In the past few months, there have been a number of news reports regarding a “deadly flesh-eating bacteria” that has claimed the lives of ten people and infected another 31 in Florida. Is there really a new deadly bug out there, or is it just media hype?

The deadly bacteria making headlines is nothing new and does not pose a significant health risk to healthy individuals. The cause of these infections is *Vibrio vulnificus*.

The most common *Vibrio* pathogens in the United States are *Vibrio vulnificus*, *Vibrio parahaemolyticus*, and *Vibrio alginolyticus*. In fact, *Vibrio parahaemolyticus* is the leading cause of seafood-associated gastroenteritis in the United States.

The most well-known member of this genus is *Vibrio cholerae*, which is rare in the United States and, in most cases, is associated with travel to a foreign country. However, throughout the world, *Vibrio cholerae* causes 3 to 5 million cases of diarrheal disease and takes the lives of over 100,000 people each year.

Figure 1: *Vibrio cholerae* attaches itself to the mucosal lining of the intestinal tract with the help of its polar flagella. Colonization of the small intestine also requires the toxin coregulated pilus (TCP), a thin, flexible, filamentous appendage on the surface of bacterial cells (see photo at top of this page). There, it produces a potent toxin responsible for the characteristic watery diarrhea of cholera.

*Vibrio* species are gram negative, oxidase positive, comma-shaped rods, which...
are ubiquitous to marine and estuarine waters. These bacteria are found free-living in seawater and have been isolated from several different kinds of marine organisms, such as fish, shrimp, octopus, zooplankton, lobsters, and oysters.

The concentration of *Vibrio* in the environment rises in the summer months when the water is warm enough for the bacteria to thrive. During cooler months, there are low numbers of detectable *Vibrio* in ocean water. Recent studies show that *Vibrio parahaemolyticus* can be found in ocean sediment during winter months; it is believed the organism resides there until the water warms in summer.

Unlike other organisms that cause gastroenteritis, *Vibrio parahaemolyticus* and *Vibrio vulnificus* are not usually associated with water contaminated by fecal matter, poor hygiene, or from improper sanitation of surfaces in contact with food. *Vibrio parahaemolyticus* and *Vibrio vulnificus* are part of the normal microbiome of several different marine animals. These bacteria colonize marine animals and are present at the time of harvest.

Filter feeders, such as oysters, filter small particles and organisms from the surrounding water, filtering anywhere from 20 to 100 liters of water daily. This mechanism of feeding can lead to high concentrations of *Vibrio* in shellfish that are often 100-fold higher than are found in the surrounding water. Consequently, the concentration of *Vibrio parahaemolyticus* and *Vibrio vulnificus* in oysters harvested during summer can exceed $10^3$ CFU/gm and have been found at concentrations as high as $10^5$ CFU/gm.

During summer months when *Vibrio* are most prevalent, up to 100% of shellfish may contain *Vibrio parahaemolyticus* or *Vibrio vulnificus*.

*Vibrio* gastroenteritis is mainly associated with consumption of raw or undercooked shellfish containing *Vibrio parahaemolyticus* or *Vibrio vulnificus*. Gastroenteritis caused by *Vibrio parahaemolyticus* is characterized by watery diarrhea accompanied by abdominal cramps, vomiting, nausea, and fever. This form of gastroenteritis is usually self-limiting and subsides after 2 to 3 days. *Vibrio parahaemolyticus* can also infect soft tissue and wounds, although these infections are uncommon.

*Vibrio alginolyticus* is a common source of wound and ear (otitis media) infections and is associated with exposure to warm seawater containing the bacteria.

*Vibrio vulnificus* can cause deadly wound and bloodstream infections. The majority of wound infections come from exposure of open sores to contaminated seawater or contact with marine animals colonized by these bacteria.

Serious infections are associated with pre-existing hepatic disease and other conditions that leave the patient immune compromised. Liver diseases, which increase the availability of iron in the bloodstream, are a high risk factor for systemic infections by *Vibrio vulnificus*. This organism can also cause gastroenteritis similar to *Vibrio parahaemolyticus* in healthy individuals.

**Figure 2**: Raw or undercooked oysters are a common cause of gastrointestinal infections due to *Vibrio*. 
Vibrio vulnificus infections of the lower legs showing blistering lesions. Once in the bloodstream V. vulnificus infections are fatal 50% of the time. Ten persons have died in Florida this year due to this organism. One recent victim died only 62 hours after collecting crabs on a Florida beach.

It is believed the prevalence of Vibrio gastroenteritis is significantly underreported, with the vast majority of infections occurring between May and October. The CDC estimates that for every case of Vibrio parahaemolyticus reported, there are 142 cases that are not diagnosed.

The 2012 FoodNet surveillance program shows a 43% rise in Vibrio infections compared to 2006-2008. This rapid increase may be due in part to Vibrio infections becoming a nationally reportable disease in 2007.

Vibrio vulnificus infections are rare compared to Vibrio parahaemolyticus, but are much more serious. There is an average of 16 deaths from the Gulf Coast region and 35 deaths nationwide, from Vibrio vulnificus each year. In comparison, there is an average of only one to two deaths each year, from Vibrio parahaemolyticus.

Vibrio infections are more common in Florida than in any other Gulf Coast state. Therefore, Vibrio vulnificus infections reported in the news are tragic, but not out of the ordinary for this organism and the time of year.

In short, Vibrio infections are nothing new, but preventing infection is a difficult task. Prevention of Vibrio infection is complicated by many factors. Moreover, because Vibrio species are ubiquitous in marine and estuarine environments, it is impossible to guarantee seafood is free of these microorganisms.

Improper collection and storage of potentially contaminated seafood can also allow these organisms to multiply rapidly before consumption.

The FDA warns against several myths regarding the consumption of raw oysters that lead people to believe they are safe to eat. Some myths state that contaminated oysters will taste or smell differently, that only oysters in polluted water are unsafe to eat, or that hot sauce and alcohol will kill the bacteria.

However, the largest hurdle to preventing disease is the demand for raw oysters. Many people prefer to eat oysters that are raw or unprocessed.

Consequently, educating the public and increasing awareness of the dangers of eating raw seafood and the exposure of open wounds to seasonally warm seawater may be the best way to prevent future disease.
Additionally, individuals who are immune compromised or have pre-existing liver disease should especially avoid eating raw seafood.

There are a number of laboratory methods available for the detection of *Vibrio*. Pathogenic *Vibrio* species will grow on many types of general culture media and on some selective media for enterics, such as MacConkey Agar. *Vibrio* species will appear as non-fermenting colonies on MacConkey and can be rapidly screened by using a spot oxidase test. Unlike most *Enterobacteriaceae*, *Vibrio* are oxidase positive.

On TCBS, *Vibrio parahaemolyticus* and *Vibrio vulnificus* will appear as green colonies.

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**Figure 5:** Green colonies of *V. parahaemolyticus* on Hardy’s TCBS Agar.

In areas where *Vibrio* are endemic, the use of the selective media Thiosulfate-Citrate-Bile salts-Sucrose agar (TCBS) is common.