

# Outbreak Investigations

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### 1. Surveillance and Outbreak Investigations

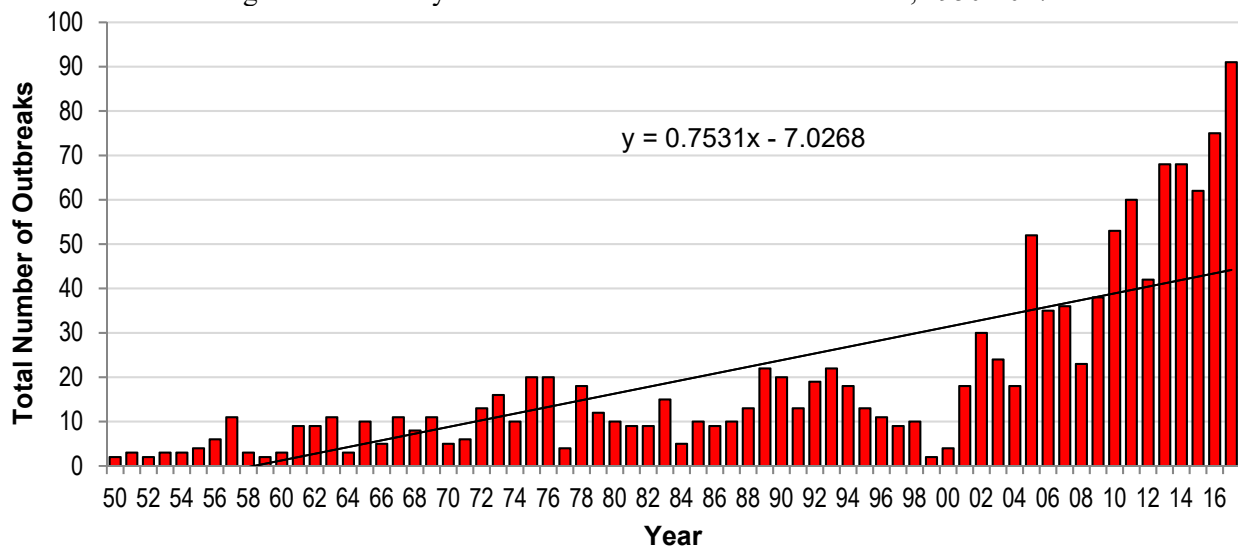
Health professionals are required by law to report selected infectious diseases (excluding STD, HIV and TB) to the Louisiana Office of Public Health Infectious Disease Epidemiology Section (IDEpi). Section epidemiologists look at the number of cases, their location and numerous other characteristics to study the distribution of these diseases and to draw some conclusions that guide the communicable disease control programs. This allows for the implementation of important preventive measures such as chemoprophylaxis to prevent invasive disease in close contacts of cases with meningococcal disease. Furthermore, section epidemiologists work closely with surveillance epidemiologists for timely and accurate follow-up on suspected and confirmed cases.

Disease outbreaks are identified by the reportable disease surveillance system, or by reports from the public or health professionals. Outbreak investigations have been expanded beyond the usual foodborne outbreaks to include arthropod-borne diseases, hospital-acquired infections and other infectious disease outbreaks in institutions. Investigations are carried out by regional teams that are supported by the section’s staff. Regional personnel, including the Infectious Disease-Rapid Response Team (ID-RRT) staff are regularly trained by the section.

### 2. Outbreak Summary 1950-2017

Infectious disease surveillance information in Louisiana is available from 1950 until the present day. From 1950 to 2017, there were a total of 1,289 recorded outbreaks in Louisiana (Figure 1).

Figure 1: Summary of total recorded outbreaks - Louisiana, 1950-2017



The number of outbreaks has steadily increased in this 67-year span; however this could be partly due to improved surveillance and reporting rather than an actual increase in the number of outbreaks. Referring to the peak in 2005, 60% of the outbreaks occurring that year were during the month of September, coinciding with the aftermath of Hurricane Katrina; 31% of those were foodborne.

### 3. Outbreaks 2010 to 2017

Outbreaks have been primarily categorized by transmission and disease type. For analyses purposes, five disease categories have been designated. Foodborne/enteric outbreaks have been by far the most common type of outbreak in Louisiana, accounting for 54% of the outbreaks. Respiratory outbreaks have made up 29% of the outbreaks over the last eight years. There were few outbreaks related to skin and soft tissue infections (SSTI) or vaccine-preventable diseases (VPD) (Table 1).

Table 1: Number of Outbreaks, by Category and Year - Louisiana, 2010-2017

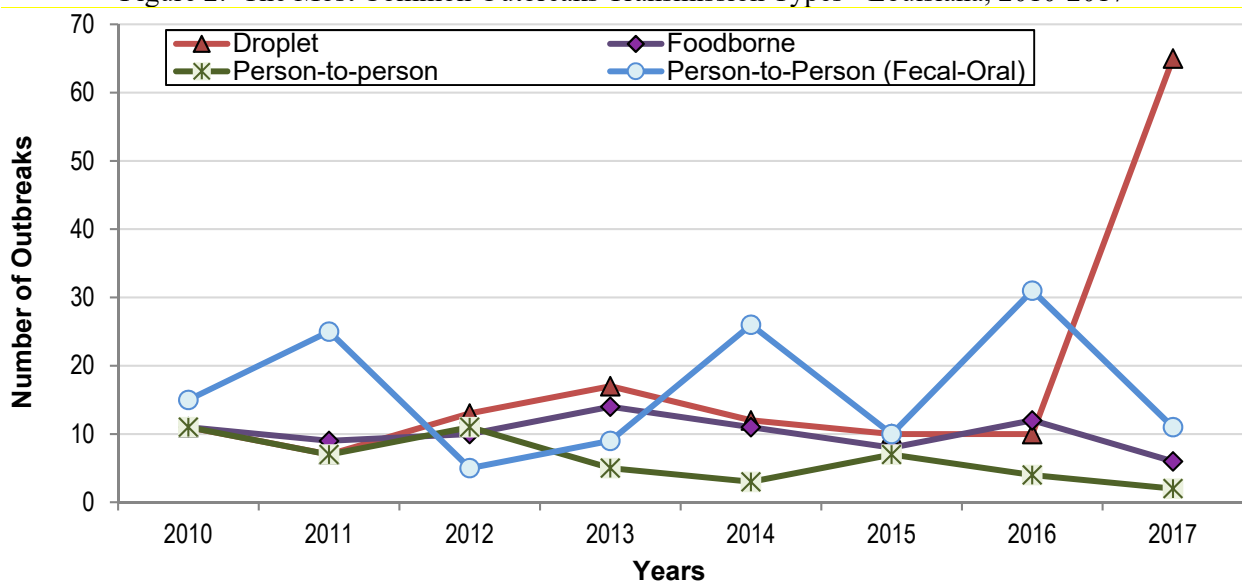
	2010	2011	2012	2013	2014	2015	2016	2017	Total
Food/Enteric	28	39	17	39	47	39	53	21	283
Other	5	8	2	6	3	5	8	0	37
Respiratory	13	9	14	17	14	10	11	63	151
SSTI*	3	2	3	3	2	2	1	4	20
VPD**	4	2	6	3	2	6	2	3	28
<b>Total</b>	<b>53</b>	<b>60</b>	<b>42</b>	<b>68</b>	<b>68</b>	<b>62</b>	<b>75</b>	<b>91</b>	<b>519</b>

\* SSTI: Skin and soft tissue infection

\*\* VPD: Vaccine-preventable disease

In the years 2010 to 2017, the most common modes of transmission were droplet, person-to-person (fecal-oral), person-to-person (such as skin and soft tissue infections, certain vaccine-preventable diseases, and other diseases caused by contact), and foodborne (Figure 2, Table 2).

Figure 2: The Most Common Outbreaks Transmission Types - Louisiana, 2010-2017



The 2017-2018 flu season saw much higher than usual outbreak activity, as seen in the spike in droplet-transmission outbreaks in 2017. This increase in influenza activity was seen nation-wide.

Table 2: Number of outbreaks, by transmission type - Louisiana, 2010-2017

Transmission Type	2010	2011	2012	2013	2014	2015	2016	2017	Total	Percentage of Known
Airborne	0	0	0	0	0	0	1	0	1	0.2%
Droplet	11	7	13	17	12	10	10	65	145	31.8%
Environment Contact	3	4	0	4	7	4	3	2	27	5.9%
Foodborne	11	9	10	14	11	8	12	6	81	17.8%
Person-to-Person	11	7	11	5	3	7	4	2	50	11.0%
Person-to-Person (Fecal-Oral)	15	25	5	9	26	10	31	11	132	28.9%
Unknown	2	6	2	13	4	20	12	4	63	
Vectorborne	0	0	0	0	0	0	1	0	1	0.2%
Waterborne	0	2	1	2	4	2	0	1	12	2.6%
Zoonotic	0	0	0	4	1	1	1	0	7	1.5%
<b>Total</b>	<b>53</b>	<b>60</b>	<b>42</b>	<b>68</b>	<b>68</b>	<b>62</b>	<b>75</b>	<b>91</b>	<b>519</b>	

The type of facility in which outbreaks occur often vary by the transmission mode of the disease. However, a commonality between all of these facilities is that they allow for large numbers of people to come in close contact with each other at any given point. This environment is conducive for diseases to spread (Table 3).

Table 3: Outbreaks by Facility Type and Transmission Type - Louisiana, 2010-2017

The

		Transmission										
		Airborne	Droplet	Environment contact	Foodborne	Person-to-Person	Person-to-Person (Fecal-Oral)	Unknown	Vectorborne	Waterborne	Zoonotic	Total
Facility Type	Area/Region	0	8	3	6	0	6	6	1	2	0	32
	Day Care / Camp	0	8	2	1	8	36	7	0	2	0	64
	Correctional	0	2	1	5	10	0	0	0	1	0	19
	Hotel	0	0	0	1	0	1	2	0	2	0	6
	LTCF	0	63	0	0	5	43	11	0	0	0	122
	Medical	1	10	14	1	4	11	6	0	1	0	48
	Multi-State	0	0	1	14	0	3	4	0	0	5	27
	Other	0	2	0	4	1	0	3	0	0	0	10
	Group / Event	0	1	3	14	1	2	8	0	3	0	32
	Private Residence	0	28	1	3	4	4	7	0	1	2	50
	Public Space	0	0	0	0	1	3	0	0	0	0	4
	Residential Facility	0	2	0	0	2	4	0	0	0	0	8
	Restaurant	0	0	0	28	0	1	2	0	0	0	31
	School/University	0	21	2	4	13	18	7	0	0	0	65
	Shelter	0	0	0	0	1	0	0	0	0	0	1
<b>Total</b>	<b>1</b>	<b>145</b>	<b>27</b>	<b>81</b>	<b>50</b>	<b>132</b>	<b>63</b>	<b>1</b>	<b>12</b>	<b>7</b>	<b>519</b>	

settings for these investigations were: area / region (geographical area such as a city, parish or region), child day care / camp, correctional facility, hotel, long-term care facility (LTCF) / adult day care, medical facility (non-long-term care), multi-state, private group /event, private residence, public space, residential facility (dorm, group living), restaurant, school / university (not isolated to dorm), shelter, and other.

Long-term care facilities, child day cares, restaurants, and schools are the main settings for foodborne and enteric disease outbreaks. The main settings for respiratory outbreaks are long term care facilities and private residences.

### 3.1 Hospitalizations

The following data shows outbreaks for which there was information on hospitalizations. The proportion of outbreaks with hospitalized cases vary according to the type of outbreak (highest in foodborne/enteric and respiratory, lowest for SSTI), and with the period considered. The average number of cases hospitalized is 3.7 per outbreak with hospitalized cases (Table 4).

Table 4: Hospitalizations – Louisiana, 2010-2017

2010-2017	Total Number	Number with Hospitalizations	Percent with Hospitalization	Number Hospitalized	Avg./Hosp.
Food/Enteric	283	81	28.6%	284	3.5
Other	37	5	13.5%	17	3.4
Respiratory	151	73	48.3%	306	4.2
SSTI	20	7	35.0%	15	2.1
VPD	28	1	3.6%	2	2.0
Total	519	167	32.2%	624	3.7

### 3.2 Deaths

Following are deaths associated with outbreaks (Table 5).

Table 5: Deaths – Louisiana, 2010-2017

Year	Category	Etiologic Agent	Facility Type	Number
2010	Food/Enteric	Perfringens	Other	3
2010	HAI	Acinetobacter	Med Facility	2
2010	Food/Enteric	Listeria	Area	2
2011	HAI	Pseudomonas	Med Facility	4
2011	Food/Enteric	Norovirus	LTCF	3
2011	HAI	Acinetobacter	Med Facility	2
2011	Parasite	Balamuthia	Private	1
2011	Waterborne	<i>Francisella novicida</i>	Correction	1
2011	Respiratory	Influenza	LTCF	1
2011	Parasite	Naegleria	Private	1
2011	SSTI	MRSA	LTCF	1
2011	Parasite	Naegleria	Private	1
2011	Food/Enteric	Listeria	Private	2
2011	HAI	Klebsiella	Med Facility	1
2012	Food/Enteric	<i>E. coli</i>	Area	1
2013	Respiratory	Influenza	Area	3
2013	Respiratory	Influenza	Med Facility	3
2013	Respiratory	Influenza	Area	4
2013	Respiratory	Legionella	Restaurant	1
2014	Respiratory	Respiratory pathogen	LTCF	3
2014	Respiratory	Group A Strep	Med	2
2014	Food/Enteric	Norovirus	Med	1
2014	Other	Other	Area	1
2015	Respiratory	Streptococcus pneumonia	Private	1

Year	Category	Etiologic Agent	Facility Type	Number
2016	Fungal	Mucormycosis	Med	2
2016	Respiratory	Influenza	LTCF	1
2016	HAI	<i>Clostridium difficile</i>	LTCF	1
2016	Other	Other	Other	1
2017	Enteric Person-to-Person	Norovirus	LTCF	1
2017	Respiratory	Influenza	LTCF	1
2017	Respiratory	Influenza	LTCF	1
2017	Respiratory	Influenza	LTCF	1
2017	Respiratory	Influenza	LTCF	1
2017	Respiratory	Influenza	LTCF	1
2017	Respiratory	Influenza	LTCF	2
2017	Respiratory	Influenza	LTCF	2
2017	Respiratory	Influenza	LTCF	1
2017	Respiratory	Influenza	LTCF	1
2017	Respiratory	Influenza	LTCF	1
2017	Respiratory	Influenza	LTCF	1
2017	Respiratory	Influenza	LTCF	1
2017	Respiratory	Influenza	LTCF	2
2017	Respiratory	Influenza	LTCF	3
2017	SSTI	MRSA	Med	1
2017	Foodborne	Multiple	Region	1

**3.3 Foodborne/Enteric Outbreaks**

A foodborne illness results from the consumption of foods contaminated with biological pathogens or toxins. The symptoms can include nausea, vomiting, abdominal pain, diarrhea, fever, headache and fatigue. In Louisiana, there were 236 foodborne/enteric outbreaks reported between 2010 and 2017. The most common etiologic agent of foodborne/enteric outbreaks was norovirus. Table 6 shows the counts by year of outbreak for the seven most common causes of foodborne/enteric outbreaks (236 of the 283).

Table 6: Most Common Etiologic Agents of Foodborne/Enteric Outbreaks - Louisiana, 2010-2017

Foodborne/Enteric	2010	2011	2012	2013	2014	2015	2016	2017	Total
E.coli	0	2	3	2	1	1	2	3	14
Enteric Unknown	2	3	2	9	8	18	5	4	51
Food Toxin	0	0	0	0	0	0	1	0	1
Foodborne Unknown	3	0	3	2	3	0	0	1	12
Norovirus	17	11	5	10	13	6	10	5	77
Salmonella	1	3	1	10	4	6	13	3	41
Shigella	3	3	3	3	5	2	19	2	40
Grand Total	26	22	17	36	34	33	50	18	236
<b>Percent/Year</b>									
E.coli	0.0%	9.1%	17.6%	5.6%	2.9%	3.0%	4.0%	16.7%	5.9%
Enteric Unknown	7.7%	13.6%	11.8%	25.0%	23.5%	54.5%	10.0%	22.2%	21.6%
Food Toxin	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.0%	0.0%	0.4%
Foodborne Unknown	11.5%	0.0%	17.6%	5.6%	8.8%	0.0%	0.0%	5.6%	5.1%
Norovirus	65.4%	50.0%	29.4%	27.8%	38.2%	18.2%	20.0%	27.8%	32.6%
Salmonella	3.8%	13.6%	5.9%	27.8%	11.8%	18.2%	26.0%	16.7%	17.4%
Shigella	11.5%	13.6%	17.6%	8.3%	14.7%	6.1%	38.0%	11.1%	16.9%

As expected with the population distribution, the most outbreaks occurred in Regions 2 and 1 (with Baton Rouge and New Orleans as the population centers, respectively) (Table 7).

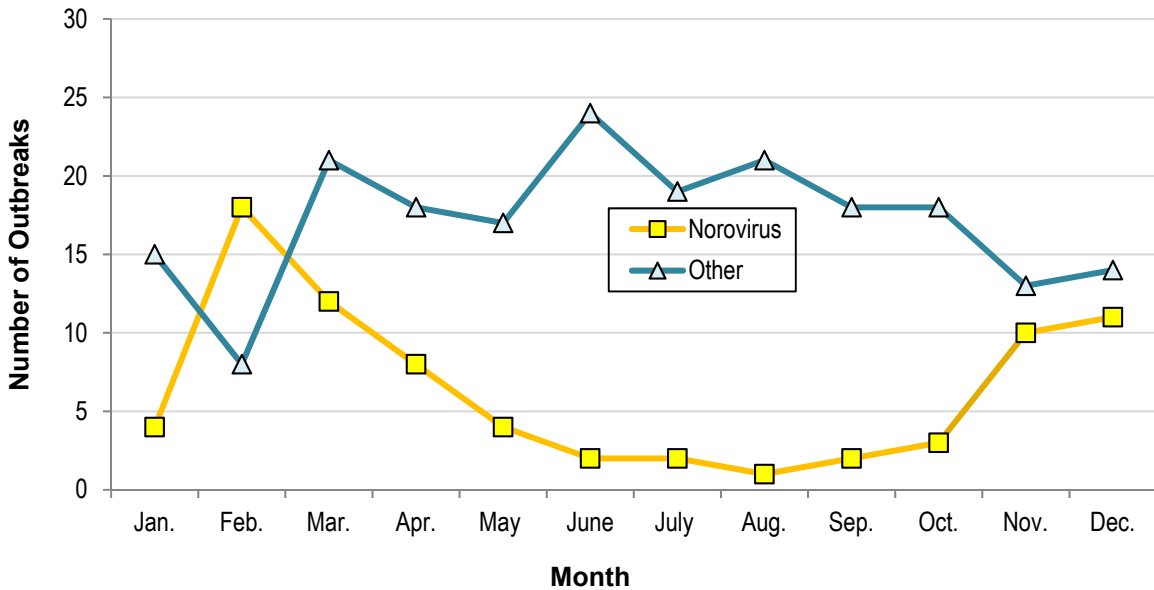
Table 7: Location of Foodborne/Enteric Outbreaks by Region - Louisiana, 2010-2017

Parish or Region	2010-2017		
	Number	Population in 100,000	Rate /100,000
Region 1	46	69.0	0.67
Region 2	59	57.1	1.03
Region 3	14	33.6	0.42
Region 4	26	48.3	0.54
Region 5	16	24.2	0.66
Region 6	27	25.6	1.05
Region 7	14	43.1	0.32
Region 8	25	31.9	0.78
Region 9	36	42.2	0.85
Multi Region	10		
Multi State	10		
<b>Total</b>	283		

### 3.4 Seasonal Trends

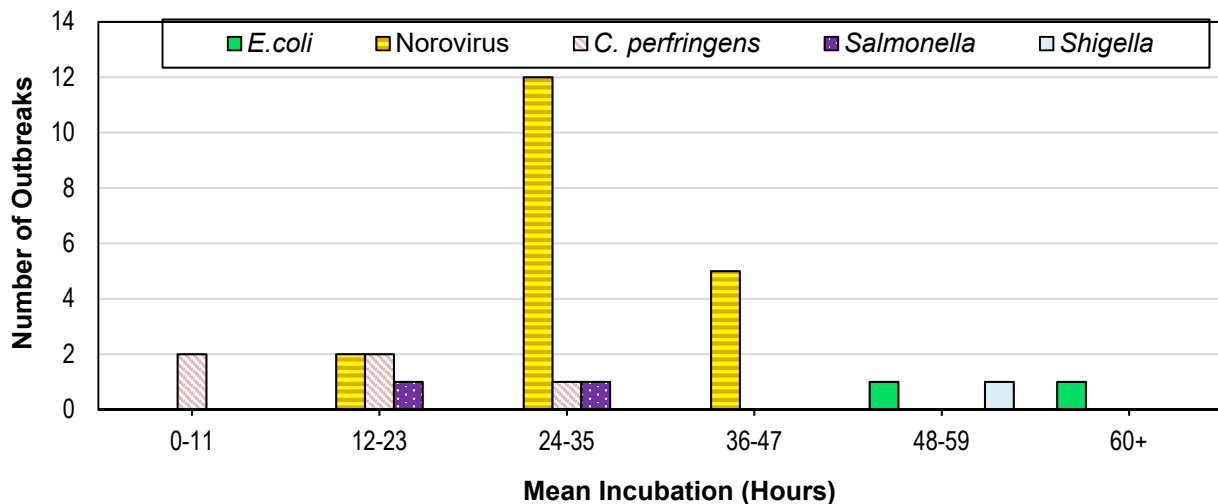
The seasonal trends are displayed for norovirus outbreaks (higher in the winter months), and for etiologies other than norovirus (higher in the warmer months), (Figure 3).

Figure 3: Seasonal transmission patterns of foodborne/enteric outbreaks – Louisiana, 2010-2017



The time between infection and first onset of symptoms is known as the incubation period. This can vary between different organisms. Norovirus typically has an incubation period of 12 to 36 hours. *C. per-fringens* emits an enterotoxin after being ingested and has an incubation period of eight to 16 hours. *Shigella* has an incubation period of 24 to 48 hours and pathogenic *E. coli* has an incubation period ranging from one to eight days (Figure 4).

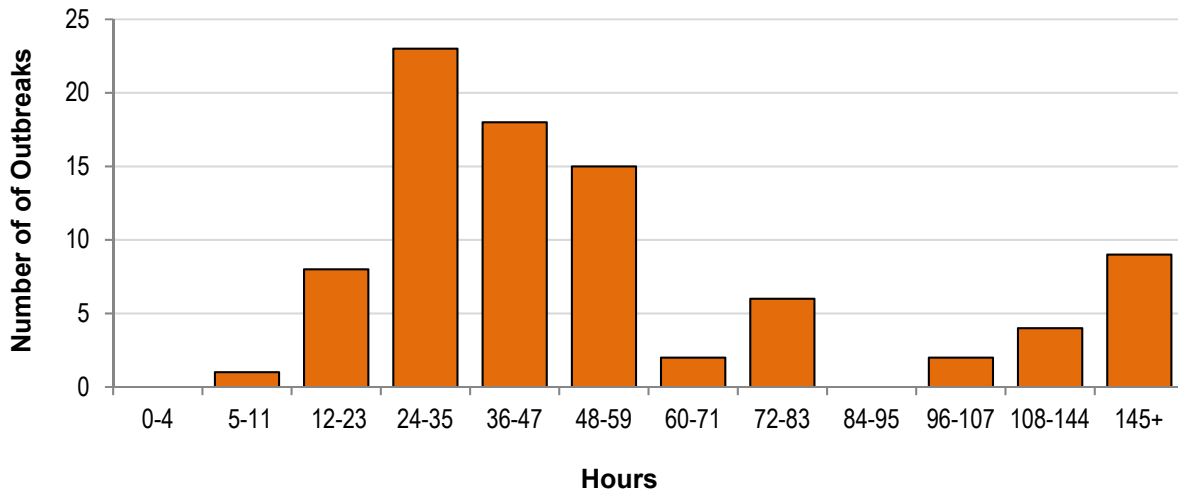
Figure 4: Mean Incubation Periods of Most Common Etiologic Agents of Foodborne/Enteric Outbreaks Louisiana, 2010-2017





The reported average duration of enteric symptoms per case for each outbreak lasted typically between 12 hours to three days after onset of illness. However, some cases reported symptoms lasting six days or longer (Figure 5).

Figure 5: Mean Duration of Illness in Foodborne/Enteric Outbreaks – Louisiana, 2010-2017



### 3.5 Respiratory Outbreaks

Respiratory illnesses are easily transmitted to those in close contact due to respiratory droplets produced from coughing, sneezing and talking. Improper hand washing and sharing personal items with ill persons can also lead to disease transmission. In Louisiana, there were 151 reported respiratory-related outbreaks between 2010 and 2017 (Table 8).

Table 8: Most Common Etiologic Agents of Respiratory Outbreaks - Louisiana, 2010-2017

Etiologic	2010	2011	2012	2013	2014	2015	2016	2017	Total
Influenza	4	3	5	5	4	0	6	57	84
Legionella	0	0	1	0	0	1	0	0	2
Other/Unknown	4	3	2	1	3	6	1	4	24
Pertussis	4	3	4	10	6	3	2	1	33
RSV	0	0	2	1	0	0	1	1	5
Strep/Pneumo	1	0	0	0	1	0	1	0	3
<b>Total</b>	<b>13</b>	<b>9</b>	<b>14</b>	<b>17</b>	<b>14</b>	<b>10</b>	<b>11</b>	<b>63</b>	<b>151</b>

**3.6 SSTI: Skin and Soft Tissue Infections**

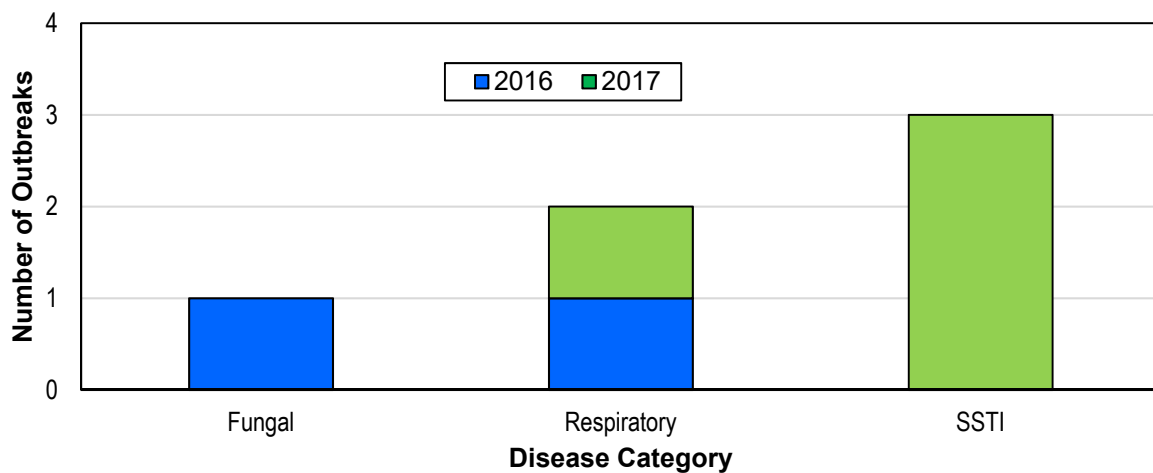
Between 2010 and 2017, 70.6% of the outbreaks related to skin and soft tissue infections (SSTI) were caused by the bacterium *Staphylococcus aureus*; of those, 50.0% were due to MRSA and 50.0% were due to *Staphylococcus aureus*. The remaining were caused by nontuberculosis mycobacterium (17.6%) and other agents (11.8%).

The facilities where these SSTI outbreaks occurred were schools (17.6%), medical facilities (52.9%), long term care facilities (5.9%), private party (5.9%), private residences (5.9%), area/regions (5.9%), and correctional facilities (5.9%).

**3.7 HAI: Health Care-Associated Infections**

Many different types of infections can be acquired in health-care settings, such as ventilator-associated pneumonia, surgical site infections, or bloodstream infections. However, outbreaks in health care settings are relatively rare. There have only been six HAI outbreaks in the past few years, with skin and soft tissue infections (SSTI) accounting for half of them (Figure 6).

Figure 6: HAI Infections by Disease Type, Louisiana 2016-2017



**4. Outbreaks 1950 to 2009**

Outbreaks have been primarily categorized by transmission type. For analyses purposes, 12 categories have been designated. Foodborne/enteric outbreaks have been by far the most common type of outbreak in Louisiana, accounting for more than 50% of the total outbreaks observed from 1950 to 2009.

Respiratory outbreaks are the second most common (11%), and the remaining individual types of outbreaks account each for 8% or less of the total observed outbreaks (Table 10).

Table 10: Number of Outbreaks, by Category and Decade - Louisiana, 1950-2009

Etiology Group	1950-59	1960-69	1970-79	1980-89	1990-99	2000-09	Total
Arbovirus	0	0	2	0	1	0	4
Foodborne /Enteric	20	59	66	51	85	189	470
Fungal	0	1	0	0	0	4	5
HAI	0	1	1	6	2	4	14
Hepatitis	3	9	21	13	16	3	65
Other	1	1	2	0	2	4	10
Parasite	0	1	2	10	1	13	27
Respiratory	3	0	6	26	18	32	85
SSTI	0	7	6	3	8	12	36
Virus	0	0	11	2	1	15	29
Waterborne	1	0	2	0	0	1	4
Zoonosis	6	1	5	1	2	1	16
<b>Total</b>	<b>34</b>	<b>80</b>	<b>124</b>	<b>112</b>	<b>136</b>	<b>279</b>	<b>765</b>

The number of foodborne/enteric outbreaks has showed the greatest increase since 1950 with more resources having been spent on investigating foodborne outbreaks. These resources include more staff time, additional lab tests making it easier to identify foodborne pathogens and genetic finger-printing (PFGE) allowing to link cases into outbreaks.

Outbreaks of respiratory diseases were rarely investigated until the 1980’s, when lab diagnostics and detection improved.

Prior to 2000, the majority of hepatitis outbreaks were attributed to hepatitis A. Due to better control efforts, incidence has been decreasing.

Skin and soft tissue infection (SSTI) outbreaks had remained low until recent years and since, have been on the rise, due to the increase in Methicillin-Resistant *Staphylococcus Aureus* (MRSA) skin infections (Figure 7, Table 11).

Figure 7: The most common outbreaks, by disease type and decade - Louisiana, 1950-2009

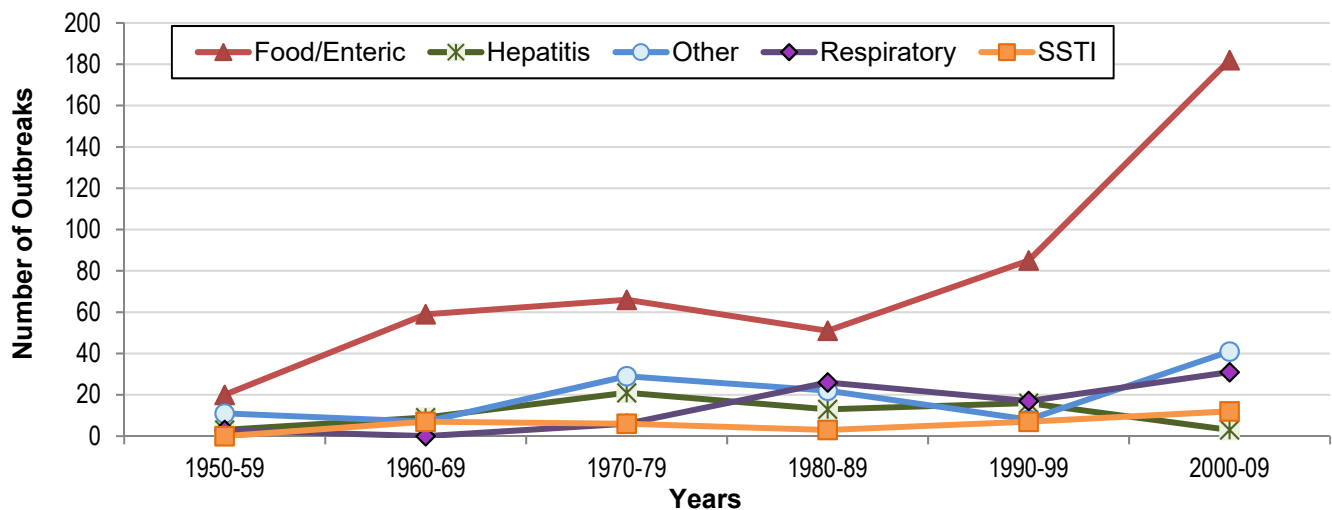


Table 11: Number of Outbreaks, by Simplified Category and Decade - Louisiana, 1950-2009

Numbers	1950-59	1960-69	1970-79	1980-89	1990-99	2000-09	Total
Food/Enteric	20	59	66	51	85	189	470
Hepatitis	3	9	21	13	16	3	65
Other	8	5	25	19	9	43	109
Respiratory	3	0	6	26	18	32	85
SSTI	0	7	6	3	8	12	36
Total	34	80	124	112	136	279	765
Column Percent	1950-59	1960-69	1970-79	1980-89	1990-99	2000-09	Total
Food/Enteric	58.8	73.8	53.2	45.5	62.5	67.7	61.4
Hepatitis	8.8	11.3	16.9	11.6	11.8	1.1	8.5
Other	23.5	6.3	20.2	17.0	6.6	15.4	14.2
Respiratory	8.8	0.0	4.8	23.2	13.2	11.5	11.1
SSTI	0.0	8.8	4.8	2.7	5.9	4.3	4.7
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

The types of facility in which outbreaks occur often vary by the

transmission mode of the disease. However, a commonality between all of these facilities is that they allow for large numbers of people to come in close contact with each other at any given point. This environment is conducive for diseases to spread (Table 12).

Table 12: Foodborne, Respiratory, Hepatitis and SSTI Outbreaks, by Facility Type - Louisiana, 1950-1999

1950-1999	Numbers						Column Percent				
Facility	FoodBorne / Enteric	Respiratory	Hepatitis	SSTI	Other	Total	FoodBorne / Enteric	Respiratory	Hepatitis	SSTI	Other
Total 486 Missing data 192											
Area	7	2	1	0	7	17	4.0	4.7	2.8	0.0	28.0
Correction	16	0	3	0	0	19	9.1	0.0	8.3	0.0	0.0
Day Care	8	21	14	0	1	44	4.6	48.8	38.9	0.0	4.0
Food Supplier	6	1	0	1	0	8	3.4	2.3	0.0	6.7	0.0
Group Party	17	1	1	1	1	21	9.7	2.3	2.8	6.7	4.0
LTCF	6	8	1	8	0	23	3.4	18.6	2.8	53.3	0.0
Medical	16	4	1	3	9	33	9.1	9.3	2.8	20.0	36.0
Other	0	1	0	0	0	1	0.0	2.3	0.0	0.0	0.0
Outside Party	8	1	1	0	0	10	4.6	2.3	2.8	0.0	0.0
Private Party	21	2	0	0	5	28	12.0	4.7	0.0	0.0	20.0
Restaurant	22	1	2	0	1	26	12.6	2.3	5.6	0.0	4.0
School	47	0	12	2	1	62	26.9	0.0	33.3	13.3	4.0
Ship	1	1	0	0	0	2	0.6	2.3	0.0	0.0	0.0
<b>Total</b>	<b>175</b>	<b>43</b>	<b>36</b>	<b>15</b>	<b>25</b>	<b>294</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

The settings for these investigations were: area (geographical area such as a city, parish or region); correctional facilities; day care center; school; medical facility; long term care facility (LTCF); restaurant; food supplier; group party; private party; outside party (picnic, campsite); and ship.

School, restaurant and private parties are the main settings for food-borne outbreaks. Schools may be over-represented in comparison with the other two settings because school officials would be eager to get an investigation done, while for restaurants and private parties, reporting may be often missed.

The main setting for respiratory outbreaks is day care centers, probably due to enhanced concerns by the parents. Schools and day care are the main settings for hepatitis outbreaks (Table 13).

Table 13: Foodborne, Respiratory, SSTI and Other Outbreaks, by Facility Type  
Louisiana, 2000-2009

2000-2009 Facility Total 279 Missing data: 1	Numbers					Column Percent				
	Foodborne /Enteric	Respiratory	SSTI	Other	Total	Foodborne /Enteric	Respiratory	SSTI	Other	Total
Area	2	4	1	5	12	1.1	12.5	8.3	10.9	4.3
College	0	1	0	0	1	0.0	3.1	0.0	0.0	0.4
Correction	11	1	1	0	13	5.9	3.1	8.3	0.0	4.7
Day Care	10	1	0	6	17	5.3	3.1	0.0	13.0	6.1
Dormitory Other	0	0	1	3	4	0.0	0.0	8.3	6.5	1.4
Food Supplier	7	0	0	1	8	3.7	0.0	0.0	2.2	2.9
Group Party	3	0	3	1	7	1.6	0.0	25.0	2.2	2.5
LTCF	31	4	0	7	42	16.5	12.5	0.0	15.2	15.1
Medical	31	8	2	11	52	16.5	25.0	16.7	23.9	18.7
Office	0	1	0	0	1	0.0	3.1	0.0	0.0	0.4
Other	7	1	0	0	8	3.7	3.1	0.0	0.0	2.9
Outside Party	3	0	1	2	6	1.6	0.0	8.3	4.3	2.2
Private Party	16	0	1	4	21	8.5	0.0	8.3	8.7	7.6
Restaurant	42	0	0	1	43	22.3	0.0	0.0	2.2	15.5
School	21	11	2	4	38	11.2	34.4	16.7	8.7	13.7
Ship	4	0	0	1	5	2.1	0.0	0.0	2.2	1.8
<b>Total</b>	<b>182</b>	<b>32</b>	<b>12</b>	<b>46</b>	<b>278</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>

The column ‘hepatitis’ is no longer presented since the number of outbreaks for this disease is so small. Outbreaks of hepatitis are included in the ‘Other’ column.

**4.1 Hospitalizations and Deaths**

The following data shows outbreaks for which there was information on hospitalization. The proportion of outbreaks with hospitalized cases vary according to the type of outbreak (highest in respiratory outbreaks, lowest for SSTI), and with the period considered. The proportion of outbreak with hospitalized cases increased from 12% before the year 2000 to 24% after the year 2000. The increase is due to intensified efforts at documenting all aspects of outbreaks after the year 2000. The number of cases hospitalized is 4.0 per outbreak with hospitalized cases (Table 14).

Table 14: Hospitalizations – Louisiana, 1950-2009

1950 to 1999	Total Number	Number with Hospitalization	Percent with Hospitalization	Number Hospitalized	Avg. /Hosp.
Food/Enteric	281	27	9.6%	153	5.7
Hepatitis	62	2	3.2%	5	2.5
Other	66	7	10.6%	22	3.1
Respiratory	53	22	41.5%	58	2.6
SSTI	24	3	12.5%	13	4.3
<b>Total</b>	<b>486</b>	<b>61</b>	<b>12.6%</b>	<b>251</b>	<b>4.1</b>
2000 to 2009	Total Number	Number with Hospitalization	Percent with Hospitalization	Number Hospitalized	Avg. /Hosp.
Food/Enteric	189	46	24.3%	153	3.3
Hepatitis	3	1	33.3%	5	5.0
Other	43	10	23.3%	22	2.2
Respiratory	32	10	31.3%	58	5.8
SSTI	12	2	16.7%	13	6.5
<b>Total</b>	<b>279</b>	<b>69</b>	<b>24.7%</b>	<b>251</b>	<b>3.6</b>

**4.2 Deaths**

There were very few deaths associated with the following outbreaks (Table 15).

Table 15: Deaths Associated with Outbreaks - Louisiana, 1950-2009

Year	Category	Etiological Agent	Facility Type	Number
2005	Food/Enteric	Norovirus	Nursing Home	1
2003	Respiratory	Pertussis	Hospital	1
2002	Other	Echovirus 7	Hospital	3
2002	Respiratory	Influenza A	Nursing Home	1
1998	Respiratory	Meningococcal Meningitis	Residential Facility	1
1980	Other	Trichinosis	City	1

### 4.3 Foodborne/Enteric Outbreaks

Foodborne illness results from the consumption of foods contaminated with biological pathogens or toxins. The symptoms can include nausea, vomiting, abdominal pain, diarrhea, fever, headache and fatigue. In Louisiana, there have been from 60 to 90 foodborne outbreaks per decade since 1950 with a sharp increase to 180 for the decade from 2000 to 2009. This sharp increase is due to a forward leaning robust response posture to outbreaks including: investigating all reported outbreaks; completion of investigations in a timely fashion; systematical provision of feed-back; and enhanced use of laboratory support.

From 1950 through 1999, the majority of foodborne outbreaks occurred in schools, households/private parties, restaurants and prisons (Table 12). Since 2000, restaurants, hurricane shelters, nursing homes and schools have been the focal facility types where foodborne outbreaks have been concentrated (Table 13).

The average number of cases per outbreak from 1950 to 1999 has been 58 persons with a range from two to 870 cases per outbreak and a total number of 6,044 cases. The average number of cases per outbreak from 2000 to 2009 has been 28 persons with a range from two to 332 cases per outbreak and a total number of 4,957 cases.

The most common etiologic agents of foodborne/enteric outbreaks are Norovirus, *Salmonella* spp., *Shigella* spp. (typically *sonnei*), *Clostridium perfringens* and *Staphylococcus aureus*, respectively (Table 16).

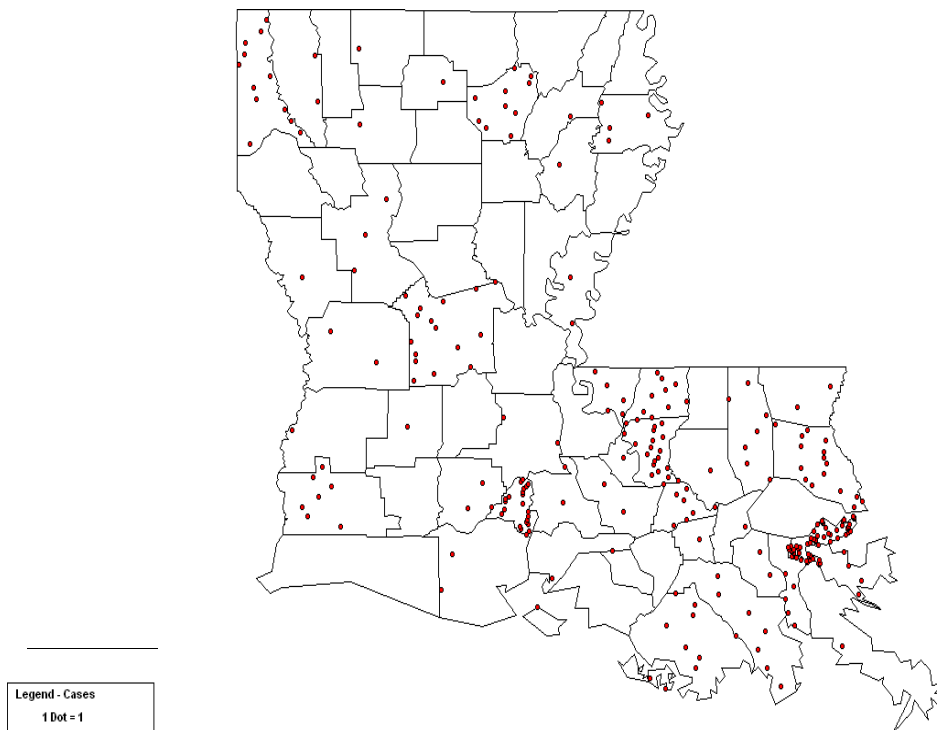
Table 16: Most Common Etiologic Agents of Foodborne/Enteric Outbreaks, by Decade  
Louisiana, 1950-2009

Foodborne/Enteric	1950-59	1960-69	1970-79	1980-89	1990-99	2000-09	Total
<i>E. coli</i>	0	1	0	0	2	0	3
Enteric Pathogen	12	36	37	21	21	84	211
Food Toxin	0	9	3	7	14	22	55
GI Virus	0	0	0	0	0	2	2
Norovirus	0	0	0	1	27	46	74
<i>Salmonella</i>	8	13	14	7	13	14	69
<i>Shigella</i>	0	0	8	8	8	13	37
Vibrio	0	0	4	7	0	1	12
Total	20	59	66	51	85	182	463
Percent	1950-59	1960-69	1970-79	1980-89	1990-99	2000-09	Total
Enteric Pathogen	60.0	61.0	56.1	41.2	24.7	46.2	45.6
Food Toxin	0.0	15.3	4.5	13.7	16.5	12.1	11.9
Norovirus	0.0	0.0	0.0	2.0	31.8	25.3	16.0
<i>Salmonella</i>	40.0	22.0	21.2	13.7	15.3	7.7	14.9
<i>Shigella</i>	0.0	0.0	12.1	15.7	9.4	7.1	8.0

Norovirus has accounted for an increasing proportion of outbreaks in recent decades (31.8% from 1990-99 and 25.3% from 2000-2009). Outbreaks caused by food toxins have also been on the rise, *C. perfringens* in particular, accounting for 16.5% of foodborne/enteric outbreaks from 1990-99. The proportions of *Salmonella* and *Shigella* have remained constant. The proportion of outbreaks without identification of an etiologic agent decreased from 60% in the 1950s to 45% currently. This demonstrates the result of improved diagnostics and surveillance capabilities over the past few decades, which could account for the large increases in norovirus and *C. perfringens*.

Although the occurrence of foodborne/enteric outbreaks is spread across the state, the majority has been concentrated in Orleans & Jefferson Parishes (27% of total foodborne/enteric outbreaks) (Figure 8).

Figure 8: Location of Foodborne/Enteric Outbreaks by Parish - Louisiana, 2000-2009



The incidence of foodborne/enteric outbreaks in Louisiana has ranged from 0.07 to 0.17 outbreaks per 100,000 population by region/parish from 1950 through 1999 and ranged from 0.12 to 0.83 outbreaks per 100,000 population by region/parish from 2000 through 2008. Lafayette parish and Region 2 (Baton Rouge area) exhibited the greatest increase of rates between 1950 to 1999 and 2000 to 2008 (Table 17).

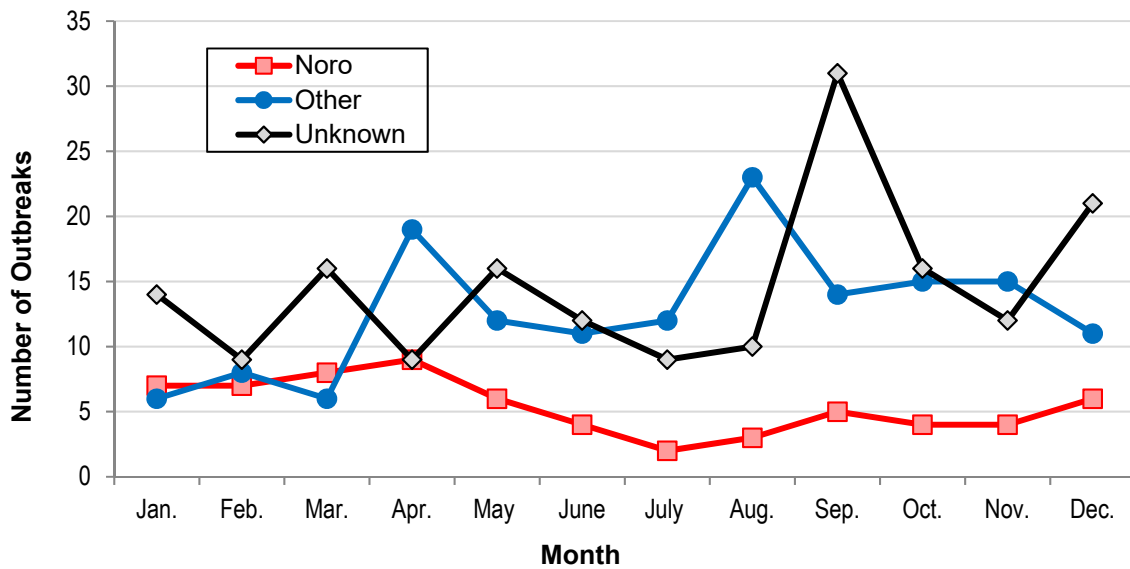


Table 17: Location of Foodborne/Enteric Outbreaks, by Parish and Decades -Louisiana, 1950-2009

Parish or Region	1950-1999			2000-2009		
	Number	Population in 100,000	Rate /100,000	Number	Population in 100,000	Rate /100,000
Region 1(New Orleans area)	135	466	0.29	73	93	0.78
East Baton Rouge	23	145	0.16	20	42	0.48
Region 2 (excluding EBR)	10	70	0.14	25	21	1.19
Region 3 (Terrebonne area)	31	165	0.19	20	43	0.47
Region 4 (Lafayette area)	25	131	0.19	12	36	0.33
Lafayette	9	59	0.15	23	18	1.28
Region 5 (Lake Charles area)	17	114	0.15	9	28	0.32
Region 6 (Alexandria area)	28	117	0.24	20	30	0.67
Region 7 (Shreveport area)	31	230	0.13	20	53	0.38
Region 8 (Monroe area)	23	163	0.14	16	35	0.46
Region 9 (St. Tammany area)	45	124	0.36	25	46	0.54
<b>Total</b>	<b>377</b>	<b>1,811</b>	<b>0.21</b>	<b>263</b>	<b>445</b>	<b>0.59</b>

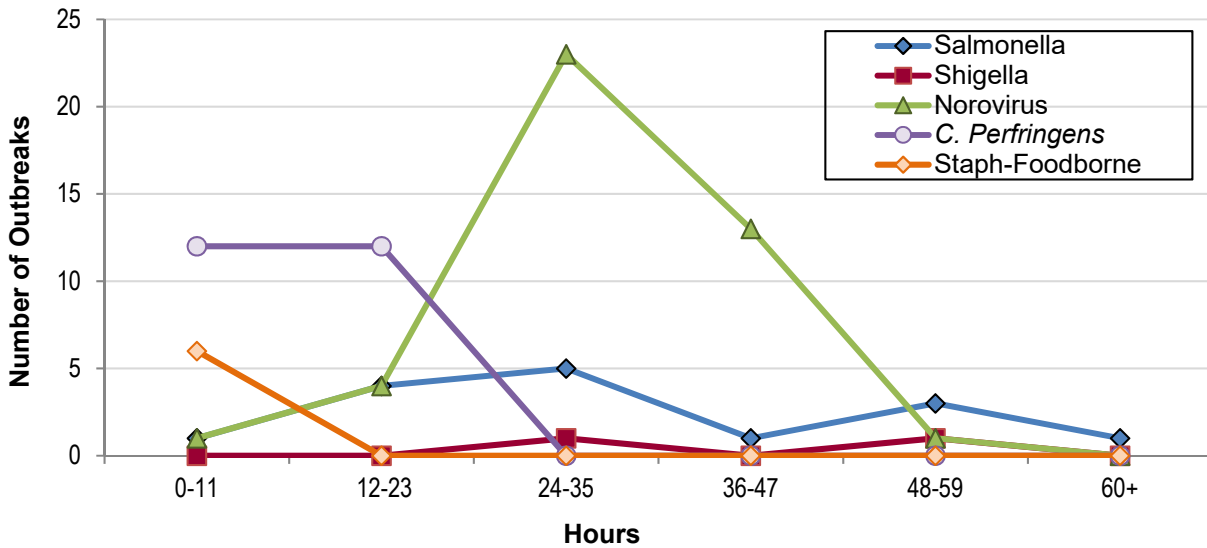
Seasonal trends are displayed for confirmed norovirus outbreaks (higher in the winter months), for confirmed etiologies except norovirus (high peak in September) and those with unknown etiology (peak in April and August) (Figure 9).

Figure 9: Seasonal Transmission Patterns of Foodborne/Enteric Outbreaks – Louisiana 1950-2009



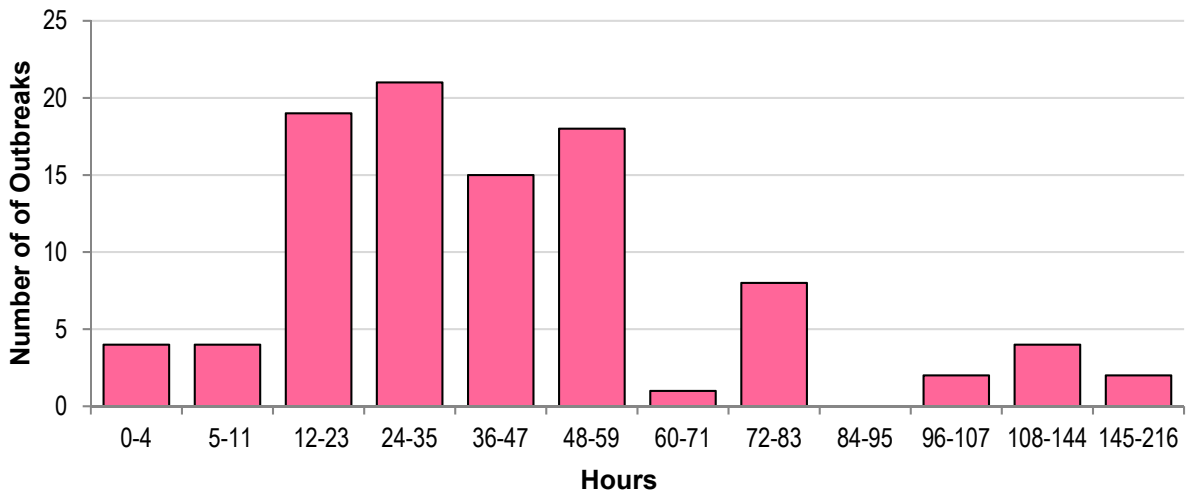
The time between infection and first onset of symptoms is known as the incubation period. This can vary between different organisms. Foodborne *S. aureus* causes illness quickly by emitting an enterotoxin once consumed. The observed mean incubation period for outbreaks due to *S. aureus* lasted no more than 11 hours. *Clostridium perfringens* also emits an enterotoxin after ingested. Mean incubation periods for *C. perfringens* lastes less than one day. The remaining pathogens' incubation periods show greater variations (Figure 10).

Figure 10: Mean Incubation Periods of Most Common Etiologic Agents of Foodborne/Enteric Outbreaks Louisiana, 1950-2009



The reported average duration of enteric symptoms per case for each outbreak lasted typically between 12 hours to 2.5 days after onset of illness. However, some cases reported symptoms lasting for up to nine days (Figure 11).

Figure 11: Mean Duration of Illness in Foodborne/Enteric Outbreaks - Louisiana, 1950-2009



**4.4 Respiratory Outbreaks**

Respiratory illnesses are easily transmitted to those in close contact due to respiratory droplets produced from coughing, sneezing and talking. Improper hand washing and sharing personal items with ill persons can also lead to disease transmission. In Louisiana from 1950 through 2009, there were a reported total of 85 respiratory-related outbreaks.

The main etiologic agents of respiratory-related outbreaks in Louisiana during this time period are *Haemophilus influenzae*, *Neisseria meningitidis*, *Streptococcus* spp., Influenza Type A, *Legionella pneumophila* and *Bordetella pertussis*, respectively. *H. influenzae* has accounted for 20% of the total number of respiratory-related outbreaks, followed closely by *N. meningitidis* at 17% (Table 18).

Table 18: Most Common Etiologic Agents of Respiratory Outbreaks by Decade Louisiana, 1950-2009

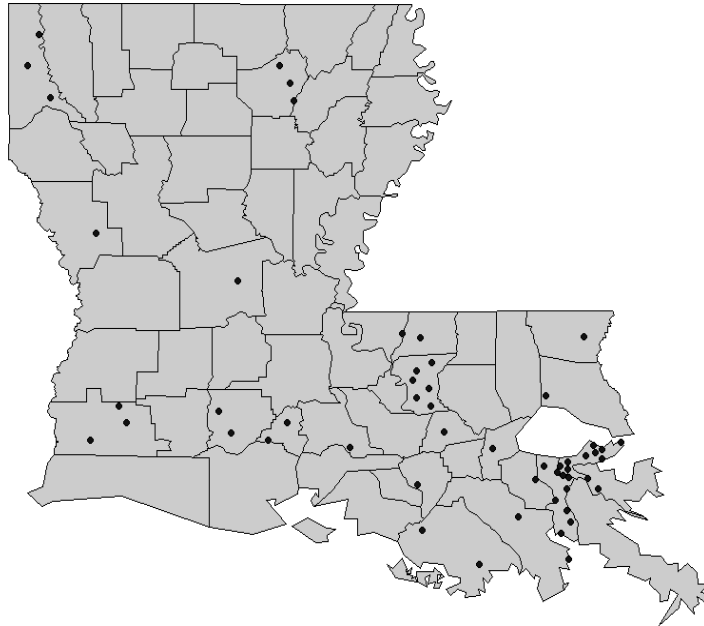
<b>Etiology</b>	<b>1950-59</b>	<b>1960-69</b>	<b>1970-79</b>	<b>1980-89</b>	<b>1990-99</b>	<b>2000-09</b>
Influenza	1	0	2	2	3	7
<i>H. influenzae</i>	0	0	1	12	1	0
Strepto/Pneumo	2	0	1	0	2	6
Pertussis	0	0	0	3	0	4
Legionella	0	0	1	1	2	1
Virus	0	0	0	0	2	2
Meningo	0	0	0	7	3	3
MRSA	0	0	0	0	0	1
Other	0	0	1	1	3	5
<b>Total Respiratory</b>	<b>3</b>	<b>0</b>	<b>6</b>	<b>26</b>	<b>16</b>	<b>29</b>

There has been a sharp decrease in the number of *H. influenzae* outbreaks since the 1980’s due to the advent of the Hib vaccine in 1985. In 1987, the vaccine was reformulated to be effective in children younger than 18 months of age; the current Hib vaccines are safe in children as young as six-weeks old. Since Hib vaccines were introduced, the incidence of invasive Hib disease in infants and children has fallen by 99%.

Forty-nine percent of the respiratory-related outbreaks in Louisiana occurred in day care facilities prior to 2000, along with an additional 19% occurring in nursing homes and hospitals/ clinics (Table 12). From 2000 to 2009, respiratory-related outbreaks have mainly occurred in schools and hospitals/clinics (Table 13). The average number of cases per outbreak from 1950 to 2009 was 16 persons with a range from one to 275 cases per outbreak.

Respiratory outbreaks have been largely concentrated in Jefferson and Orleans parishes, as well as in East Baton Rouge (Figure 12).

Figure 12: Location of Respiratory-Related Outbreaks by Parish - Louisiana, 1950-2009



There is no definite seasonal trend for respiratory-related outbreaks over the past 59 years. These outbreaks are due to mixture of numerous pathogens, the combination of which yields no obvious seasonal patterns.

#### **4.5 Hepatitis Outbreaks**

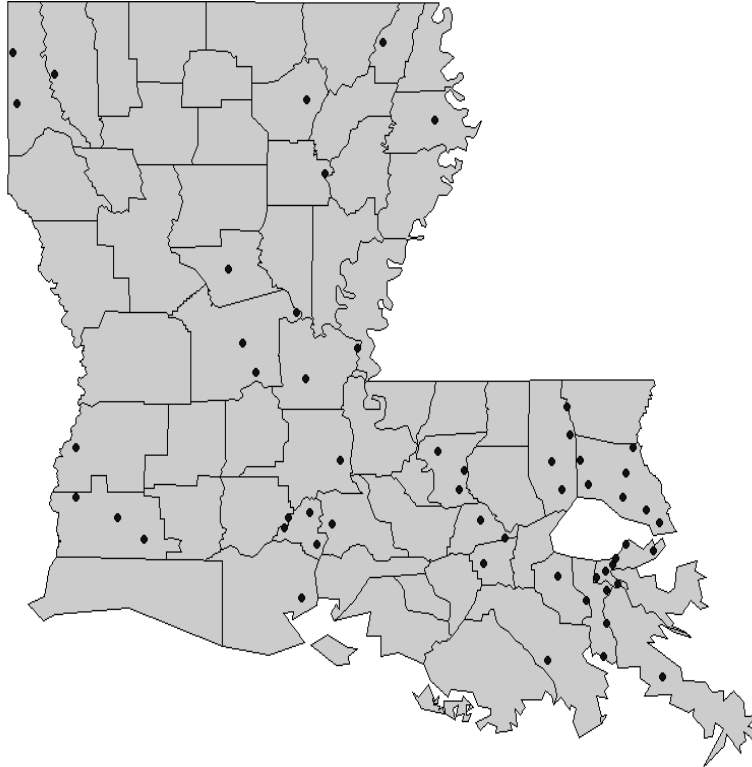
In the United States, hepatitis is most commonly due to types A, B, C and less commonly, due to D and E. Depending on the type of hepatitis virus, the transmission can vary. Types A and E are typically transmitted via the fecal-oral route, type B via blood and other bodily fluids and type C mostly via blood.

From 1950 to 2009, there were a total of 64 reported outbreaks of hepatitis in Louisiana. Although the virus type of most of these are unknown, particularly prior to the advent and improvement of laboratory diagnostics, the remaining hepatitis outbreaks have been caused by types A, B and E. Type A has been the leading single most common cause of hepatitis outbreaks, accounting for 95% of the total reported hepatitis outbreaks. The majority of Hepatitis A outbreaks occurred from 1970 to 1979 (n=20). Since 2000, there has only been one Hepatitis A outbreak. Type B has only accounted for two outbreaks in the 1970's and 80's. Type E accounted for one outbreak in 2007.

Prior to 2000, day cares and schools constituted 42% of the hepatitis outbreak locations- likely due to fecal-oral transmission among children (Tables 11 and 12). Hepatitis outbreaks from 1950-2009 have ranged from one to 72 persons with an average case number of 9.6 persons per outbreak.

St. Tammany, Tangipahoa, Lafayette, Orleans and Jefferson parishes exhibit the most concentrated locations of hepatitis outbreaks from 1950 through 2008 (Figure 13).

Figure 13: Location of Hepatitis Outbreaks by Parish - Louisiana, 1950-2009



The seasonal trend of hepatitis outbreaks show peaks in June and September.

#### **4.6 SSTI: Skin and Soft Tissue Infections**

From 1950 to 2009, all of the outbreaks related to skin and soft tissue infections have been caused by the bacterium *Staphylococcus aureus*. However, beginning in 1991, outbreaks caused by the strain of *Staphylococcus aureus* which is resistant to methicillin drugs (commonly called “MRSA”) were identified. Out of the 36 total reported SSTI outbreaks in Louisiana, seven (20%) are known to have been caused by MRSA and four are suspected to have been caused by MRSA.

The single most common type of facility where SSTI outbreaks have occurred are nursing homes/ residential facilities, accounting for 26% of the total number of SSTI outbreaks in Louisiana from 1950 through 1999. Hospitals/clinics as well as schools were also the major location of SSTI outbreaks prior to 2000. Since 2000, schools and company gatherings have been the main location types of SSTI outbreaks (Table 13).

The majority of SSTI outbreaks have occurred in Rapides and Orleans parishes. Otherwise, there does not appear to be a pattern of SSTI outbreaks across the state (Figure 14).

Figure 14: Location of SSTI Outbreaks by Parish - Louisiana, 1950-2009



September and May appear to be the peak months of the year for SSTI outbreaks. Transmission is relatively low and stable the rest of the year.

**4.7 Other**

There were 108 outbreaks caused by various other etiologic agents or unknown etiologic agents (Table 19).

Table 19: Etiologic Agents/Illness Types of Other Outbreaks by Decade - Louisiana, 1950-2009

Etiologic Agent/ Illness Type	1950-59	1960-69	1970-79	1980-89	1990-99	2000-09	Total
Arbovirus	0	0	2	0	1	0	3
Fungus	0	1	0	0	0	4	5
HAI	0	1	1	6	2	4	14
Other	1	1	2	0	2	4	10
Parasite	0	1	2	10	1	13	27
Virus	0	0	11	2	1	15	29
Water	1	0	2	0	0	1	4
Zoonosis	6	1	5	1	2	1	16
<b>Total</b>	<b>8</b>	<b>5</b>	<b>25</b>	<b>19</b>	<b>9</b>	<b>42</b>	<b>108</b>