Vibrio Infections in Louisiana: Twenty-Five Years of Surveillance 1980-2005

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A total of 1,007 *Vibrio* infections were reported to the Infectious Disease Epidemiology Department at the Louisiana Office of Public Heath, between 1980 and 2005. The most common were *Vibrio vulnificus* (257 infections), *Vibrio parahemolyticus* (249 infections), and *Vibrio cholerae* non O1 (200 cases). Other species were much less common. *Vibrio vulnificus* infections, which are associated with consumption of raw seafood (particularly oysters) or contact with sea water, and severe immuno-suppression or liver disease were increasing. Septicemia and blood stream infections are the main manifestations of this infection. The number of infections due to *Vibrio parahemolyticus* on the other hand, causing mostly gastroenteritis, has remained stable. *Vibrio cholerae* infections are less common and almost always associated with consumption of partially cooked or contaminated crabs.

INTRODUCTION

Vibrios inhabit both marine and estuarine environments (1). They are found ubiquitously in the water, sediment and as an intracellular symbiont of shellfish (2). Several species of this genus are pathogenic to humans. *Vibrio cholerae* comprises about 200 serogroups, but the most important as human pathogens are serogroups O1 and O139. There are about ten species of non-cholera vibrios that cause infections in humans (3). Two very significant species are *Vibrio parahaemolyticus* affecting primarily the gastro-intestinal tract and *Vibrio vulnificus* causing invasive disease in severely immuno-compromised individuals.

METHODOLOGY

Vibrio infections are defined as the isolation of a *Vibrio* in a human. The first infections were reported in 1978 in Louisiana. Systematic reporting was instituted in 1980, hence we chose the period 1980 to 2005. Counts of *Vibrio* infections were first reported in the State of Louisiana's vital statistics annual report in 1980. All reports of suspect/confirmed *Vibrio* infections originated from various reporting sources including hospitals, physicians, public and private laboratories. All *Vibrio* illnesses were investigated using standardized "Cholera and other *Vibrio* illness" surveillance reports.

Case investigations involved collection of demographic and clinical information, including pre-existing conditions, medications taken prior to illness and epidemiologic information pertaining to seafood consumption and exposure to brackish or salty water and seafood drippings. Whenever consumption of seafood was implicated as an exposure, a trace-back investigation was conducted, regarding suspected product and place of consumption.

All isolates were identified, either at the hospital laboratories or at the State Public Health Laboratory using Trypticase soy agar (TSA) slant, triple sugar iron (TSI) slant, blood agar slant or cystine trypticase agar (CTA). Hospitals submitted *Vibrio* isolates for further testing. Isolates were cultured on thiosulfate citrate bile salts sucrose agar (TCBS) or blood agar plates. Polymerase chain reaction (PCR) was used to identify *V. parahaemolyticus*, *V. vulnificus* and the Cholera toxin, since 2004. All viable *Vibrio* isolates were submitted to the Center for Disease Control and Prevention, for confirmation. A Microsoft Access® database was used to track and store all data from the standardized *Vibrio* report forms. The main clinical classification included: septicemia, wound infection, gastro-enteritis. Few isolates were from gallbladder or urine.

RESULTS

A total of 1,007 *Vibrio* infections were reported to the Infectious Disease Epidemiology Department at the Louisiana Office of Public Heath, between 1980 and 2005. The most common were *Vibrio vulnificus* (257 infections), *Vibrio parahemolyticus* (249 infections), and *Vibrio cholerae* non O1 (200 cases). Other species were much less common (Table 1). The age group distribution showed a progressively

higher incidence among older age groups for all vibrio infections. Among children, males and females were equally affected, but as age increased the proportion of males became greater (Figure 1). The clinical presentation was known for 673 infections. The geographical distribution for the past ten years (Figure 2) showed higher reported rates in the coastal areas.

Vibrio vulnificus

Vibrio vulnificus accounted for 25% of all *Vibrio* infections reported between 1980 and 2005. The yearly number of cases reported ranged from 5 to 20 with a definite upward trend (slope 0.44 cases / year). Of the cases with known clinical presentations, 48% were septicemia, 47% wound infections. Gastro-enteritis was much less frequent disease presentation with only 4% of cases (Table 2).

Out of 80 cases, for which the source of the *Vibrio* was known, 60% were attributed to either a sustained wound or a pre-existing wound that was exposed to salty or brackish water; 4% were attributed to seafood drippings on a wound or sustaining a wound while preparing seafood; 25% were attributed to consumption of raw shellfish, particularly raw oysters; and 11% to the consumption of cooked seafood (Table 3).

The main pre-existing medical conditions found in cases of *V. vulnificus* infection were liver disease (33%), alcoholism (22%), diabetes (28%), gastritis (13%), gastric ulcer (4%), malignancy (15%), and immuno-suppression (8%) (Table 4).

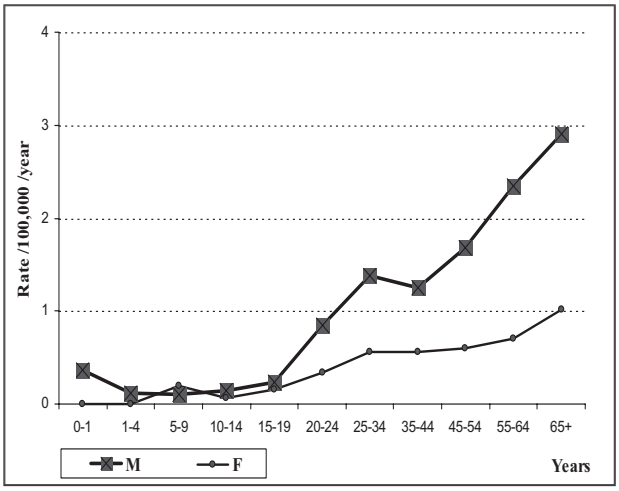

Figure 1. Age/gender incidence/100,000 (1980-2005).

The case fatality rate for *V.vulnificus* cases was high (31%). It was clearly associated with pre-existing medical conditions, 60% for those who had severe chronic liver disease versus 24% for those with pre-existing conditions other than liver disease (Table 5).

Table 1. Distribution of vibrio infections by species, 1980-2005.	
Species	1980 to 2005
Vulnificus	257
Parahaemolyticus	249
Cholera Non-O1	200
Alginolyticus	26
Damselae	7
Fluvialis	41
Hollisae	26
Mimicus	76
Other	1
Multiple	24
Undetermined species	75
Subtotal Non Cholera O1	**981**
Cholera O1	24
Cholera O1 Non-toxigenic	1
Grand total	**1007**

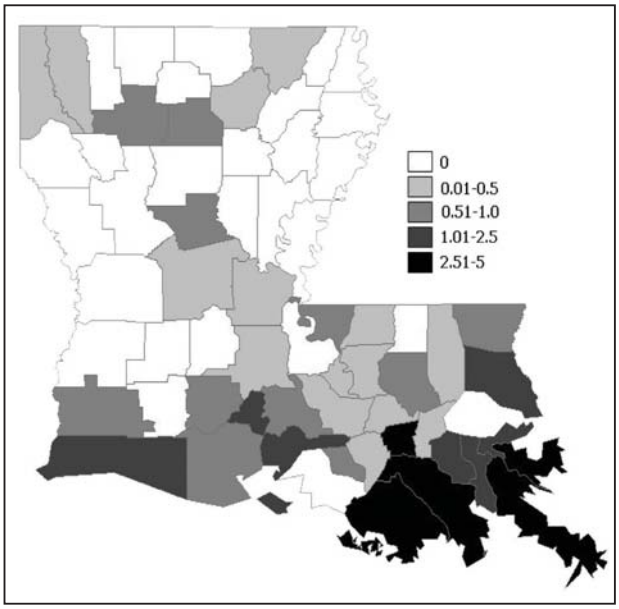

Figure 2. Mean annual rate of *Vibrio* cases/100,000 population in Louisiana (1996-2005).

Hurricane Katrina affected the gulf coast states of Louisiana and Mississippi in August of 2005. Eleven out of the 19 cases of *Vibrio vulnificus* in 2005, resulted from wounds (sustained at time of exposure or pre-existing wounds) that were exposed to floodwaters, resulting from the aftermath of Hurricane Katrina.[4,5]

Vibrio parahaemolyticus

Vibrio parahaemolyticus accounted for 25% of all *Vibrio* infections. The yearly number of cases reported ranged from 5 to 18 with no evident upward trend (ascending slope 0.04 cases / year). Of the cases with known clinical presentations, the great majority were gastro-enteritis (74%) and wound infections (22%) (Table 2).

Out of 64 cases for which exposure was known, 39% were attributed to consumption or raw oysters or other shellfish, 44% to consumption of cooked shellfish, and only 17% to contact with sea or brackish water (Table 3).

The main pre-existing medical conditions found in cases with *V. parahaemolyticus* infection were liver disease (13%), gastritis (8%), gastric ulcer (8%), and the use of antacid (14%) (Table 4). The case fatality rate for *V. parahaemolyticus* cases was low (6%).

Table 2. Distribution of clinical presentations by species, 1980-2005.						
Species	Known species	Gastro-enteritis	Septicemia	Wound Infection	Gall-bladder	Urine
Vulnificus	189	8	91	89	0	1
Parahaemolyticus	200	147	9	44	0	0
Cholera Non-O1	143	111	22	7	2	1
Alginolyticus	17	5	1	11	0	0
Damselae	4	1	1	2	0	0
Fluvialis	34	26	0	5	0	3
Hollisae	20	18	1	0	1	0
Mimicus	53	46	3	2	2	0
Cholera O1	13	10	3	0	0	0

Table 3. Distribution of clinical presentations by species, 1980-2005.

	Numbers				Proportion			
	V.parahemolyticus	V.vulnificus	V.cholerae Non O1	V.cholerae O1	V.parahemolyticus	V.vulnificus	V.cholerae Non O1	V.cholerae O1
Known Exposure	64	80	35	8	100.0	100.0	100.0	100.0
Seawater /Fishing /Wound	11	48	2	2	17.2	60.0	5.7	25.0
Seafood Handling /Dripping /Wound	0	3	2	0	0.0	3.8	5.7	0.0
Oyster /Shellfish /Raw	25	20	9	0	39.1	25.0	25.7	0.0
Oyster /Shellfish Cooked	28	9	22	6	43.8	11.3	62.9	75.0

Vibrio cholerae **Non O1**

Vibrio cholerae Non O1 was the third most common species of *Vibrio* encountered in Louisiana with 20% of cases. The yearly number of cases reported ranged from 2 to 16 with a slightly downward trend (Figure 4). Of the cases with known clinical presentations, the great majority were gastro-enteritis (77%) and septicemia (15%). Wound infections were rare (5%) (Table 2).

Out of 35 cases for which exposure was known, 26% were attributed to consumption or raw oysters or other shellfish, and paradoxically 63% to consumption of cooked shellfish, and only 6% to contact with sea, brackish or fresh water (Table 3). A small proportion of cases had known pre-existing medical conditions (6%). The case fatality rate for *V.cholerae* Non O1 cases was low (6%). There were two cases infected with *Vibrio cholerae* O141, one of these cases was exposed to domestic shellfish while the other had history of international travel in the seven days prior to symptom onset.

Vibrio cholerae **O1, toxigenic**

The first case of *Vibrio cholerae* O1 was reported in 1978. This case had a classic intense diarrhea. Subsequently an intensified case detection among hospital consultants found an additional ten cases. A randomized house to house survey of the cities involved showed an eight percent prevalence of antibodies against *Vibrio cholerae* toxin. Since 1980, there were 24 cases reported (Figure 5). Cases were sporadic with a few outbreaks. These outbreaks were usually the result of intensified case detection. The great majority were infected with toxigenic *Vibrio cholerae* O1 serotype Inaba, biotype El Tor.

The major clinical presentations were gastro-enteritis (77%) and septicemia (23%). Most cases had acquired their infection from eating cooked seafood (75%), mostly cooked crab. Gastritis, gastric ulcer, and use of antacids were the main medical risk factors.

DISCUSSION

Vibrio parahaemolyticus and *V. vulnificus* are natural inhabitants of seawater and they get concentrated in raw shellfish, particularly in raw oysters. While the number of cases of *Vibrio parahaemolyticus* remained constant, the number of cases of *Vibrio vulnificus* was increasing. This

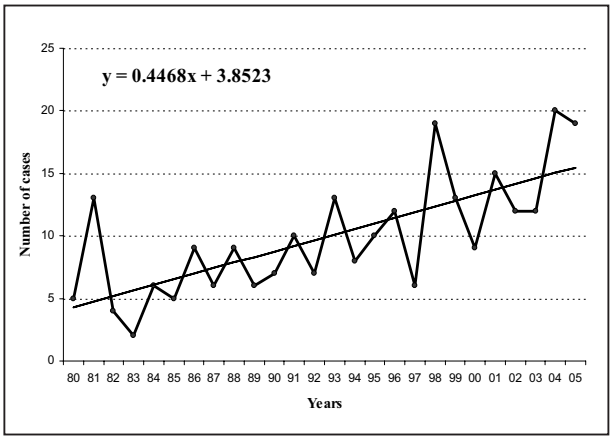

Figure 3. *Vibrio vulnificus* (1980-2005).

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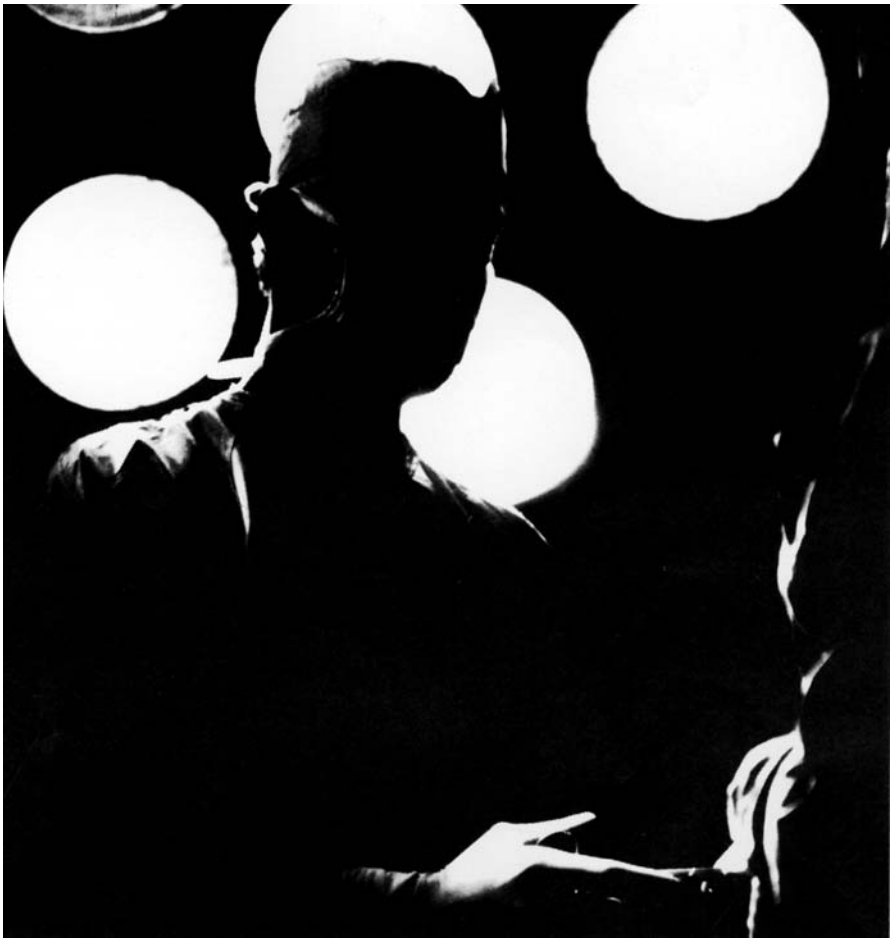

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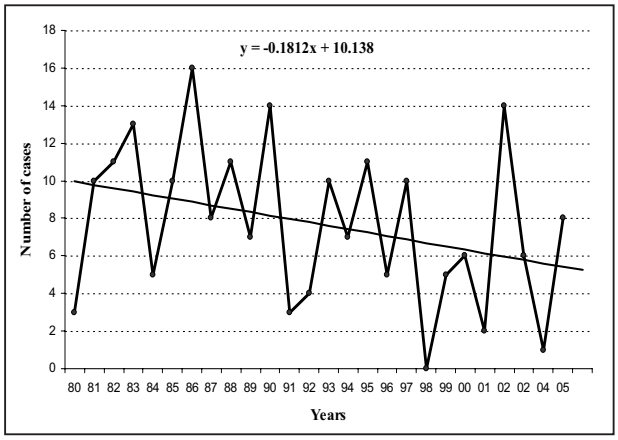

Figure 4. *Vibrio cholerae* non O1 (1980-2005).

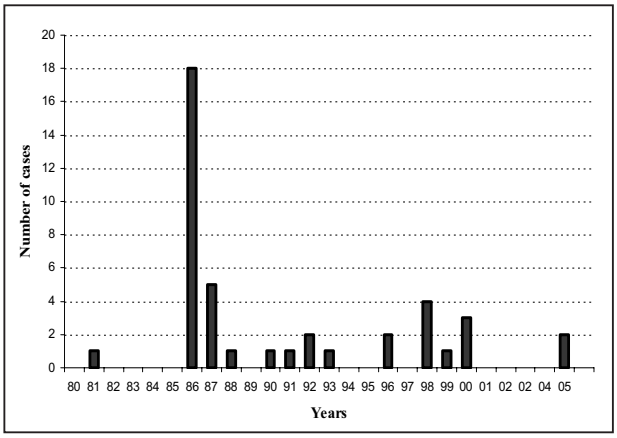

Figure 5. *Vibrio cholerae* O1 (1982-2005).

increase may be explained by the increasing number of people with medical risk factors (advanced liver disease, immuno-suppression) kept alive thanks to the progress of medical care.

People with mild cases of gastrointestinal illness do not seek medical attention. As a result, many possible *Vibrio* illnesses are not reported. Active case finding around cases may yield additional cases that went undetected. Therefore, it may be useful to enquire, if there were any other people sick with similar symptoms around the same period of time while the case was symptomatic. Health care providers who obtain stool specimens from patients with gastrointestinal

Table 4. Distribution of medical conditions by species, 1980-2005.

	Numbers				Proportion			
	V.parahemolyticus	V.vulnificus	V.cholerae Non O1	V.cholerae O1	V.parahemolyticus	V.vulnificus	V.cholerae Non O1	V.cholerae O1
Known pre-existing medical conditions	77	129	39	12	100.0	100.0	100.0	100.0
Alcoholic	4	29	1	1	5.2	22.5	2.6	8.3
Diabetic (oral)	9	30	1	3	11.7	23.3	2.6	25.0
Diabetic (insulin)	2	6	1	0	2.6	4.7	2.6	0.0
Gastritis	6	17	3	3	7.8	13.2	7.7	25.0
Gastric Ulcer	6	5	6	2	7.8	3.9	15.4	16.7
ImmunoSuppression	5	11	0	0	6.5	8.5	0.0	0.0
Liver disease	10	42	3	1	13.0	32.6	7.7	8.3
Malignancy	4	19	5	1	5.2	14.7	12.8	8.3
Chemotherapy	1	5	1	0	1.3	3.9	2.6	0.0
Steroid	3	8	1	0	3.9	6.2	2.6	0.0
Antacid	11	16	6	3	14.3	12.4	15.4	25.0

Note: Some cases have more than one condition so that the sum of all percentage could be over 100%

Table 5. Case fatality rates.			
Species	Cases with known outcome	Death	Case Fatality Rate
Parahaemolyticus	105	6	5.7
Vulnificus	159	50	31.4
Cholera Non-O1	57	3	5.3
Cholera O1	30	0	0.0
V.Vulnificus and			
Liver disease	40	24	60.0
Other condition	37	9	24.3
No known condition	89	16	18.0

complaints should request *Vibrio* cultures when risk factors for *Vibrio* are elicited by the history. A random survey of laboratories on the gulf coast demonstrated that only 20% of them used TCBS routinely to culture stool specimens.[6] Most hospital and private laboratories use automated biochemical systems, which sometimes cause misclassification with other enteric pathogens. All suspected *Vibrio* isolates from hospitals should be sent to the State Public Health Laboratory for identification and typing. Pulse-field gel electrophoresis testing for *Vibrio* bacteria is available to improve detecting common source outbreaks.

People who have underlying conditions especially liver disease should be made aware of the risk of consuming raw seafood or exposing open wounds to salty or brackish water. There is a need for educating the population on safe methods of seafood consumption, such as the cooking time, method and timeliness of storage. For example, crabs are a common source of *Vibrio* O1. Crabs may have been cooked and put back into their original container, or insufficiently cooked. For education of medical professionals, the Office of Public has information posted on its website at www.infectiousdisease.dhh.louisiana.gov.

REFERENCES

1. Kita-Tsukamoto K, Oyaizu H, Namba K, et al. Phylogenetic relationships of marine bacteria, mainly members of the family Vibrionaceae, determined on the basis of 16S rRNA sequences. *Int. J. Syst. Bacteriol* 1993; 43:8-19.
2. Nishiguchi MK. Temperature affects species distribution in symbiont populations of vibrio species. *Appl Environ Microbiol* 2000; 66:3550-3555.
3. Oliver JD, Kaper JB. Vibrio species. In: Doyle MP, Beuchat LR, Montville TJ (editors). *Food Microbiology: Fundamentals and Frontiers.* Washington DC:American Society of Microbiology; 1997:228-264.
4. CDC. Vibrio illnesses after hurricane Katrina – multiple states, August – September 2005. *MMWR* 2005; 54:928-931.
5. CDC. Two cases of toxigenic Vibrio cholerae O1 Infection after hurricanes Katrina and Rita – Louisiana, October 2005. *MMWR* 2006; 55:31-32.
6. Marano NN, Daniels NA, Easton AN, et al. A survey of stool culturing practices for Vibrio species at clinical laboratories in gulf coast states. *J Clin Microbiol* 2000; 38:2267-2270.

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