 patient), *V. fluvialis*, *V. vulnificus* (1 patient); *V. parahaemolyticus*, *V. vulnificus* (1 patient), and *V. alginolyticus*, *V. parahaemolyticus*, and *V. ponticus* (1 patient). None of these are included in the rows for individual species.

Geographic Location

Of the 1,176 vibriosis cases, 340 (29%) were reported from Gulf Coast states, 276 (23%) from Pacific Coast states, 424 (36%) from Atlantic Coast states, and 136 (12%) from non-coastal states (Figure 1).

The *Vibrio* species reported most frequently from Gulf Coast states were *V. vulnificus* 87 (26%), *V. parahaemolyticus* 83 (24%), and *V. alginolyticus* 81 (24%). The *Vibrio* species reported most frequently from non-Gulf Coast states were *V. parahaemolyticus* 511 (61%), *V. alginolyticus* 127 (15%), and *V. vulnificus* 50 (6%).

Figure 1. Number of cases of *Vibrio* infections (excluding toxigenic *V. cholerae* O1 and O139), by state, 2013 (N= 1,176 from 45 states).



Transmission categories and reported exposures

Among the 1,176 vibriosis patients, 60 (5%) reported international travel in the seven days before illness began. Among the 1,116 domestically-acquired vibriosis cases, 644 (58%) were classified as confirmed or probable foodborne, 353 (32%) as confirmed or probable non-foodborne, and 119 (11%) as having an unknown transmission route (Figure 2). Illnesses peaked in the summer months for all categories, but the peak was most pronounced for foodborne infections (Figure 3).

Among the 290 patients with confirmed and probable foodborne vibriosis who reported eating a single seafood item (Table 2), 169 (58%) ate oysters (88% of whom consumed them raw), 26 (9%) ate clams (81% of whom consumed them raw), 18 (6%) ate crab, and 14 (5%) ate finfish.

For cases with non-foodborne transmission, 298 (84%) patients reported having skin exposure to a body of water within 7 days before illness began, 65 (18%) reported contact with marine wildlife, and 46 (5%) reported handling seafood.

Figure 2. Domestically acquired vibriosis cases by transmission route and species, United States, United States, 2013 (N=1,116).

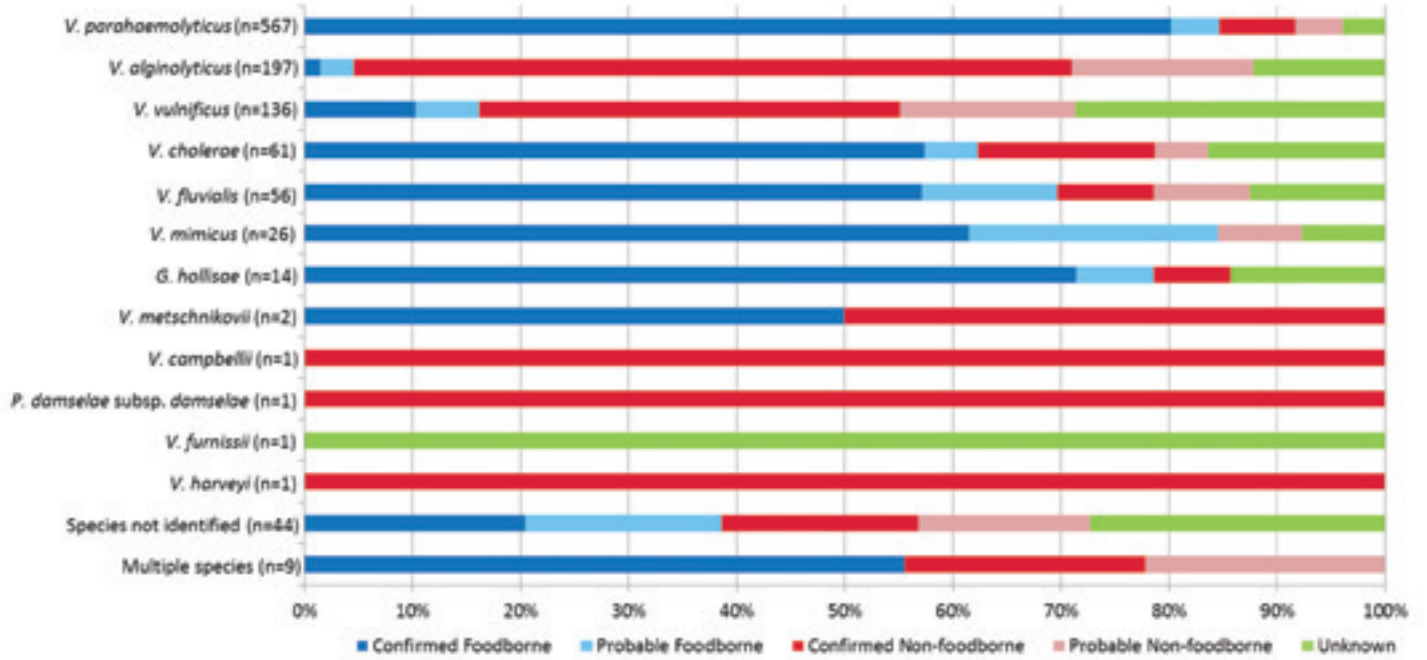
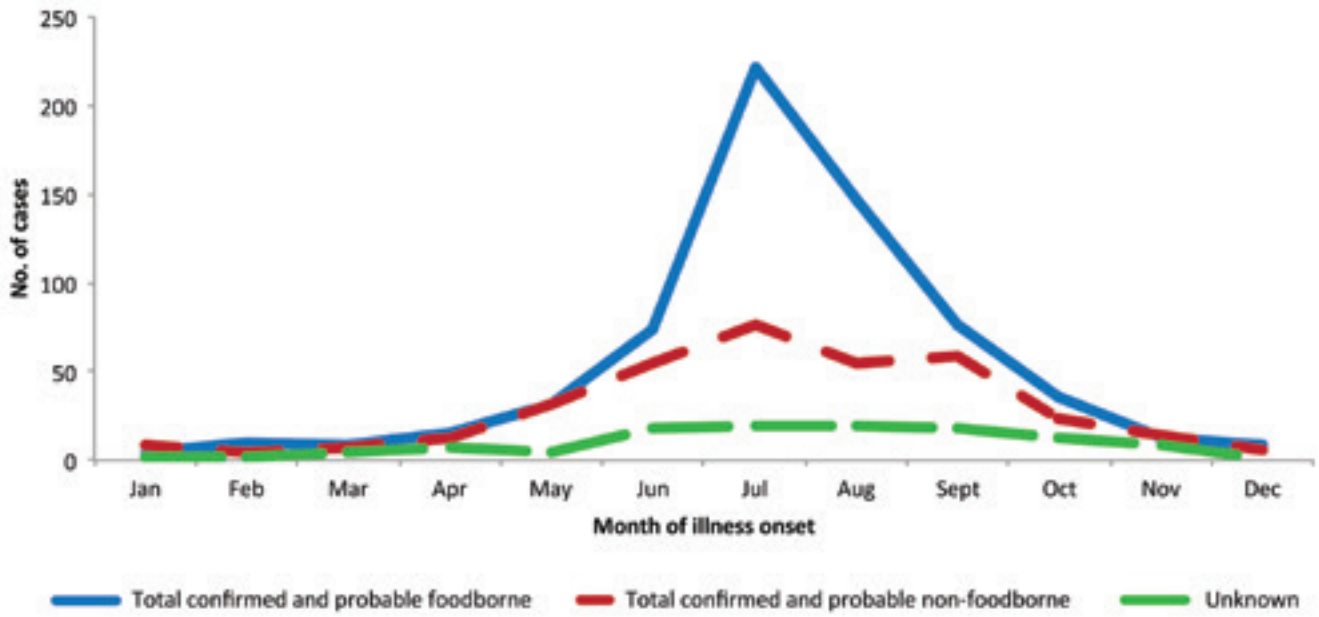


Figure 3. Domestically acquired vibriosis cases, by month of illness onset or specimen collection (when onset date not available), and transmission route, United States, 2013 (N=1,115).



*1 unknown transmission case missing onset and specimen collection dates.

Table 2. Seafood exposures among 290 patients with domestically-acquired foodborne vibriosis who reported eating a single seafood item in the week before illness onset, United States, 2013.

	Mollusks			Crustaceans				Other	
	Oysters	Clams	Mussels	Shrimp	Lobster	Crab	Crayfish	Other Shellfish*	Finfish†
Patients who ate single seafood item, n (% of 290)	169 (58)	26 (9)	0 (0)	10 (3)	4 (1)	18 (6)	3 (1)	3 (1)	14 (5)
Patients who ate the single seafood item raw, n (% of n in row above)	148 (88)	21 (81)	0 (0)	1 (10)	0 (0)	4 (22)	0 (0)	1 (33)	2 (14)

* Other shellfish reported: conch and scallops.

† Finfish reported: catfish, cod, eel, haddock, halibut, red snapper, salmon, sardines, and tilapia.

Laboratory

In 2013, CDC confirmed 279 isolates as *V. parahaemolyticus*; eight serogroups were identified: O4 (51%), O1 (18%), O11 (11%), O5 (9%), O3 (5%), O10 (5%), O8 (2%), and O6 (1 isolate, <1%). Among the serogroup O4 isolates, 118 (42%) were K4 and 20 (7%) were Kunknown.

Toxigenic *V. cholerae*, excluding serogroups O1 and O139

Serogroup O141

In 2013, no patients with toxigenic *V. cholerae* serogroup O141 infection were reported.

Serogroup O75

In 2013, one patient with toxigenic *V. cholerae* O75 infection was reported. The patient reported consuming cooked blue crab that was purchased from a seafood market. Harvest area is unknown.

Table 3. Cases of toxigenic *V. cholerae* infections (excluding serogroups O1 and O139), United States, 2013.

State	Age	Sex	Month of Illness Onset	International Travel	Exposure	Serogroup	Antimicrobial Resistance
North Carolina	51	F	9	None	Consumed cooked blue crab	O75	Susceptible to all drugs tested in <i>V. cholerae</i> panel

II. Cholera

Serogroups O1 & O139

In 2013, 14 patients with toxigenic *V. cholerae* serogroup O1 infection were reported. Of the 14 patients, 73% were hospitalized and none died. Thirteen (93%) cases were travel-associated (8 with travel to Haiti, 1 to the Dominican Republic, 2 to Cuba, and 2 to other cholera-affected countries). The remaining patient reported no travel; however, this patient was a healthcare worker who reported caring for a cholera patient in the hospital.

No cases of toxigenic *V. cholerae* O139 infection were reported.

Table 4. Cases of toxigenic *V. cholerae* serogroup O1, biotype El Tor, infection, 2013.

Location	Age	Sex	Month of Illness Onset	International Travel	Exposure	Serotype	Antimicrobial Resistance*
Massachusetts	39	M	January	Yes	Travel to Haiti	Ogawa	FUR, NAL, SOX, STR, STX
Delaware	57	F	January	Yes	Travel to Haiti	Ogawa	FUR, NAL, SOX, STR, STX
Connecticut	57	M	January	Yes	Travel to Haiti	Ogawa	FUR, NAL, SOX, STR, STX
Massachusetts	78	F	February	Yes	Travel to Dominican Republic	Ogawa	FUR, NAL, SOX, STR, STX
Florida	46	F	July	Yes	Travel to Haiti	Ogawa	FUR, NAL, SOX, STR, STX
Florida	51	F	July	Yes	Travel to Haiti	Ogawa	FUR, NAL, SOX, STR, STX
Florida	80	F	July	Yes	No travel	Ogawa	FUR, NAL, SOX, STR, STX
Washington	47	F	August	Yes	Travel to Haiti	Ogawa	FUR, NAL, SOX, STR, STX
Massachusetts	65	F	August	Yes	Haiti of resident	Ogawa	FUR, NAL, SOX, STR, STX
Minnesota	57	F	August	Yes	Travel to India	Ogawa	FUR, NAL, SOX, STR, STX
Florida	58	M	September	Yes	Travel to Haiti	Ogawa	FUR, NAL, SOX, STR, STX
Illinois	87	M	October	Yes	Travel to Cuba	Ogawa	FUR
Florida	49	M	December	Yes	Travel to Cuba	Ogawa	FUR, NAL, SOX, STR, STX
New Jersey	51	M	December	Yes	Travel to China, Philippines, Bahrain, Cyprus	Ogawa	FUR, NAL, SOX, STR, STX

*FUR=furazolidone, NAL=nalidixic acid, SOX=sulfisoxazole, STR=streptomycin, STX=trimethoprim-sulfamethoxazole

III. Publications using COVIS data, 2013 and 2014

Loharikar A, Newton AE, Stroika S, Freeman M, Greene KD, Parsons MB, Bopp C, Talkington D, Mintz ED, Mahon BE. Cholera in the United States, 2001–2011: a reflection of patterns of global epidemiology and travel. *Epidemiol Infect.* 2015 Mar;143(4):695–703. Available from <http://dx.doi.org/10.1017/S0950268814001186>

Newton AE, Garrett N, Stroika SG, Halpin JL, Turnsek M, Mody RK. Notes from the field: increase in *Vibrio parahaemolyticus* infections associated with consumption of Atlantic Coast shellfish — 2013. *MMWR.* 2014;63:335–6. Available from <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6315a6.htm>

Martinez-Urtaza J, Baker-Austin C, Jones JL, Newton AE, Gonzalez-Aviles GD, DePaola A. Spread of Pacific Northwest *Vibrio parahaemolyticus* strain. *N Engl J Med.* 2013 Oct 17;369(16):1573–4. Available from <http://www.nejm.org/doi/full/10.1056/NEJMc1305535>

Slayton RB, Newton AE, Depaola A, Jones JL, Mahon BE. Clam-associated vibriosis, USA, 1988–2010. *Epidemiol Infect.* 2014 May;142(5):1083–8. Available from <http://dx.doi.org/10.1017/S0950268813001830>

Vugia DJ, Tabnak F, Newton AE, Hernandez M, Griffin PM. Impact of 2003 state regulation on raw oyster-associated *Vibrio vulnificus* illnesses and deaths, California, USA. *Emerg Infect Dis.* 2013 Aug;19(8):1276–80. Available from <http://dx.doi.org/10.3201/eid1908.121861>

Appendix

Method for Classification of Transmission Routes in the Cholera and Other Vibrio Illness Surveillance (COVIS) System

I. Exposure categories

To classify transmission routes, the first step is to categorize patient exposures. For a given illness episode, >1 patient exposure can be reported to COVIS; each reported exposure is categorized individually. If all exposures fall into a single category, then the report is considered to have a single exposure category. If not, the report is considered to have multiple exposure categories. For a given case, if any exposure is reported, we assume that other exposures for which information was not reported were not present. Exposures are classified using three categories:

1. **Seafood consumption:** Ingestion of seafood. Does not include touching seafood.
2. **Marine/estuarine contact:** Includes direct skin contact with marine/estuarine life, bodies of water, or drippings from raw or live seafood.
3. **Unknown exposure:** no exposure history reported.

II. Specimen site categories

The next step in classifying transmission routes is to categorize reported specimen sites. For a given illness episode, >1 specimen site can be reported; each reported site is categorized individually. If all specimen sites fall into a single category, then the report is considered to have a single specimen site category. If not, then the report is considered to have multiple specimen site categories. Specimen sites are classified using five categories:

1. **Gastrointestinal site (GI):** stool, bile, appendix, rectum, gall bladder, colon
2. **Blood or other normally sterile site (sterile):** blood, cerebrospinal fluid (CSF), peritoneal fluid, lumbar disc fluid, lymph node, bullae
3. **Skin or soft tissue site (SST):** wound, ear (other than otitis media and middle ear, which are included in 'other, non-sterile site'), appendage, tissue
4. **Other, non-sterile site (ONS):** urine, sputum, aspirate, bronchial washing, effusion, catheter, endotracheal, eye, nasal, placenta, respiratory, sinus, tonsil
5. **Unknown site (unknown):** no specimen site reported or no site specified for 'other'

Note: The lists of sites for each category above are not intended to be exhaustive. Rather, they reflect the sites actually reported to COVIS and can be updated if new sites are reported.

III. Transmission route

The final step in classifying transmission involves review of exposure and specimen site categories for each reported case. Reports are classified into one of three transmission routes, foodborne, non-foodborne, and unknown, based on criteria below:

1. Single exposure category: seafood consumption

- **Confirmed Foodborne:** *Vibrio* isolated only from GI or sterile site OR *Vibrio* isolated from multiple specimen site categories, including a GI site.
- **Probable Foodborne:** *Vibrio* isolated only from SST, ONS, or unknown sites OR *Vibrio* isolated from multiple specimen site categories, not including GI.

2. Single exposure category: marine/estuarine contact

- **Confirmed Non-foodborne:** *Vibrio* isolated **only** from SST or sterile site OR *Vibrio* isolated from multiple specimen site categories, with SST reported.
- **Probable Non-foodborne:** *Vibrio* isolated **only** from GI, ONS, or unknown sites OR *Vibrio* isolated from multiple specimen site categories, not including SST.

3. Multiple exposure categories: both seafood consumption AND marine/estuarine contact

- **Confirmed Foodborne:** *Vibrio* isolated only from a GI site OR *Vibrio* isolated from multiple specimen site categories, with GI reported and SST not reported
- **Confirmed Non-foodborne:** *Vibrio* isolated only from a SST site OR *Vibrio* isolated from multiple specimen site categories, with SST reported and GI not reported
- **Unknown:** *Vibrio* isolated only from a sterile, ONS, or unknown site OR *Vibrio* isolated from multiple specimen site categories, including either 1) both GI and SST or 2) neither GI nor SST.

4. Unknown or no reported exposure (note that categorization is the same as for multiple exposure categories)

- **Confirmed Foodborne:** *Vibrio* isolated only from a GI site OR *Vibrio* isolated from multiple specimen site categories, with GI reported and SST not reported
- **Confirmed Non-foodborne:** *Vibrio* isolated only from a SST site OR *Vibrio* isolated from multiple specimen site categories, with SST reported and GI not reported
- **Unknown:** *Vibrio* isolated only from a sterile, ONS, or unknown site OR *Vibrio* isolated from multiple specimen site categories, including either 1) both GI and SST or 2) neither GI nor SST.

NCEZID Atlanta:

For more information please contact Centers for Disease Control and Prevention

1600 Clifton Road NE, Atlanta, GA 30333 MS C-09

Telephone: 1-404-639-2206

Email: cdcinfo@cdc.gov