

How Many Cases of Foodborne Illnesses in Louisiana?

There is no simple answer to this question or one simple best estimate to the question. This uncertainty is reflected in the estimates provided by the Centers for Disease Control and Prevention (CDC) for foodborne illnesses in the United States. The CDC estimates are for 30 known pathogens and 38 million cases, with 90% confidence that the range is from 19 million to 61 million. (Table 3 – Appendix) In summary, according to the best estimates, there may be from 26 million to 74 million foodborne illnesses in the U.S. - quite a large degree of uncertainty.

This report is focused on foodborne illnesses resulting from infection (or toxi-infection) by infectious agents (bacteria and their toxins, virus, fungus, parasites and prions). Foodborne illnesses due to food allergies, or presence of toxic chemicals in food, are not included in this report.

1-There is no reliable way to quantify "food-borne illnesses", contrary to what many people think.

There are three common assumptions that underline the belief that counting foodborne illnesses should be an easy task.

1.1- Foodborne illnesses should be reportable; the answer is to look up the number of reportable diseases that are foodborne.

Reportable conditions are classified by the causative agent (bacteria, virus, fungus, prion and toxin). There is a long list of diseases that could be transmitted by food or by “person to person” or by the contaminated environment without food being involved at all. For example, norovirus is usually transmitted person-to-person but a food handler that did not wash his hands may carry enough norovirus on his hands to contaminate food resulting in foodborne illnesses.

1.2-Foodborne illnesses occur in outbreaks. Outbreaks are investigated. Counting the number of cases included in outbreaks should provide an answer.

Most foodborne illnesses (over 95%) occur as sporadic cases (sporadic means “occurring at irregular intervals; having no pattern or order in time” as opposed to illnesses occurring in outbreaks). For sporadic cases it is impractical to determine mode of transmission (food, person-to- person or contaminated environment). In an outbreak, one has a better chance of determining the mode of transmission by trying to find out what all of the ill people have in common.

1.3-Most foodborne illnesses are characterized by diarrhea and vomiting (gastro-enteritis). It is as simple as counting the number of gastro-enteritis.

It is true that most, though not all, foodborne illnesses present as gastro-enteritis; besides foodborne gastro-enteritis there are gastro-enteritis due to:

- infectious agents transmitted person-to-person or transmitted from the environment without

food being involved: example norovirus picked up on a door handle

- other causes of diarrhea such as medications, laxative abuse, radiation therapy, chronic bowel diseases (Crohn's, ulcerative colitis, irritable bowel disease), malabsorption, hyperthyroidism, some cancers, digestive tract surgery and even competitive running.

The estimate for the number of acute cases of gastro-intestinal illness in the U.S. is one case per person per year = 4,500,000 per year in Louisiana. Some are severe enough to cause the patient to seek medical care; most are benign and do not result in seeking medical care.

Finally, there are numerous foodborne illnesses that are not gastro-enteritis: example foodborne toxins causing neurologic symptoms.

2-So what can be counted or estimated?

There are many ways to address this question:

- 1) The number of people infected by a bacteria or virus sometimes acquired from food and sometimes acquired by other means
- 2) The number of cases reported to the department of health as sick from a bacteria or virus sometimes acquired from food and sometimes acquired by other means
- 3) The number of infected people included in the foodborne outbreaks investigated by the Department of Health
- 4) The number of foodborne outbreaks in the state
- 5) The number of acute gastro-enteritis (diarrheal diseases mostly) that are not attributable to a known non-food related cause

The choice often depends on what one wants to prove with the data.

3-How does food end up being laden with harmful infectious agents.

Illnesses transmitted by food include four types of transmission:

- The food came from an infected animal that was improperly prepared: eggs, chicken, meat, infected with a bacteria and not killed during food preparation: example, Salmonella in eggs, Listeria in unpasteurized milk, Shiga Toxin producing E.coli (STEC) in beef meat.
- The food was contaminated in the environment: example *Vibrio vulnificus* or *Vibrio cholerae* in raw oysters, or cantaloupes contaminated by the soil at the farm
- The food was contaminated during the preparation from the time it is collected to the kitchen: example peanut butter contaminated during the grinding and packing process or potato salad contaminated by Salmonella from raw chicken due to poor safety practices in the kitchen.
- The food was contaminated by a human source just before consumption (cook, food handler): carrier for typhoid fever (Typhoid Mary), or a cook with norovirus infection not washing his hands.

4-What are the most common infectious agents causing foodborne illness in the U.S.? Which will be described as “the usual suspects”?

About 30 of these are listed in the first column of Table 1 “Common U.S. Foodborne Illnesses”. For each one of these, epidemiologists have estimated the proportion (percentage that is likely to be foodborne. These percentages are listed in the same table in column 3. For example 100% of the illnesses caused by *Bacillus cereus* are foodborne, but 30% of illnesses caused by *Shigella* are foodborne.

Table 1: Common Foodborne Illnesses in Louisiana

		1	2	3	4	5	6
30 Known Pathogens: Louisiana		Estimated All (Foodborne and Other) Annual Cases- LA	% Food Borne	Estimated Annual Foodborne Cases - LA	Number of Case Reports/Yr, All Cases Food & Others - LA	Estimated Foodborne Hospitalizations -LA	Estimated Foodborne Deaths - LA
	Bacterial	80,280	x	67,059	2,320	606	14
1	Bacillus cereus	1,100	100	1,100	5	0	0
2	Botulism, foodborne *	0	100	0	1	1	0
3	Brucella	30	50	15	2	1	0
4	Campylobacter	22,000	80	17,600	200	141	1
5	C perfringens	15,800	100	15,800	20	7	0
6	E. coli O157H7	1,600	70	1,120	10	36	0
7	E. coli STEC	2,800	80	2,240	10	5	0
8	E.coli ETEC	700	30	210	0	0	0
9	Other pathogenic E,coli	700	100	700	0	0	0
10	Listeria	30	99	30	20	24	4
11	S. typhi	10	95	10	0	3	0
12	Salmonella other	20,500	95	19,475	1,500	332	6
13	Shigella	8,200	30	2,460	500	24	0
14	Staphylococcus, food	4,000	100	4,000	20	18	0
15	Streptococcus food	180	100	180	0	0	0
16	V. cholerae toxigenic *	0	100	0	2	0	0
17	V. vulnificus	10	50	5	10	2	1
18	V.parahemolyticus	20	75	15	5	2	0
19	Vibrio other	600	50	300	15	1	0
20	Y. enterolytica	2,000	90	1,800	0	9	0
	Viral	503,900	x	92,123	500	255	3
21	Norovirus	348,000	26	90,480	500	244	2
22	Rotavirus	51,500	1	515	0	6	0
23	Sapovirus	51,500	1	515		1	0
24	Astrovirus	51,500	1	515	0	1	0
25	Hepatitis A	1,400	7	98	0	2	0
	Parasitic	36,100	x	4,175	110	81	6
26	Crypto parvum	12,500	8	1,000	40	4	0
27	Cyclospora	300	99	297	5	0	0
28	Giardia	20,400	7	1,428	65	4	0
29	Toxoplasma	2,900	50	1,450	0	74	5
30	Trichinella	0	100	0	0	0	0
	ALL	620,280	x	163,357	2,930	942	23

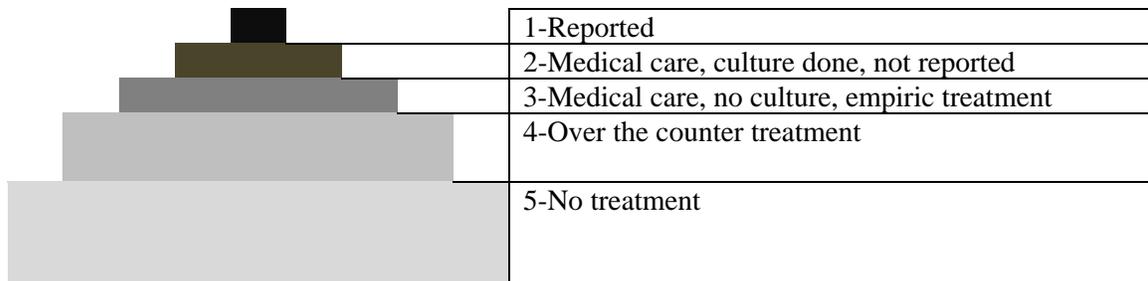
*Less than 1 per year

5-Estimates of the number of people infected by the “usual suspects”.

Using the number of reportable illness cases caused by the usual suspects is not useful to paint an accurate picture of the disease burden. (Disease burden is the impact of a health problem in an area measured by financial cost, mortality, morbidity, or other indicators.) For disease burden, this discussion focuses only on the number of cases).

There are several reasons for the lack of reliability of reporting. Salmonella infections are a good example to describe what happens:

- Estimation: some **20,500 persons** get infected by Salmonella in Louisiana every year.
- Number of Salmonella infection reports: **1,500 cases**
- Most of the salmonellosis cases are a mild diarrheal illnesses.
- Most are not going to seek medical care; they will not do anything but wait for the symptoms to subside, or they will use over-the-counter treatment.
- A few are going to consult at a clinic or physician's office and maybe treated with antibiotics. No culture is made, so there is no formal diagnosis of Salmonella infection made and no report is made to the health department.
- The only cases reported to the health department are those that were brought to medical care and for whom a culture was made. About one-third of the reported cases are in infants and one to two year olds. The main reason is that when an infant is sick, the parents become quickly concerned and bring the child for medical attention; then a stool culture is more likely to be ordered and if positive for Salmonella, a report is more likely to be made.
- Therefore what the surveillance picks up is the tip of the iceberg.



This begs the question: Why do reporting at all? The answer is simple: Knowing the physical characteristics of the water in the ice and the sea (mainly temperature and salinity), it is possible to calculate the volume of the iceberg if the volume of the tip (layer1) is known. Therefore, knowing the number of reportable cases and the epidemiologic characteristics of the causative agents, it is possible to estimate the total disease burden and to monitor trends and impact of preventive measures.

Another way to answer the question is: Public health is mostly concerned by layers 1, 2 and 3. These are the serious cases. The main focus of preventive measures is the reduce the three top layers. Determining the size of layer 1 allows a fairly precise estimate of layers 2 and 3.

6-Another approach is to count the number of cases hospitalized

Counting hospitalized cases has been a great challenge in the past. Recently having access to databases used by health care facilities to obtain insurance reimbursement has made this task somewhat easier, but there are still some flaws in that system. Generalizing the use of electronic medical records and health information exchanges should lead to much more reliable data.

The main problem with the data right now is that the reporting is limited to a small number of diagnoses; the etiologic agent often does not make the top eight diagnoses.

7-Estimating the number of foodborne illnesses in Louisiana

The following table shows the estimation of the number of foodborne illnesses caused by the 30 known most common foodborne pathogens in Louisiana:

- Column 1: Estimate of specific illnesses in Louisiana, all included foodborne and others non-foodborne
- Column 2: Estimated foodborne proportion (percentage) of illnesses caused by a specific agent,
- Column 3: Estimate of specific foodborne illnesses in Louisiana (calculated by column 1 multiplied by the percentage in column 2),
- Column 4: Typical number of illness cases reported per year in Louisiana in the past five years. This number includes all cases, whether foodborne or not. The cases of *B.cereus*, *C.perfringens* and Staphylococci from food and norovirus, are extracted from outbreak investigations and not from direct reports.
- Column 5: Estimate of hospitalizations (extrapolated from CDC data) resulting from foodborne illnesses in Louisiana.
- Column 6: Estimate of deaths (extrapolated from CDC data) resulting from foodborne illnesses in Louisiana.

The current estimate is that 17% of all meals are consumed in a commercial food establishment (CFE). Assuming a similar level of precautions is taken between home and CFE, the number of foodborne illnesses attributable to CFE would be 28,000.

8. Number of foodborne outbreaks and number of people affected by them

Disease outbreaks are identified by the reportable disease surveillance system or by reports from the public, community leaders, food service establishments 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. Foodborne outbreaks constitute about half of all outbreak investigations. 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 Infectious Disease Epidemiology Section.

Every year some 20 to 30 foodborne illness outbreaks are investigated. The settings where the outbreaks originate are varied: Private parties, picnics, weddings, work-related parties (28%), educational facilities, schools, day care centers, colleges (27%), restaurants (13%), health care facilities (12%), correctional facilities (9%), others (11%). Reporting is biased towards facilities such as correctional, educational and healthcare institutions.

There is a wide spectrum of number of affected persons. It is sometimes difficult to get an accurate count of the people affected. The outbreak investigation focus is to determine the cause of the out-

break. The main goal is to capture all of the cases (people with illness), and a similar number of controls (not ill) to carry out a case-control study. Trying to identify all the cases would be very time consuming and impractical. For example, if an outbreak is linked to a restaurant, it is impractical to find out all the customers that were affected. Once 10 or 20 ill persons are identified, a case-control study can be carried out. Estimating at about 25 cases per outbreak, the total number of persons affected could be approximately 500 to 750 people.

The number of persons hospitalized is about 15 per year; the number of deaths ranges from one to five per year.

Outbreak investigation indicators from Louisiana closely match those from the U.S.. Table 2 compares:

1. The actual data reported by CDC for all states in 2008,
2. The expected data from Louisiana obtained by extrapolating from CDC using proportional population
3. The actual data from Louisiana

Table 2: Foodborne Illness Outbreaks – Louisiana and the United States, 2008

	FoodBorne Illness Outbreaks U.S. 2008	FoodBorne Illness Outbreaks LA Expected /Year	FoodBorne illness Outbreaks LA Actual/Year
Number of Outbreaks	1,034	17	20 to 30
Illness Cases	23,152	386	500 to 750
Hospitalizations	1,276	21	15
Deaths	22	0	0 to 1
Outbreaks with Etiologic Agents Identified	479	8	12
Percentage with Etiologic Agents Identified	46.3%	46.3%	48.0%

Obviously a very small proportion of all outbreaks occurring in the state are reported. Using data from outbreaks reported in facilities where outbreaks are more likely to be reported and assuming that food safety is uniform throughout the state, the rate of foodborne illnesses per year is estimated at two per 1,000 per year or 9,000 per year in Louisiana.

While the food vehicle (potato salad, turkey stuffing for example) is often easy to identify, the definite etiologic agent is not. To make a definite confirmation of an etiologic agent, the bacteria (the easiest ones to confirm) must be identified in the food and in the stools of a few ill persons. Obtaining stools from the sick and food leftovers preserved adequately is very challenging.

Among the etiologic agents identified there are 72% enteric pathogens (bacteria mostly), 12% bacterial toxins (*Bacillus cereus*, *Clostridium perfringens*, *Staphylococcus aureus* mostly), 16% enteric viruses

(norovirus mostly). Among the bacterial enteric pathogens the most common are Salmonella by far, Shigella, Vibrios and Shiga Toxin producing *E.coli* (STEC).

9-How about the unspecified infectious agents and other food related illness due to chemicals and other causes which are not the main focus of this report.

The starting point is to have an estimate of the gastro-enteritis cases and to subtract from this estimate the estimated number due to causes that are not linked to food (see section 1.3). By subtracting the estimates of foodborne-illnesses due to the 30 known pathogens, the CDC estimated that there were 38.4 million such cases with a 90% credibility ranging from 6.6 million to 61,072,000 hospitalizations with a 90% credibility ranging from 10,000 to 150,000 and 1,500 deaths with a 90% credibility ranging from 400 to 3,300 deaths.

Extrapolating to Louisiana these unspecified foodborne illnesses would represent:

575,000 cases
1,200 hospitalizations
30 deaths.

References

1-CDC Estimates from Meade et al 1999. Emerging Infectious Diseases Vol. 5, No. 5, Food-Related Illness and Death in the United States,

2-Preliminary FoodNet Data on the Incidence of Infection with Pathogens Transmitted Commonly Through Food -10 States, 2009. MMWR April 16, 2010 / 59(14);418-422,

3- Vital Signs: Incidence and Trends of Infection with Pathogens Transmitted Commonly Through Food — Foodborne Diseases Active Surveillance Network, 10 U.S. Sites, 1996–2010

4-CDC Estimate of food-borne illness in the US, 2011. <http://www.cdc.gov/foodborneburden/2011-foodborne-estimates.html>

5-Data and Methodological Differences, 2011 and 1999
<http://www.cdc.gov/foodborneburden/differences-in-estimates.html>

6-Food-borne illnesses and outbreaks, CDC 2011
<http://www.cdc.gov/foodsafety/facts.html>

Appendix - Table 3: CDC Table – Common Foodborne Illnesses – United States

30 Known Patho- gens U.S.	CDC Esti- mated U.S. Annual Cases	% Food Borne	CDC Esti- mated U.S. Foodborne Annual Cases	% Hos- pitaliza- tion	Esti- mated Hospitali- zations U.S.	Estimated Food-borne Hospitaliza- tions U.S.	% Mor- tality	Esti- mate d Deat h U.S.	Estimated Food- borne Death U.S.
Bacterial	4,863,927	x	4,056,026	x	50,566	36,365	x	1,082	863
Bacillus cereus	63,623	100	63,623	0.4	20	20	0.0	1	0
Botulism, food-borne *	55	100	55	55.0	42	42	0.9	9	9
Brucella	2,003	50	1,002	82.6	132	55	17.3	2	1
Campylobacter	1,322,137	80	1,057,710	17.1	13,240	8,463	0.1	119	76
C perfringens	950,000	100	950,000	0.6	439	438	0.1	26	26
E. coli O157H7	96,534	68	65,643	46.2	3,268	2,136	0.5	31	20
E. coli STEC	168,698	82	138,332	12.8	405	271	0.3	0	5
E.coli ETEC	39,781	30	11,934	0.8	26	13	0.0	0	0
Other patho- genic E.coli	39,781	100	39,781	0.8	26	8	0.0	0	0
Listeria	1,662	99	1,645	94.0	1,520	1,455	15.9	266	255
S. typhi	5,752	96	5,522	75.7	623	197	0.0	0	0
Salmonella other	1,229,007	94	1,155,267	27.2	23,128	19,936	0.5	452	378
Shigella	494,908	30	148,472	20.2	5,491	1,456	0.1	38	10
Staphylococcus, food	241,994	100	241,994	0.4	1,067	1,064	0.0	6	6
Streptococcus food	11,257	100	11,257	0.2	1	0	0.0	0	0
V. cholerae toxigenic *	277	100	277	43.1	7	2	0.0	0	0
V. vulnificus	207	47	97	91.3	202	93	34.8	77	36
V.parahemolytic us	44,950	86	38,657	22.5	129	100	0.9	5	4
Vibrio other	34,585	57	19,713	37.1	163	83	3.7	16	8
Y. enterolytica	116,716	90	105,044	34.4	637	533	2.0	34	29
Viral	30,220,411	x	5,523,697	x	162,849	15,284	x	779	161
Norovirus	20,865,958	26	5,425,149	0.0	56,013	14,663	0.0	571	149
Rotavirus	3,090,354	1	30,904	1.7	69,721	348	0.0	32	0
Sapovirus	3,090,384	1	30,904	0.4	17,430	87	0.0	0	5
Astrovirus	3,090,324	1	30,903	0.4	17,430	87	0.0	5	0
Hepatitis A	83,391	7	5,837	31.5	2,255	99	2.4	171	7
Parasitic	2,163,652	x	252,129	x	15,221	4,880	x	736	333
Crypto parvum	748,123	8	59,850	25.0	2,725	210	0.3	46	4
Cyclospora	19,808	99	19,610	6.5	20	11	0.0	0	0
Giardia	1,221,564	7	85,509	8.8	3,581	225	0.1	34	2
Toxoplasma	173,995	50	86,998	2.6	8,889	4,428	0.2	656	327
Trichinella	162	100	162	24.3	6	6	0.2	0	0
ALL	37,247,990	x	9,831,852	x	228,636	56,529	x	2,597	1,357

Appendix - Table 4: CDC Table – Known and Unknown Pathogen Numbers – United States

KNOWN PATHOGENS									
CDC Known	37,220,098	x	9,388,075	x	228,744	55,961	x	2,612	1,351
CI Low	28,434,745	x	6,641,440	x	188,326	19,534	x	1,723	712
CI High	47,630,066	x	12,745,709	x	275,301	75,741	x	3,919	2,268
Case /Pop	31								
UNKNOWN PATHOGENS									
CDC Unknown		x	38,400,000	x		71,878	x		1,686
CI Low		x	19,800,000	x		9,924	x		369
CI High		x	61,200,000	x		157,340	x		3,338
Case /Pop	8								
TOTAL									
CDC Total		x	47,788,075	x		127,839	x		3,037
CI Low		x	26,441,440	x		29,458	x		1,081
CI High		x	73,945,709	x		233,081	x		5,606
Case /Pop	6								