

## *E. coli* O157:H7

*E. coli* O157:H7 is a Class B Disease and must be reported to the state within one business day.

### Epidemiology

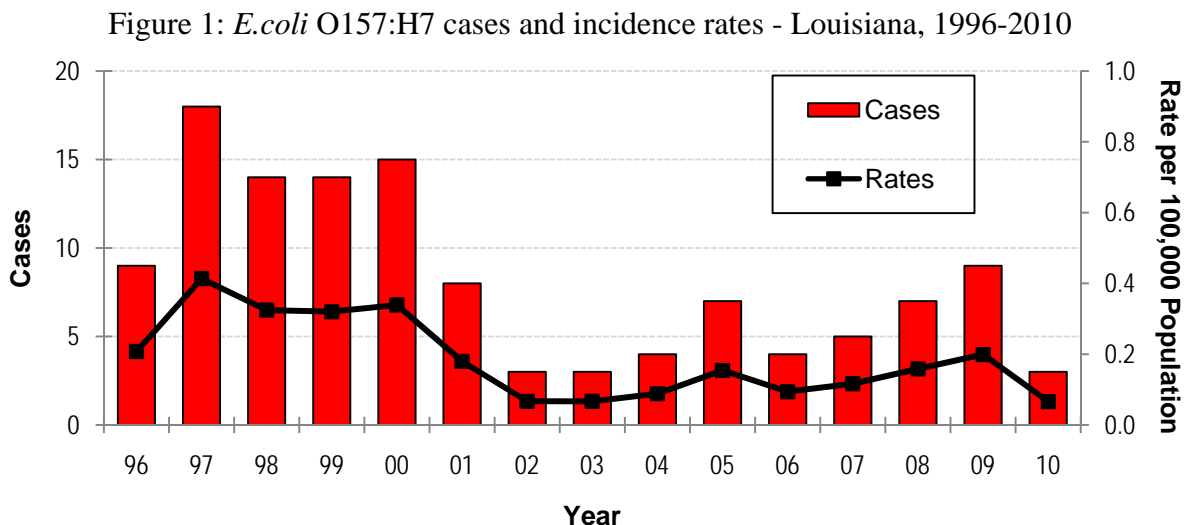
Enterohemorrhagic *Escherichia coli* (EHEC) or *E. coli* O57:H7 are bacteria that produce toxins (shiga-toxins) that cause illness. *E. coli* O157:H7 has a bovine reservoir and can be transmitted by undercooked ground beef and unpasteurized milk. These bacteria can also be spread from person-to-person by fecal-oral transmission, with person-to-person transmission most commonly being seen in families, child care centers and custodial institutions. Outbreaks from contaminated food and water have also occurred.

*E. coli* O157:H7 exists, at least intermittently, in both dairy and beef herds in the majority of cattle farms across the United States. Typically, O157 is detectable in the feces of fewer than five percent of cattle in the U.S. at any point in time. Despite this low detection rate, sixty percent of retail ground beef contains Shiga-Toxin producing *E. coli* (STEC). This is due in part to the way hamburger meat is produced. Hamburger meat is processed in bulk from a large number of animals. Up to a hundred cows may contribute to a single pack of hamburgers.

Symptoms of *E. coli* infection include diarrhea that ranges from mild and non-bloody to stools that are virtually all blood but contain no fecal leukocytes. Fever is not usually present.

### Incidence

*E. coli* O157:H7 became reportable in Louisiana in 1996. The number of cases ranged from eight to almost twenty per year in the late nineties then decreased in recent years to less than ten. (Figure 1)



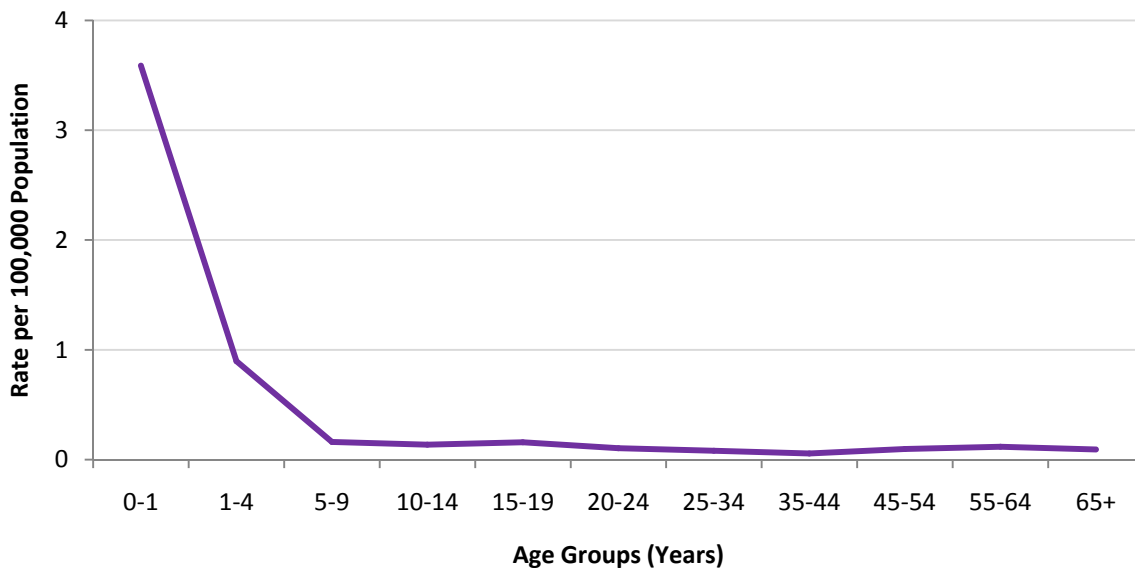
The most recent data (2010) from FoodNet\* states shows a national incidence rate of STEC (O157) infections to be 0.9 per 100,000 population. The incidence rate of *E. coli* O157:H7 infections for Louisiana in 2010 was 0.07 per 100,000 population.

\* *FoodNet* is a collaborative project of the CDC, ten EIP sites, the U.S. Department of Agriculture (USDA), and the *Food and Drug Administration (FDA)*.

### Age Group Distribution

The age group distribution shows a very high rate among infants and young children (Figure 2). There is no difference in incidence rates between males and females.

Figure 2: *E. coli* O157:H7 average annual incidence rates by age - Louisiana, 1996-2010

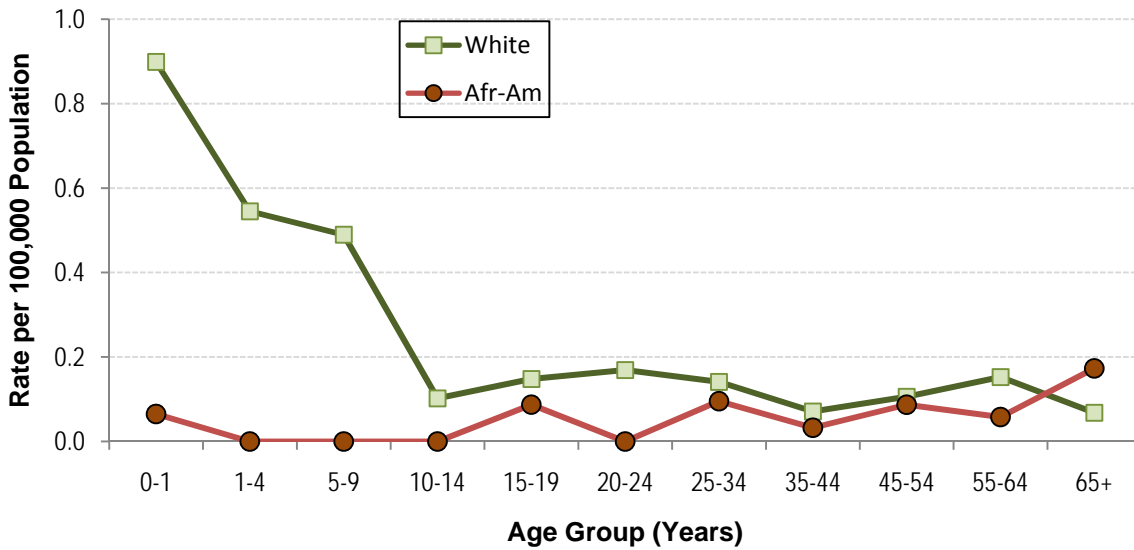


The highest rates are observed among infants who are not exposed to undercooked meat. These cases result from fecal-oral cross contamination when infants are fed. Detection is higher among infants than among older children and adults because infants with diarrhea are more likely to be brought to medical care and have stool cultured.

### Race Distribution

The race distribution shows a large discrepancy by race, with White infants and children having higher rates compared to African-Americans. These rates of *E. coli* O157:H7 are more reflective of diagnosis of diarrhea and access to medical care rather than true incidence (Figure 3).

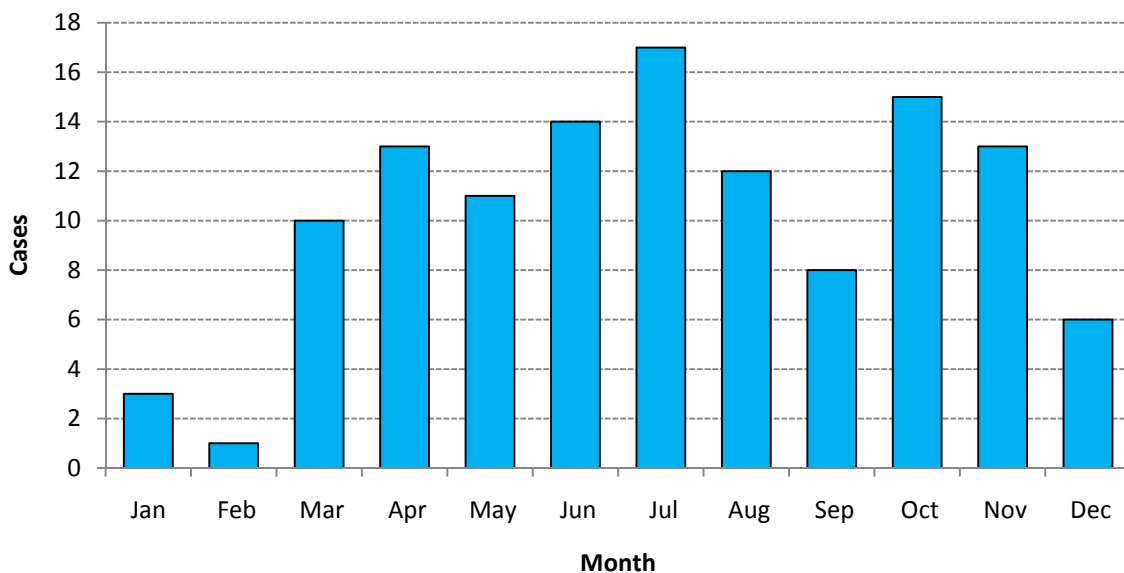
Figure 3: *E. coli* O157:H7 average incidence rates by race and age - Louisiana, 1996-2010



**Seasonal Distribution**

Typically the seasonal distribution of *E. coli* infections shows a higher number of cases during the summer months. Data from 1996 to 2010 shows an increase in cases from April to November in Louisiana (Figure 4).

Figure 4: *E. coli* O157:H7 total cases by month - Louisiana, 1996-2010



## Geographical Distribution

The geographic distribution of *E. coli* O157:H7 cases is a reflection of reporting patterns from medical providers (Table 1).

**Table 1:** Incidence rate of *E. coli* O157:H7 infections per 100,000 population by parish Louisiana, 1996-2010

Region	Parish	Inc. Rate 1996-2010	Region	Parish	Inc. Rate 1996-2010
1	Orleans	0.10	6	Rapides	0.73
	Jefferson	0.19		Avoyelles	0.48
	Plaquemines	0.26		Vernon	0.13
	St. Bernard	0.37		Grant	0
2	E. Baton Rouge	0.13		Winn	0.41
	W. Baton Rouge	0.62		La Salle	0
	E. Feliciana	0.33		Catahoula	0
	W. Feliciana	0		Concordia	0
	Ascension	0.23	7	Caddo	0.08
	Iberville	0		De Soto	0
	Pointe Coupee	0		Sabine	0.28
3	Lafourche	0.07		Bossier	0.06
	Terrebonne	0		Webster	0
	St. Mary	0		Claiborne	0
	St. John	0		Bienville	0
	St. Charles	0.67		Red River	0
	St. James	0.62		Natchitoches	0.17
	Assumption	0.86	8	Ouachita	0.27
4	Lafayette	0.10			Union
	St. Martin	0		Lincoln	0
	Iberia	0		Jackson	0.42
	Acadia	0		Morehouse	0.22
	Vermillion	0.12		Caldwell	0
	Evangeline	0		Richland	0.96
	St. Landry	0.15		W. Carroll	0
	5	Calcasieu	0.29		E. Carroll
Cameron		0		Madison	0
Beauregard		0		Franklin	0
Jefferson Davis		0		Tensas	0
Allen		0	9	St. Tammany	0.45
		Tangipahoa		0.25	
		Washington		0.45	
		St. Helena		0	
			Livingston	0.19	

## Other *E. coli*

Most strains of *E. coli* are normal, harmless inhabitants of the intestinal tract.

There are a few Enterohemorrhagic *E. coli* (EHEC) strains beyond O157:H7, e.g., *E. coli* O26:H11. All of these strains produce cytotoxins resembling those found in *Shigella dysenteriae*, type 1. These toxins are referred to as shigalike toxins or verotoxins.

Enteroinvasive *E. coli* (EIEC) strains include these specific serotypes of *E. coli*: O28, O112, O115, O124, O136, O143, O144, O147, O152, O164 and O167. The EIEC strains resemble *Shigella*, biochemically, and can invade intestinal epithelial cells.

Enteropathogenic *E. coli* (EPEC) strains traditionally have been defined as members of specific *E. coli* serotypes that have been epidemiologically incriminated as causes of infantile diarrhea. They include the following somatic serogroups: O44, O55, O86, O111, O114, O119, O125, O126, O127, O128, O142 and O158.

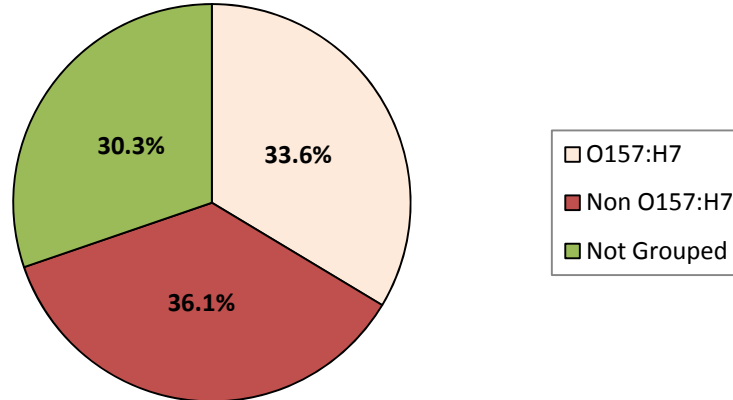
More recently, EPEC has been defined according to specific virulence properties. EPEC strains adhere to intestinal mucosa and produce a characteristic lesion in the gastrointestinal tract, termed an attaching and effacing lesion. EPEC do not produce enterotoxins and are not invasive.

Enterotoxigenic *E. coli* (ETEC) strains colonize the small intestine without invading it and produce either or both heat-labile and/or heat-stable enterotoxins. Examples of these strains include O6:H16 and O8:H9.

There is no tracking system for EPEC and ETEC; tracking of these strains is done only in research projects.

In 2001, national surveillance began for shiga-toxin producing *E. coli* under the name of EHEC. The case definition changed from EHEC to STEC (shiga-toxin producing *E. coli*) in 2006 and serotype specific reporting was implemented. From 2004 to 2010, the majority of the STEC cases in Louisiana were identified as shiga-toxin producing *E. coli*, non-O157:H7 (36.1%). The remaining cases were *E. coli* O157:H7 (33.6%), and STEC, not grouped (30.3%). (Figure 5)

Figure 5: Reported STEC cases by serotype - Louisiana, 2004-2010



### Hospitalization Surveillance

Hospitalization surveillance is based on the Louisiana Inpatient Hospital Discharge Data (LaHIDD). In 1997, the Louisiana legislature mandated the reporting of hospital discharge data. LaHIDD serves as the state registry containing hospital discharge data submitted to the Department of Health and Hospitals (DHH). The Office of Public Health (OPH) is responsible for making the data available to OPH sections as needed. The data is available with a delay of one to two years. The Infectious Disease Epidemiology Section uses these data sets for the surveillance of infectious diseases in hospitals. LaHIDD data sets contain demographic information (names, gender, age, date of birth, address, admit diagnosis, discharge diagnoses (main plus eight more diagnoses), procedures (main plus five), charges, length of stay and hospital name. The diagnoses and procedures are coded with ICD-9 codes. Repeat hospitalizations are not included. The data are based on the years 1999 to 2010.

Records of patients with *E.coli* were extracted using the following ICD9 codes whether in the main diagnosis or in the eight additional secondary diagnoses:

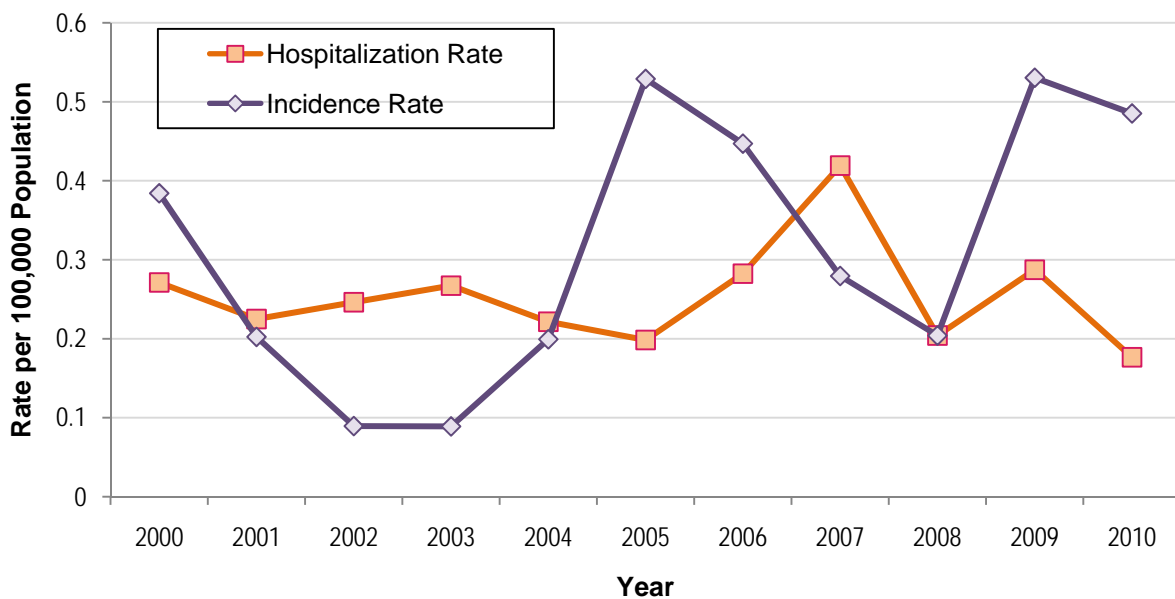
<u>CODE</u>	<u>DISEASE</u>
008.0	INTESTINAL INFECTION DUE TO <i>ESCHERICHIA COLI</i> ( <i>E. COLI</i> )
008.00	INTESTINAL INFECTION DUE TO <i>E. COLI</i> , UNSPECIFIED
008.01	INTESTINAL INFECTION DUE TO ENTEROPATHOGENIC <i>E. COLI</i>
008.02	INTESTINAL INFECTION DUE TO ENTEROTOXIGENIC <i>E. COLI</i>
008.03	INTESTINAL INFECTION DUE TO ENTEROINVASIVE <i>E. COLI</i>
008.04	INTESTINAL INFECTION DUE TO ENTEROHEMORRHAGIC <i>E. COLI</i>
008.09	INTESTINAL INFECTION DUE TO OTHER INTESTINAL <i>E. COLI</i> INFECTIONS

## Hospitalization Numbers, Rates and Trends

The following statistics are based on unduplicated patients.

The hospitalization rates due to *E. coli* infections ranged from 0.18 per 100,000 population to 0.42 per 100,000 population from 2000 to 2010. For most years, the hospitalization rate is different from the incidence rate of *E. coli* infections. This is due in part to the fact that not all *E. coli* cases are hospitalized. (Figure 6)

Figure 6: *E. coli* hospitalization and incidence rates per 100,000 population  
Louisiana, 2000-2010



## Gender

The trends in hospitalization rates by gender were variable between 1999 and 2010. The overall rate of hospitalizations due to *E. coli* was 0.26 per 100,000 population for males and for females. For most years, males had a higher rate of hospitalization due to *E. coli* than females.

## Race

Rates were calculated for Whites and African-Americans only. Numbers for other race and ethnic groups are small and the populations are often inaccurate. Rates based on race are underestimates of real rates since not all cases have race reported.

The overall rate of *E. coli* hospitalizations from 1999 to 2010 was 0.25 per 100,000 population for Whites and 0.14 per 100,000 population for African-Americans.

## Age Group

*E. coli* transmission is mainly through ingestion of foods contaminated with ruminant feces and direct contact with animals and their environment. No one group is more susceptible; however children younger than five years of age are diagnosed most frequently. Those sixty-five years old and older, while not defined as a high risk group for *E. coli* infections, is at a higher risk for complications as a result of an *E. coli* infection.

The age group distribution of hospitalization rates due to *E. coli* infections is similar to the age group distribution of the incidence rate (seen in Figure 2). The highest rates of hospitalization and incidence are seen in the age groups newborn to one year of age, and one year to four years of age.

## *E. coli* Categories

Some kinds of *E. coli* cause disease by making a toxin called Shiga toxin. The bacteria that make these toxins are called “Shiga toxin-producing” *E. coli*, or STEC for short. Enteroinvasive *E. coli* (EIEC), enterotoxigenic *E. coli* (ETEC) or enterohemorrhagic *E. coli* (EHEC) all refer generally to the same group of bacteria. The most commonly identified STEC in North America is *E. coli* O157:H7

Enteroinvasive strains of *E. coli* (EIEC) are endemic in developing countries. Rarely are infections and outbreaks of EIEC disease reported in industrialized countries. Hospitalization rates for the period from 1999 to 2010 were 0.05 per 100,000 hospitalizations, with only three hospitalizations due to enteroinvasive *E. coli* in Louisiana.

Enterotoxigenic strains of *E. coli* (ETEC) are major cause of travelers’ diarrhea in people from industrialized countries who visit developing countries. Additionally, it is also a major cause of dehydrating diarrhea in infants and children in developing countries. Five hospitalizations have been reported in Louisiana from 1999 to 2010.

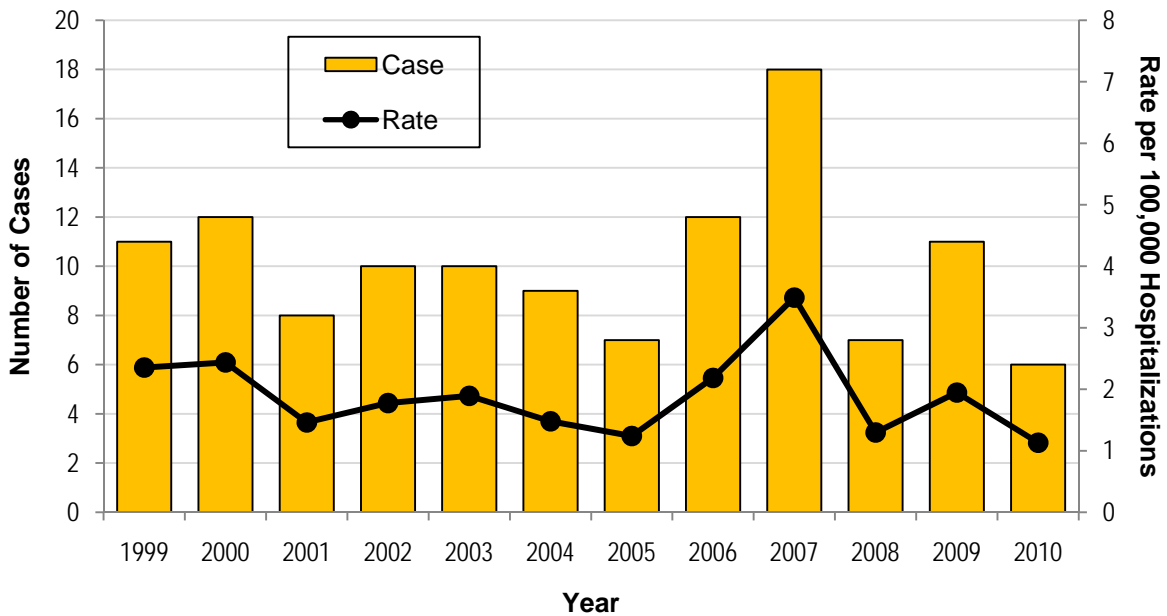
Enterohemorrhagic strains of *E. coli* (EHEC) are the main STEC serotype in North America. This serotype is thought to cause ninety percent of cases of diarrhea-associated hemolytic uremic syndrome (HUS). In Louisiana, there were seven hospitalizations due to EHEC between 1999 and 2010.

Enteropathogenic *E. coli* (EPEC) was found to have been a diagnosis for only one hospitalized patient for the years from 1999 to 2010 in Louisiana. Since 1960s, EPEC has largely disappeared as an important cause of diarrhea in infants in North America.

Oftentimes, *E. coli* is identified as a causative agent but serotyping is not conducted. This can explain why so many cases of “unspecified” or “other” cases of *E. coli* are seen. From 1999 to 2010, the hospitalization rate due to those *E. coli* infections was higher compared to that of

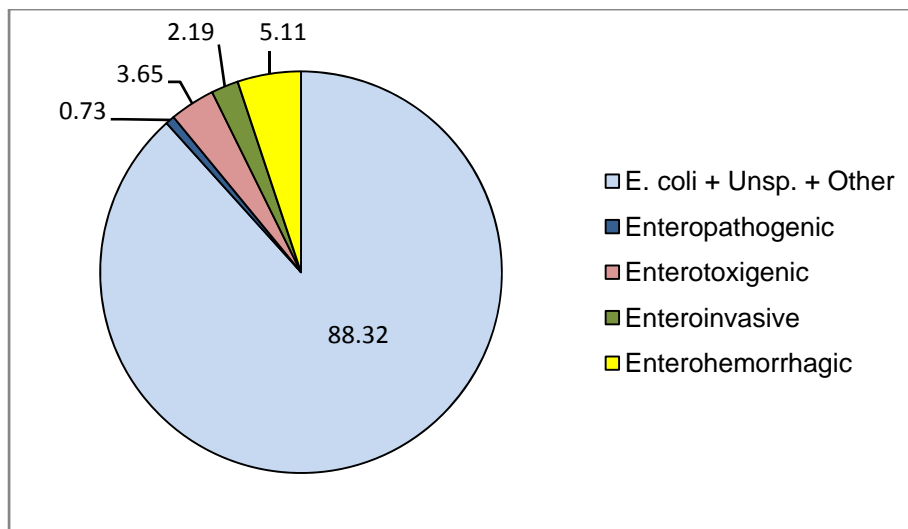
EHEC, ETEC, and EIEC. The highest rate of hospitalizations due to *E. coli* infections was seen in 2007 (3.5 per 100,000 hospitalizations), while the lowest was in 2010 (1.13 per 100,000 hospitalizations) (Figure 7).

Figure 7: Hospitalizations due to *E.coli*, *E.coli* Unspecified and *E.coli* Other – Louisiana, 1999-2010



Almost 90% of hospitalizations due to *E. coli* were attributed to those cases coded *E. coli*, *E. coli* unspecified and *E. coli* other. (Figure 8)

Figure 8: Subgroups for diagnosis of *E. coli* - Louisiana, 1999-2010



## **Mortality**

For the years 1999 to 2010, there was one death among patients with *E. coli* infections. The patient was 88 years-old, and the *E. coli* infection was in addition to diagnoses including nutritional marasmus, congestive heart failure and acute renal failure.