ANALYSIS OF RESTAURANT-ASSOCIATED FOODBORNE ILLNESS COMPLAINTS IN KANSAS, 2009-2012

By

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A FIELD EXPERIENCE REPORT

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Abstract

Foodborne illness is a common but in many calls preventable disease. The Centers for Disease Control and Prevention has reported over half of the foodborne illness outbreaks were associated with restaurants. In Kansas, the state and local health departments are responsible for investigation of foodborne illnesses. The Kansas Department of Health and Environment and Kansas Department of Agriculture work together to monitor the restaurant-based intrastate foodborne illnesses. Restaurant-based foodborne illness complaint data from 2009 to 2012 were analyzed for this study. The objective was to compare characteristics of these complaints and to evaluate what information regarding the complaint would more likely lead to a foodborne illness outbreak. Of the 1,011 complaints, 109 were investigated, and 46 were confirmed as outbreaks. The investigation rate of all complaints was 10.8%, and the outbreak rate of all the investigation was 42.2%. Etiology of these outbreaks indicated two major pathogens: 30.4% of Norovirus, and 8.7% *Salmonella* spp. More complaints and outbreaks were seen in areas with higher populations. Outbreak confirmation was more frequent among complaints involving multiple households, and more brief exposure-to-illness time.

Key words: Foodborne illness, Complaint, Kansas

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I would like to express my gratitude towards my parents for their never-ending support, encouragement, and kind co-operation which help me in completion of this project.

Chapter 1 - Field Experience

My field experience placement was facilitated through the Governor's Internship Program. It took place within the Kansas Department of Health and Environment (KDHE) in Topeka, Kansas; under the guidance of Daniel Neises, Senior Epidemiologist in the Bureau of Epidemiology and Public Health Informatics. The field experience included 240 on-site hours at KDHE, and was fulfilled from February 1, 2013 to July 10, 2013.

Governor's Office Internship Program

The Governor's Internship Program is a select internship experience designed to give high-quality college students (juniors and senior undergraduates, graduate and law students) the opportunity to see the inner workings of state government and contribute to growing and improving the State of Kansas (KDHE, 2012b). The internship program operates in three time frames each year in spring, summer and fall.

Kansas Department of Health and Environment

The Kansas Department of Health and Environment (KDHE) is a state level department. It is directed by the secretary Dr. Robert Moser, with the mission of protecting and improving the health and environment for all Kansas residents, and the vision of "healthy Kansas living in safe and sustainable environment" (KDHE, 2011). KDHE is divided into four separate divisions, which include Administration-Office of the Secretary, Division of Public Health, Division of Health Care Finance, and Division of Environment (KDHE, 2011a). The Division of Public Health is composed of nine bureaus, including the center for health equity, center for performance management, community

health systems, disease control and prevention, environmental health, epidemiology and public health informatics, family health, health promotion, and oral health. My internship took place in the Bureau of Epidemiology and Public Health Informatics (Figure 1).

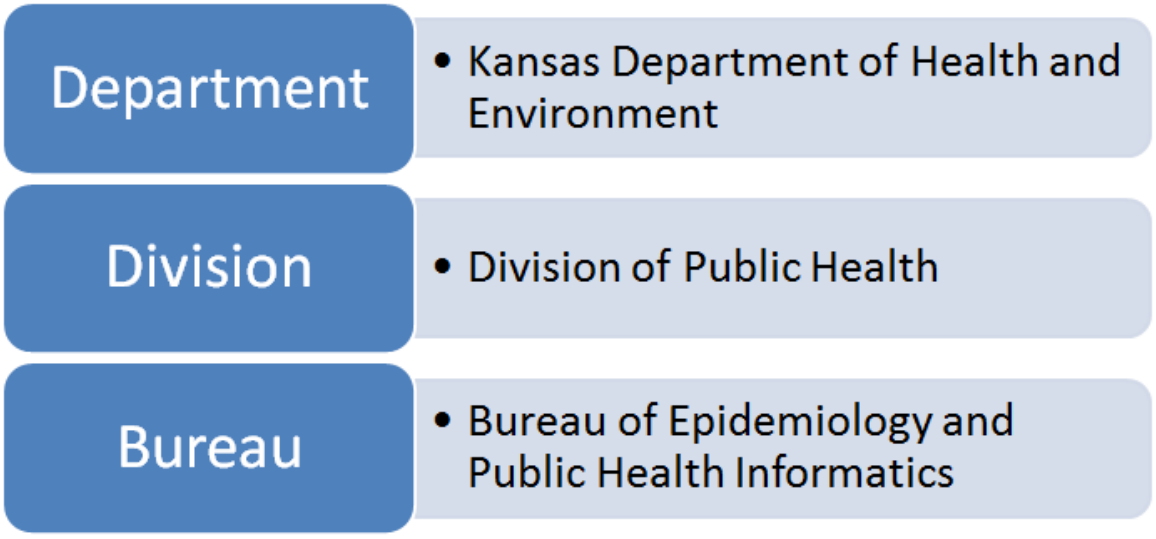

Figure 1: Organization structure of this field experience at the Kansas Department of Health and Environment

Bureau of Epidemiology and Public Health Informatics

The Bureau of Epidemiology and Public Health Informatics (BEPHI) is responsible for collecting, analyzing, and interpreting data on a variety of conditions of public health importance (KDHE, 2013b).

The records collected by the BEPHI include births, deaths, infant mortality, marriages, and disease conditions, including infectious disease. In the foodborne illness analysis project, foodborne illness outbreak data are pulled from EpiTrax. EpiTrax is an open source, highly configurable, comprehensive surveillance and outbreak management application designed for public health (KDHE, 2012a).

MPH Field Experience Project Overview

I have participated in some projects during the internship where I applied my public health knowledge. The KDHE foodborne illness complaints data from 2009 through 2012 were analyzed for this study. Other projects of the field experience were daily telephone conferences, telephone interviews for a *Hepatitis C* outbreak investigation, and a school survey of vaccination among students in grade 6, 7 and 8.

The objective of my field experience main project was to describe and analyze restaurant-associated foodborne illness complaints reported to the Kansas Department of Health and Environment (KDHE) from the Kansas Department of Agriculture (KDA) during 2009-2012. Conducting this assessment provided experience working with actual data collected by public health agencies and the challenges the data can present. Assessing foodborne illness complaints will help KDHE determine what types of food establishments are most frequent for complaints and outbreaks. Observing the outbreak investigation process provided “real world” experience with infectious disease epidemiology in public health.

Chapter 2 - Introduction to Foodborne Illness

Foodborne illnesses refer to diseases acquired through eating or drinking contaminated food or liquids. Foodborne illness is infection or irritation of the gastrointestinal tract caused by biological agents or chemical agents. The majority of illnesses are caused by harmful bacteria and viruses. Pathogens causing most foodborne illnesses nationwide are norovirus, *Salmonella* spp., *Clostridium perfringens,* and *Campylobacter* spp. (CDC, 2011b). Symptoms may be mild or serious. The most common symptoms are abdominal cramps, nausea and vomiting, diarrhea, fever and dehydration.

Some people are more likely to develop foodborne illness than others. Older adults, pregnant woman and young children are most vulnerable to foodborne illnesses. Also at risk are people with compromised immune systems or chronic diseases. Foodborne illness can be life-threatening and lethal for these vulnerable groups.

Each year, roughly one out of six people (about 48 million citizens) in the United States gets sick from foodborne diseases, 128,000 are hospitalized, and 3,000 die (CDC, 2012; CDC, 2011a).

Foodborne illnesses have a severe impact on medical costs in the United States. *Salmonella*, found in raw and undercooked meat, poultry, dairy products, and seafood, leads to $365 million in direct medical cost annually (CDC, 2011a).

Foodborne illness is often a preventable public health problem. Food may become contaminated at many critical points, such as production, processing, and even after

purchase. Properly controlling and monitoring critical points such as storing, cooking, cleaning, and handling foods can reduce the risk of foodborne illnesses. Based on the estimation of the Centers for Disease Control and Prevention (CDC), reducing 10% of the foodborne illnesses would keep about 5 million Americans from getting sick each year.

Restaurants are a significant contributor to the burden of foodborne disease. From 1998 to 2004, CDC reported 9,040 foodborne disease outbreaks. Of these outbreaks, 4,675 (52%) were associated with restaurants (Jones and Angulo, 2006). The majority of restaurant outbreak etiologies were undetermined; of the known etiologies, norovirus and *Salmonella* spp. were most frequently seen (Table 1).

Table 1: Etiology of restaurant-associated outbreaks reported to the Centers for Disease Control and Prevention during the period 1998-2004 (Jones and Angulo, 2006)

Etiology	No. (%) of outbreaks
Unknown	3377 (72)
Norovirus	496 (11)
Salmonella species	349 (7)
Scombroid	119 (3)
Escherichia coli	57 (1)
Clostridium perfringens	54 (1)
Shigella species	50 (1)
Hepatitis A	36 (1)
Staphylococcus species	35 (1)
Other	122 (3)

Duties of KDHE and KDA

The Bureau of Epidemiology and Public Health Informatics at the Kansas Department of Health and Environment (KDHE) is responsible for collecting, analyzing, and interpreting data on a variety of conditions of public health importance (KDHE, 2013b). Notifiable conditions, including diseases that may be caused by foodborne illness, must be reported to KDHE per Kansas Administrative Regulation 28-1-2(Appendix A lists reportable diseases in Kansas). KDHE assists local health departments with the investigation of infectious disease cases (KDHE, 2010), and with outbreak investigations, if one is detected.

The Kansas Department of Agriculture (KDA) supports agriculture in Kansas (KDA, 2012), and is responsible for enforcing many agribusiness regulations, including inspecting commercial food operations such as meat processing facilities and dairies. The Food Safety and Lodging Program at KDA is responsible for routine inspections at grocery stores, restaurants in grocery stores, restaurants, and lodging facilities (KDA, 2006) such as licensing businesses, and receiving complaints.

Foodborne illness complaints, investigations, and outbreaks

There are three phases of a foodborne illness outbreak investigation in Kansas: receiving a complaint, conducting an environmental inspection and initial epidemiological investigation, and conducting a full outbreak investigation.

Citizens can make a foodborne illness complaint regarding a restaurant by contacting KDA through either an online form (http://www.ksda.gov/food_safety/) or telephone (785-296-5600). Alternatively, a citizen may telephone KDHE or a local health

department first about an illness complaint. KDHE and KDA share information received about foodborne illness complaints

After a complaint is received, KDA may send an inspector to the establishment for an on-site inspection. If the complaint meets KDHE's outbreak definition, an initial epidemiological investigation is conducted. KDHE defines a foodborne disease outbreak as two or more individuals who experience a similar illness after eating a common food or food from a common place, in the absence of other shared exposures (KDHE, 2008). Because people living in the same household people may share the same food and have other shared exposures, complaints involving only a single household are generally not investigated by KDHE.

Once the outbreak definition is met, KDHE works with the local health department to get sufficient epidemiologic information from the complainant(s). Detailed information about foods consumed and symptoms experienced are collected. If the symptoms and incubation periods reported are consistent with foodborne illness, KDHE and the local health department conduct a full outbreak investigation. If the complainants cannot be reached for more information, or if the epidemiological information is not consistent with a foodborne illness, the epidemiological investigation is stopped and the complaint is classified as "not an outbreak."

Foodborne disease outbreak investigations are conducted to determine what factors are associated with illness and what measures can be done to prevent further illness. A typical investigation is composed of epidemiologic investigation, laboratory analysis, and an environmental assessment (KDHE, 2008). Additional interviews may be conducted with others known to be exposed to the same restaurant, and stool

specimens may be collected from ill individuals for laboratory testing. KDA shares inspection results with the KDHE, and KDHE shares epidemiology results with the KDA. KDA works with restaurant to make corrective measures, such as reviewing a HACCP (Hazard Analysis and Critical Control Points) plan, or training employees on food safety.

Chapter 3 - Analysis of Foodborne Illness Complaints

Objectives

This study focused on the analysis of restaurant-associated foodborne illness complaints in Kansas received by the KDA from 2009 to 2012. The objectives were to examine the characteristics of these complaints and to compare complaints that led to outbreak investigations to those that did not.

Methods

Foodborne illness complaints were received by the Kansas Department of Agriculture through an online complaint form on the KDA website or telephone calls. A Microsoft Word form was completed for each complaint, and then shared via encrypted email with KDHE. Beginning in 2009, KDHE transferred the data from each complaint into Microsoft Excel spreadsheets. New spreadsheets were created for each calendar year of complaints. Only complaints that were initially reported to KDA were included; complaints that citizens first reported to KDHE or a local health department were excluded.

Information collected included report date; method of complaint submission; establishment name, type, and address; meal date and time; illness onset date and time; and the number of households and ill persons affected. Additional data fields were calculated from the complaint data, such as exposure-to-illness days, exposure-to-complaint days, and illness-to-complaint days. Exposure-to-illness days were defined as the interval from the time an individual was exposed to the restaurant's food to the time of

illness onset. Exposure-to-complaint days were defined as the time between an individual was exposed to the restaurant's food to the time they made a complaint. Illness-to-complaint days were defined as the time of illness onset to the time they made a complaint. The day of the week column in each complaint was determined by using SAS version 9.2 (SAS Institute, Inc.; Cary, North Carolina), a widely used statistical software package, which was also utilized to remove typographical errors from the complaints.

For purposes of this analysis, all complaints were grouped by three main categories: complainant information, establishment information, and investigation information. Details are provided in Figure 2.

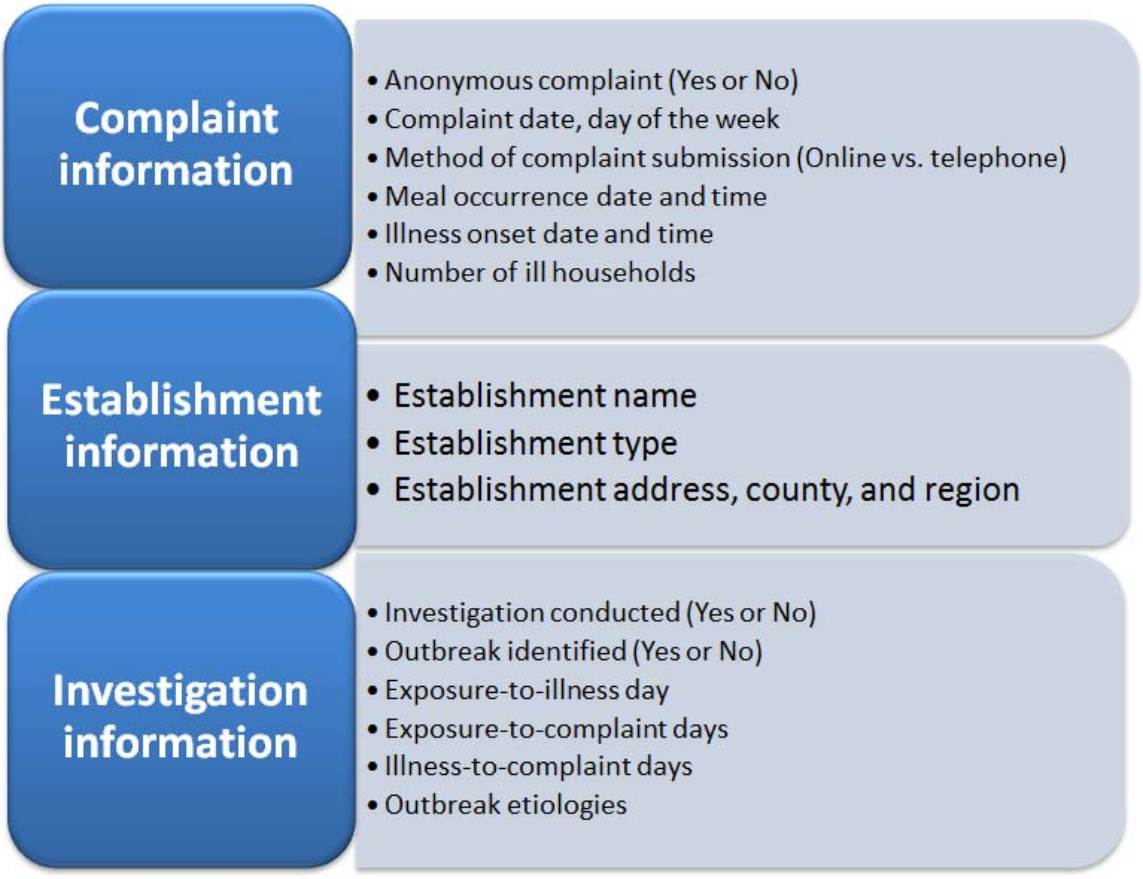

Figure 2: Classification of complaint information

The data set included restaurant-based complaints from four calendar years: 2009, 2010, 2011, and 2012. KDA collects complaints for three types of facilities: food service restaurant (FSR), food service grocery (FSG), and lodging (LOD). For this analysis, only complaints regarding ready-to-eat (RTE) food from these three facility types were included.

After omitting non-RTE food complaints, the data set contained 1,011 complaints received from 2009 to 2012.

The KDA foodborne illness complaint data set was merged with KDHE's data set of foodborne illness investigations and outbreaks. Investigation data from January 1, 2009 to December 31, 2011 was extracted from the Kansas Electronic Disease Surveillance System (EDSS), and the current surveillance system, EpiTrax, provided data from January 1, 2012 to December 31, 2012.

Merging these data sets allowed for the comparison of three categories of restaurant-associated foodborne illness complaints: no investigation (complaints that did not lead to a KDHE investigation), not an outbreak (KDHE conducted an initial investigation, but the complaint could not be defined as an outbreak), and outbreak (KDHE determined that an outbreak occurred and a full investigation was conducted). The investigation rate and outbreak rate were calculated. The investigation rate was defined as the percentage of complaints that led to a KDHE investigation:

Investigation rate = (number of investigations / number of complaints)* 100%

The outbreak rate was defined as the percentage of outbreaks among investigated complaints:

Outbreak rate = (number of outbreaks / number of investigations)*100%

Results and Discussion

Complaints received in each year

A total of 1011 complaints were received from 2009 to 2012, in which 109 were investigated and 46 were confirmed as outbreaks. Table 2 shows the number of complaints, investigations and outbreaks in each year. The investigation rate was 10.8%, and the outbreak rate was 42.2%.

Table 2: Number of restaurant-associated food-borne illness complaints received in Kansas, 2009-2012

Year	Number of complaints	Number of investigations	Number of outbreaks
2009	248	24	1
2010	270	23	9
2011	214	29	17
2012	279	33	19
Total	1011	109	46

Method of complaint submission

The restaurant-associated complaints were received either by telephone calls or website forms. In 2009-2012, 676 (66.9%) complaints were received by telephone, 239 (23.6%) complaints were received through the KDA website, and 96 (9.5%) complaints had no recorded method of submission. The following figure (Figure 3) displays the

Kansas foodborne complaint investigations and outbreaks distribution in different receiving measures from 2009 to 2012. Generally, complaints received by telephone were much more frequent than complaints received by website form; investigations and outbreaks were more frequent in telephone-based complaints. Note the year 2009 was the first year of using online form filing restaurant-associated foodborne illness complaints, the small number of complaints receiving online may indicate this. In these four years, making complaints by website has an increasing trend, and outbreaks also appear more with this tendency. The growth trend of complaints received by website forms may be due to the extensive use of internet and people's awareness of using government websites.

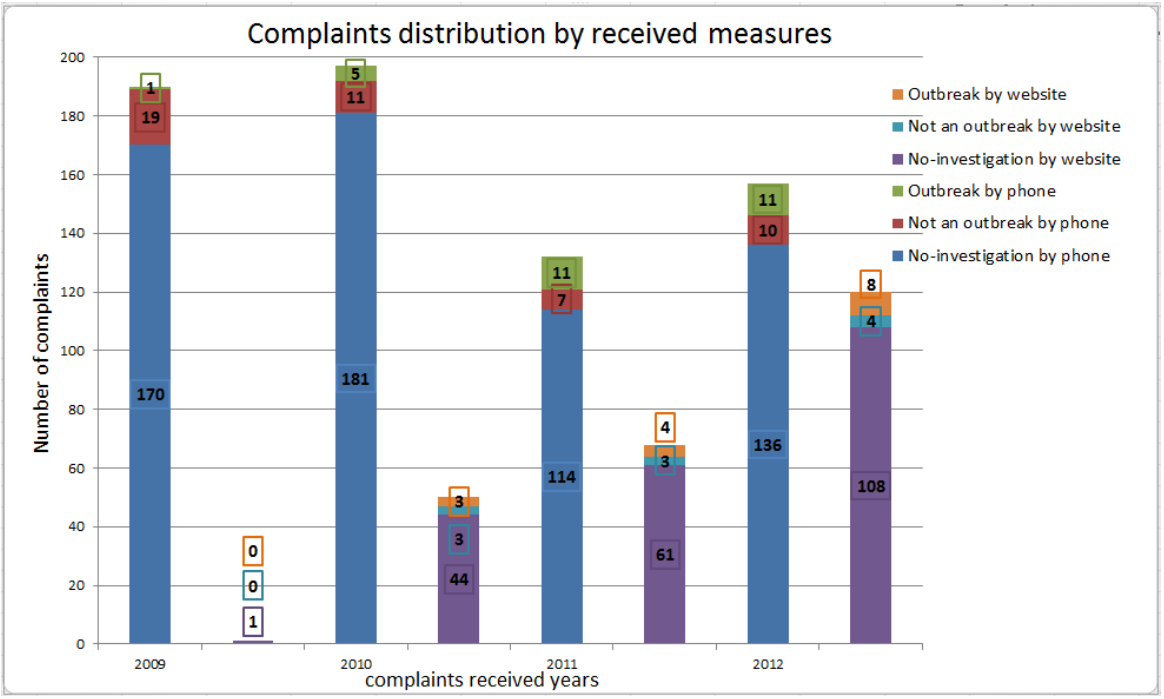

Figure 3: Restaurant-associated food-borne illness complaints distribution by received measures

In 2009-2011[1], the total complaints numbers were 733, and 149 (20.3%) of them were received anonymously. In these anonymous complaints, 83 (55.7%) were received by telephone, and 46 (30.9%) were received by the KDA website, and 20 (13.4%) had no recorded method of submission. Only a few (n=6) investigations took place from anonymous complaints and one outbreaks was detected (Figure 4). Figure 4 indicates the increasing trend of anonymous complaints from 2009 to 2011.

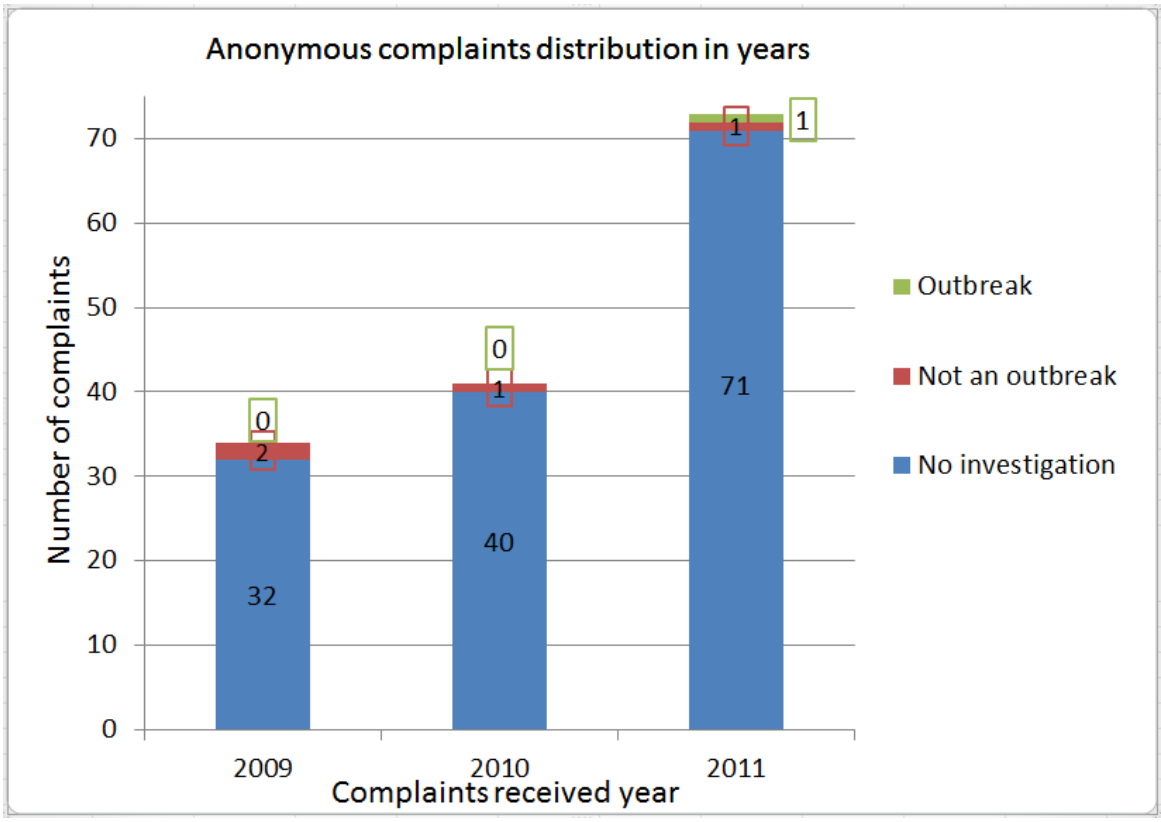

Figure 4: Number of anonymous restaurant-associated food-borne illness complaints received in Kansas, 2009-2011.

[1] There was no information about anonymous complaints in the data collected in 2012.

Outbreak etiology

In this study, there were 1,011 total complaints, 109 investigations, and 46 outbreaks. In this complaint-based pool of 46 outbreaks, the outbreak etiology was confirmed in 18 outbreaks: 14 (30.4%) outbreaks were caused by norovirus, and four (8.7%) were caused by *Salmonella* spp. (Table 3). The etiology was not determined in 28 (60.9%) outbreaks.

Table 3: Restaurant-associated food-borne illness complaint outbreak etiologies in Kansas, 2009-2012

Pathogen	Number of outbreaks	Percentage (%)
Norovirus	14	30.4
Salmonella spp.	4	8.7
Unknown	28	60.9

Outbreaks were classified by counties based on restaurant address, and the number of outbreaks per county was examined. Figure 5 shows the outbreaks identified from restaurant-associated complaints in Kansas counties from 2009 to 2012. Only three counties have more than 10 outbreaks: Johnson County, Shawnee County, and Sedgwick County. The western half of Kansas had only 5 (10.8%) outbreaks.

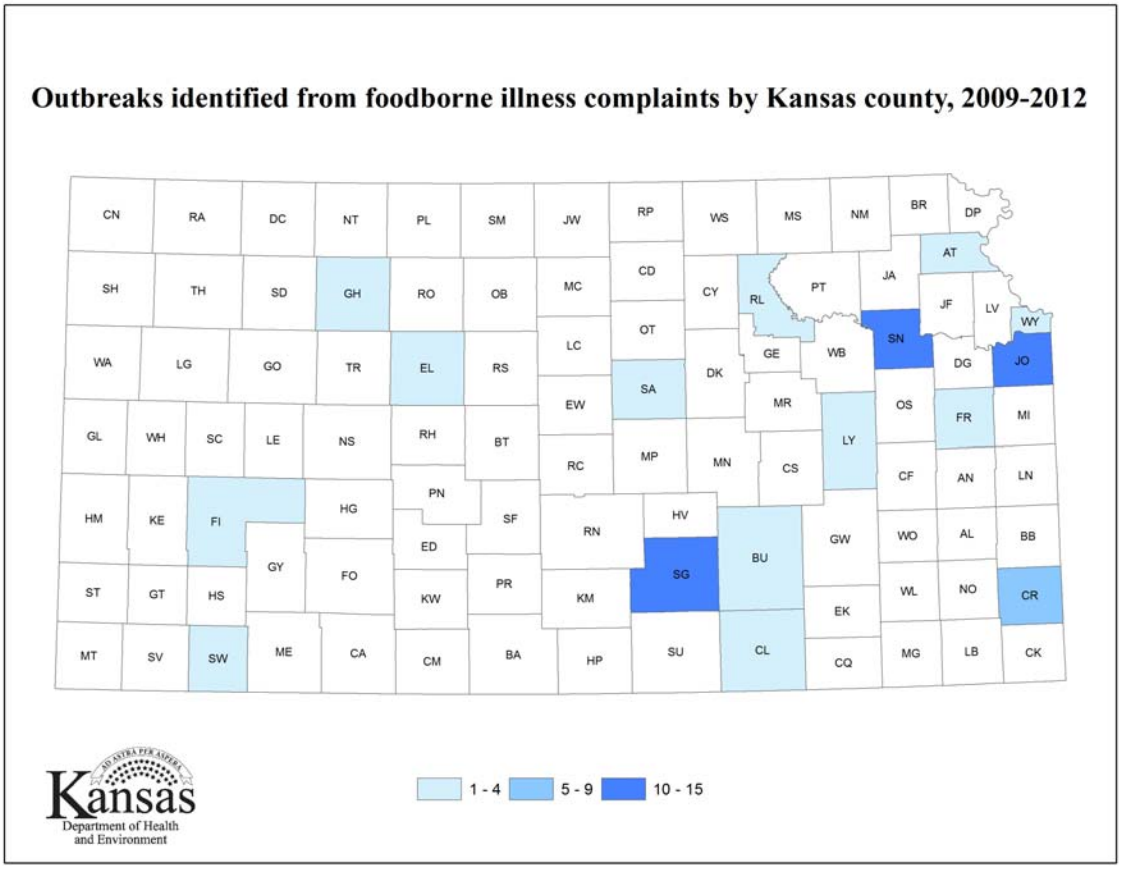

Figure 5: Outbreaks identified from restaurant-associated food-borne illness complaints by Kansas County, 2009-2012.

Complaints by counties groups

Complaints were classified into counties based on restaurant address, and the number of complaints per county was examined. The counties with the highest number of complaints was Johnson County (n=315, 31.2%), followed by Sedgwick County (n=169, 16.7%), and Shawnee County (n=110, 10.9%). These three counties accounted for over half (n=594, 58.8%) of all complaints. While only 14 complaints were received for Crawford County, five (35.7%) were determined to be outbreaks.

Figure 6 displays the distribution in Kansas counties of foodborne illness complaints from 2009 to 2012. The following table (Table 4) lists statewide foodborne illness complaints received from 2009 to 2012 based on county units. The complaints were divided into three categories based on the investigation and outbreak status.

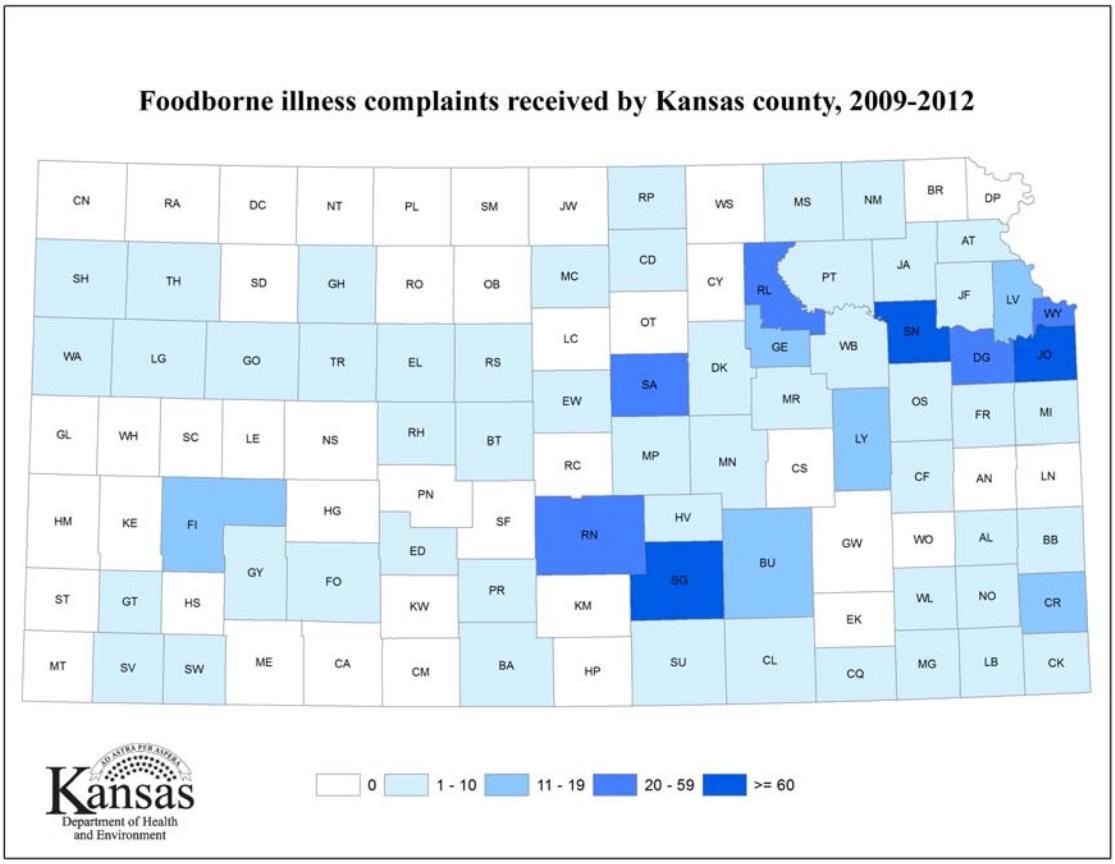

Figure 6: Map of counties in Kansas reporting restaurant-associated food-borne illness complaints from 2009 to 2012

Table 4: Number of restaurant-associated food-borne illness complaints, investigation and outbreak regarding restaurants in Kansas counties, 2009-2012

County	Number of complaints not investigated	Number of complaints investigated, but not an outbreak	Outbreak	Total
ALLEN	3			3
ATCHISON	2		1	3
BARBER	1			1
BARTON	4			4
BOURBON	3			3
BUTLER	10	1	1	12
CHAUTAUQUA	1			1
CHEROKEE	1			1
CLOUD	3			3
COFFEY	1			1
COWLEY	7		1	8
CRAWFORD	8	1	5	14
DICKINSON	1			1
DOUGLAS	38	3		41
EDWARDS	2			2
ELLIS	8		1	9
ELLSWORTH	2			2
FINNEY	9	1	1	11
FORD	7	1		8
FRANKLIN	4	1	1	6
GEARY	15			15
GOVE	1			1
GRAHAM	1		1	2
GRANT	3			3
GRAY	3			3
HARVEY	10			10
JACKSON	2			2
JEFFERSON	4			4
JOHNSON	286	16	13	315
LABETTE	7			7
LEAVENWORTH	14	1		15
LOGAN	1			1
LYON	12	1	1	14
MARION	2			2
MARSHALL	2			2
MCPHERSON	3			3
MIAMI	7			7
MITCHELL	1			1
MONTGOMERY	6			6
MORRIS	1			1
NEMAHA	2			2
NEOSHO	5			5
OSAGE	1			1

POTTAWATOMIE	4			4
PRATT	2			2
RENO	25	2		27
REPUBLIC	1			1
RILEY	27	1	1	29
RUSH	1			1
RUSSELL	3			3
SALINE	28		2	30
SEDGWICK	141	14	14	169
SEWARD	7		2	9
SHAWNEE	97	2	11	110
SHERMAN	1			1
STEVENS	1			1
SUMNER	2			2
THOMAS	1			1
TREGO	1			1
WABAUNSEE	1			1
WALLACE	1			1
WILSON	3			3
WYANDOTTE	51	4	4	59

The KDHE Bureau of Local and Rural Health classifies counties by peer groups, which are based on the population density. This classification system divides the 105 counties into five groups: urban (150 or more persons per square mile), semi-urban (40-149.9 persons per square mile), densely-settled rural (20-39.9 persons per square mile), rural (6-19.9 persons per square mile), and frontier (less than 9 persons per square mile). A map showing the peer group classification of each county is provided in the Figure 7. The distribution of foodborne illness complaints by county peer groups are listed in Table 5.

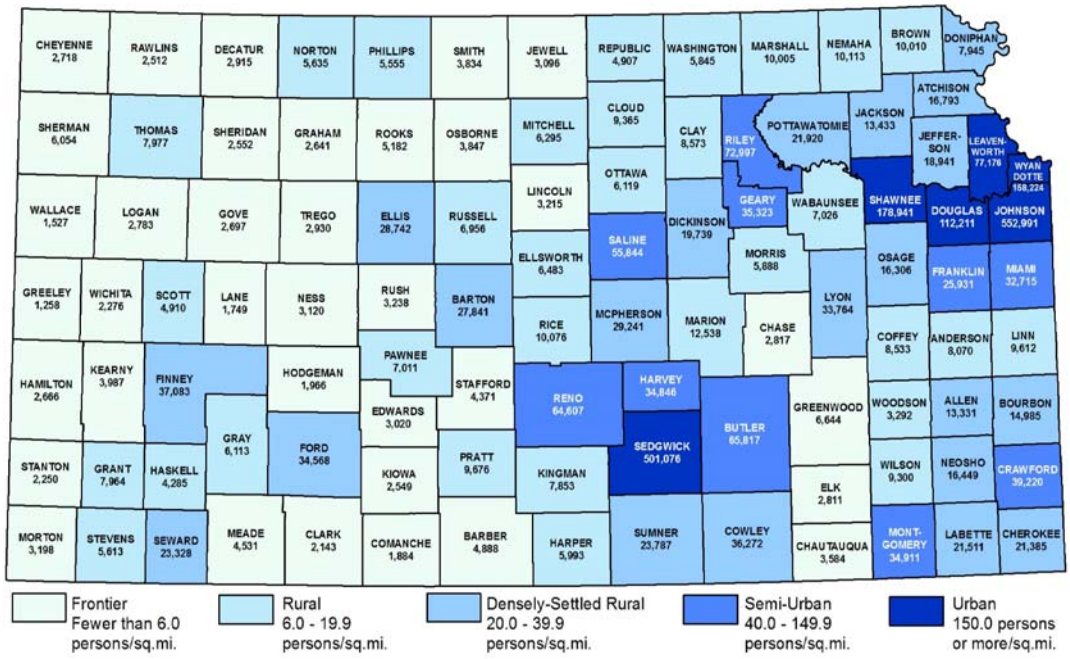

Figure 7: Kansas county population density peer group classifications (KDHE, 2013a)

Table 5: Restaurant-associated food-borne illness complaints reported by Kansas county population density peer groups, 2009-2012

County	No investigation	Not an outbreak	Out-break	Total complaints	Population per region (Estimate 2011)	Percent of population (2011)	Complaints per 10,000 people
Frontier	11	0	1	12	113,453	3.95%	1.058
Rural	32	0		32	237,591	8.27%	1.347
Dense Rural	92	3	7	102	477,364	16.63%	2.137
Semi-Urban	140	6	10	156	462,211	16.10%	3.375
Urban	627	40	42	709	1,580,619	55.05%	4.486

Population per square mile (2011 Estimate): Frontier: less than 6.0 persons; Rural: 6.0-19.9 persons; Densely-Settled Rural: 20.0-39.9 persons; Semi-Urban: 40.0-149.9 persons; Urban: 150 or more persons. (KDHE, 2013a)

The complaint distribution corresponds to the population distribution. Complaints are concentrated in urban counties. Over two-thirds of the outbreaks took place in the urban group, where more than half of the total population resides. The percent of outbreaks in the semi-urban and densely-settled rural groups is nearly equal (16.10% and 16.63%), lower compared to the urban group. The rural and frontier groups bear the lowest number of outbreaks. In the urban county peer group with a high population density, 4.486 complaints were received per 10,000 people, while in the frontier county peer group with a low population density the rate was 1.058 complaints per 10,000 people. One possible reason is that people in rural counties are more familiar with each other compare to big cities; therefore when a foodborne disease occurs it is unlikely to make a complaint and hold against a restaurant owned by an acquaintance.

There are 105 counties in Kansas. These counties were divided into six geographic groups. Statistics based on these geographic regions are listed below (Figure 8 and Table 6). The following map and table show a trend of complaint distribution. The most complaints occurred in Johnson, Sedgwick and Shawnee counties. The geographic area with the most complaints report was the northeast region, while the least complaints report was the northwest region. Reasons could include more restaurants in larger counties; and different population density all around Kansas. A potential reason could be people in these counties have a relatively easier access to the health care provider.

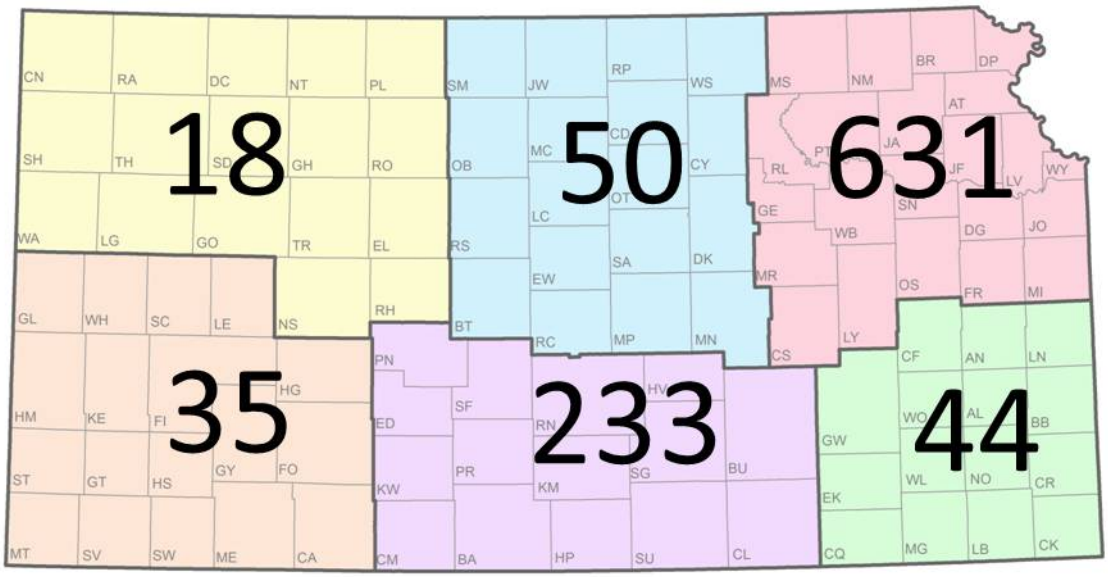

Figure 8: Restaurant-associated food-borne illness complaints distribution in Kansas county geographic groups in 2009-2012

Table 6: Number of restaurant-associated food-borne illness complaints, investigations and outbreaks in Kansas geographic regions, 2009-2012

Regions	No investigation	Not an outbreak	Outbreak	Total
North Central	48	0	2	50
Northeast	570	29	32	631
Northwest	16	0	2	18
Southeast	38	1	5	44
South Central	200	17	16	233
Southwest	30	2	3	35

In the past four years, 42 counties did not receive any restaurant-associated foodborne illness complaints. As listed below, these counties are centralized in west regions, especially in Southwest (Table 7).

No complaints were received for 12 counties in the Southwest region and eight counties in the Northwest region. These two regions accounted for nearly half (n=20, 47.6%) of the total counties with no complaints.

Table 7: Kansas counties (by geographic region) in which no restaurant-associated food-borne illness complaints were reported during 2009-2012 (n=42)

NORTH-EAST	SOUTH-EAST	SOUTH CENTRAL	NORTH CENTRAL	NORTH-WEST	SOUTH-WEST
Brown	Anderson	Comanche	Clay	Cheyenne	Clark
Chase	Elk	Harper	Jewell	Decatur	Greeley
Doniphan	Greenwood	Kingman	Lincoln	Ness	Hamilton
	Linn	Kiowa	Osborne	Norton	Haskell
	Woodson	Pawnee	Ottawa	Phillips	Hodgeman
		Stafford	Rice	Rawlins	Kearny
			Smith	Rooks	Lane
			Washington	Sheridan	Meade
					Morton
					Scott
					Stanton
					Wichita

Weekday distribution

The study shows that the number of complaints received also varied by day of the week. Figure 9 displays the complaint distribution by weekdays.

In terms of weekdays, 282 (27.9%) complaints were received on Mondays, followed by Tuesdays with 257 complaints. The number received on Thursdays and Fridays was

similar, at approximately 150. Generally, the complaint number went down with sequence of the day. The unbalanced distribution on weekdays may be due to two reasons: the KDA is closed on weekends, and people eat out more on weekends. Complaints reported during weekends will be accepted on Mondays, which is why Mondays bear the undoubted peak in a week. The only complaint received on Sunday is a rare exception for recording a foodborne disease complaint with a weekend date.

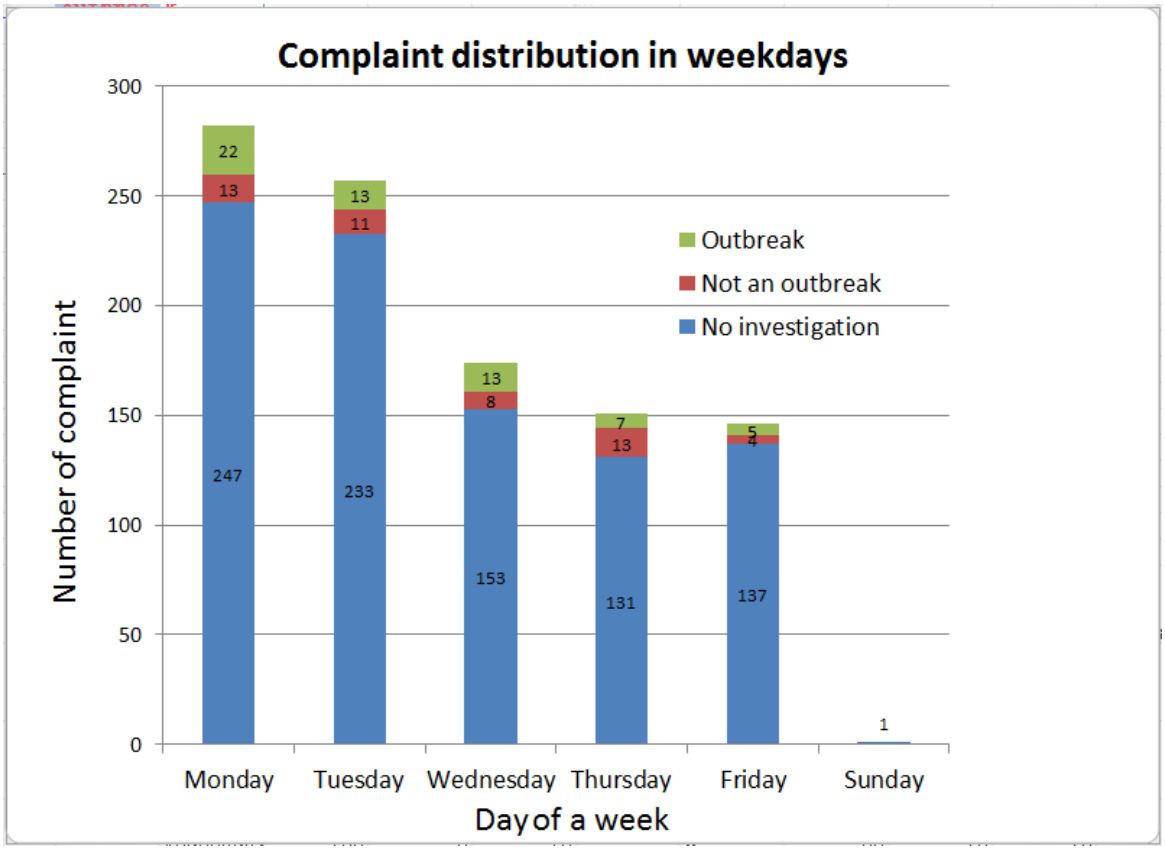

Figure 9: Distribution of restaurant-associated food-borne illness complaints received in Kansas by day of week, 2009-2012

Based on the received complaints, when complainants recall their possible exposure date, they also have a various distribution by weekdays. Figure 10 indicates the complaint

exposures distribution by day of the week. Weekends (Saturdays and Sundays) bear the highest number, and Fridays are relatively high. The lowest number occurs on Thursday.

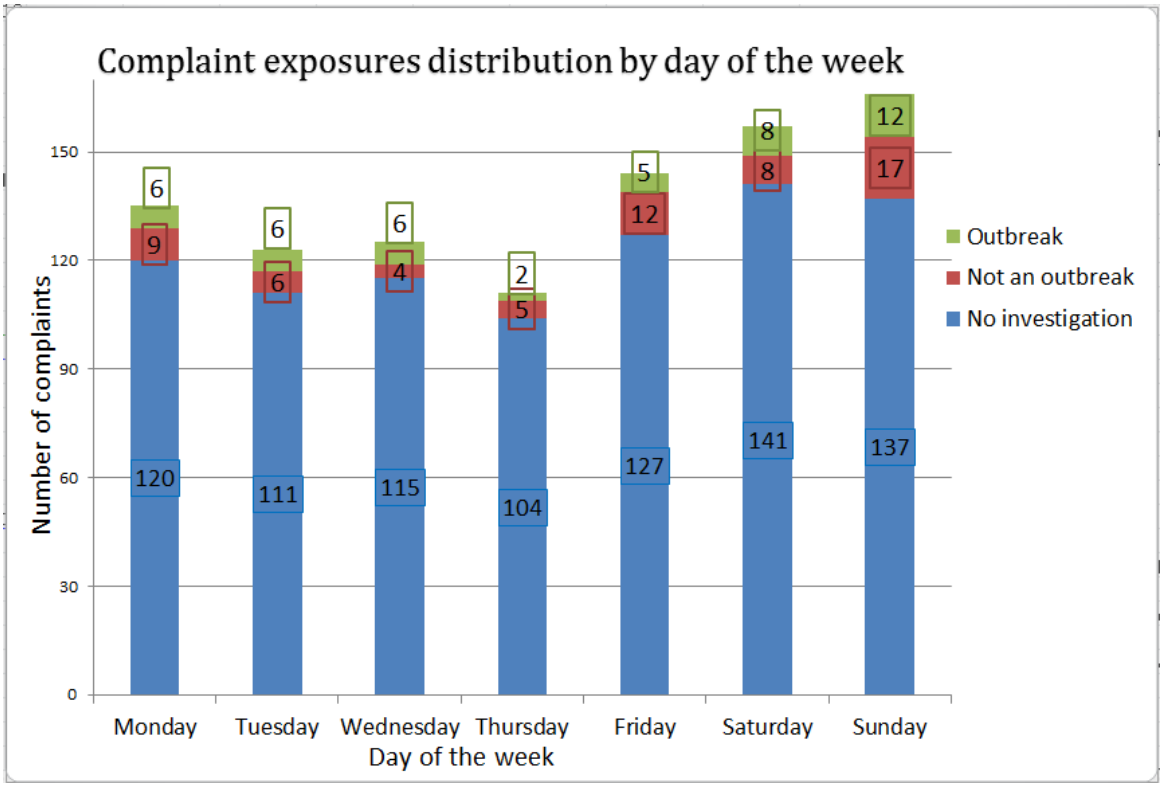

Figure 10: Distribution of restaurant-associated food-borne illness complaints recall exposures in Kansas by day of the week, 2009-2012

Household numbers in outbreaks

To evaluate the collected complaint data for many factors associated with foodborne illness outbreaks, for this analysis we chose the household number and the incubation time period. The household number means the number of households in the outbreak.

The following figure (Figure 10) displays the outbreak distribution in household numbers.

In a complaint, the household number has a close connection with the selection of making an investigation. In Figure 11, the one household category has 671 complaints, within only 3 outbreaks in four years. Meanwhile, in the category of 5 or more households, 16 outbreaks were confirmed out of 26 complaints. Therefore, when more households are involved, there is a higher possibility for confirming an outbreak.

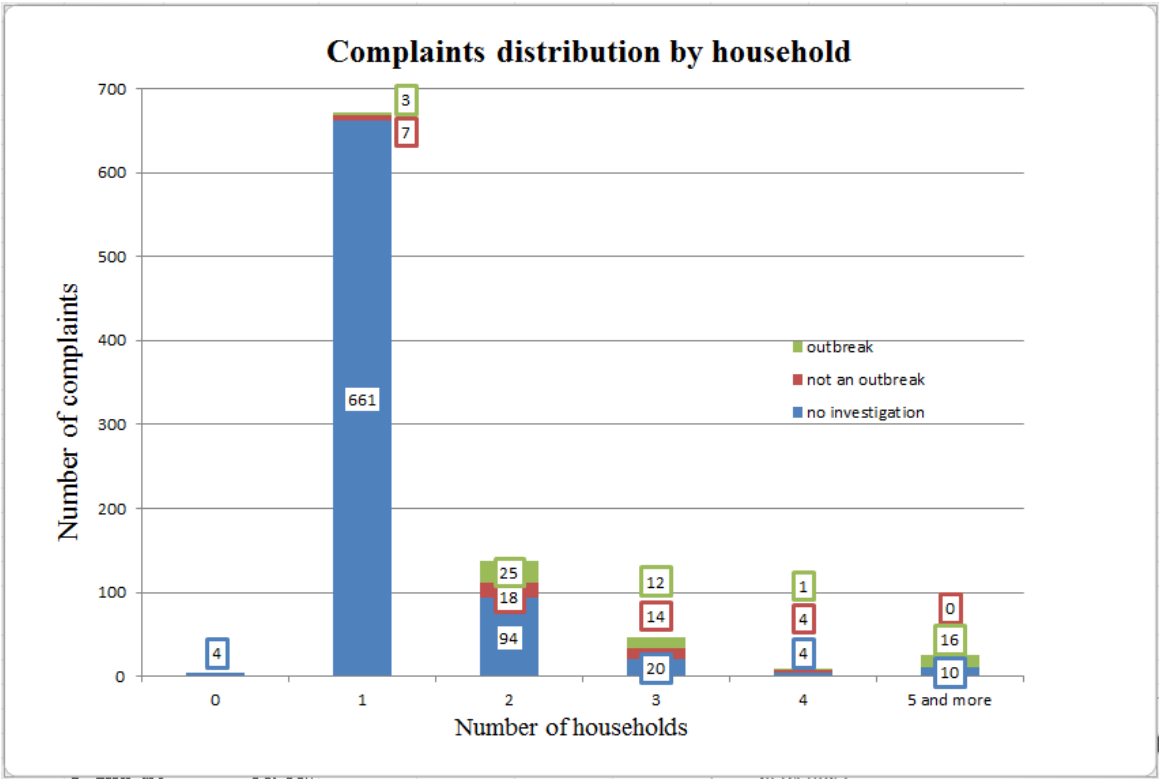

Figure 11: Distribution of restaurant-associated food-borne illness complaints received in Kansas by household numbers, 2009-2012

Analysis of time between estimated exposure, illness onset, and complaint

The following figures (Figure 12, Figure 13, and Figure 14) display the complaints distribution in different time periods. The blue bars are complaints that did not lead to an investigation. The red bars are complaints in which an investigation was started but which were ultimately not defined as an outbreak. The green bars indicate number of outbreaks.

Figure 12 reveals the complaint distribution in exposure-to-illness days; 591 (58%) out of 1011 complainants said they got sick the same day they consumed the suspect foods. and 27 (4.5%) outbreaks were detected in these 597 complaints. In the category of one day between exposure to the suspect foods to illness onset, 293 complaints were reported, and 16 (5.4%) were detected as outbreaks. For those complaints that have two or more days interval between exposure and illness onset, no outbreaks were detected. There were 86 complaints that did not have a specific exposure-to-illness time recorded.

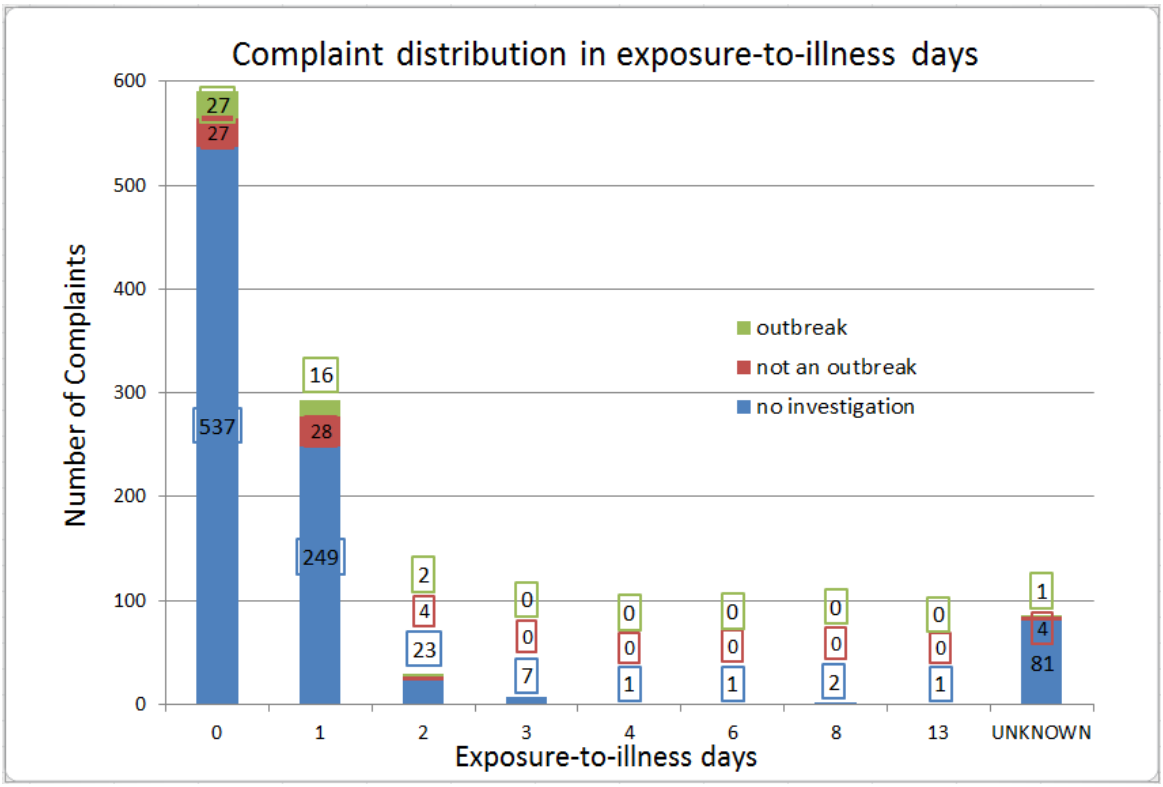

Figure 12: Distribution of restaurant-associated food-borne illness complaints received in Kansas by exposure-to-illness days, 2009-2012

Complaints distribution in exposure-to-report days is shown in Figure 13. Only 22 individuals reported becoming ill the same day after being exposed to the restaurant. After being exposed to the suspect foods in restaurants, the first week (7 days) represented the most intensive time period for making complaints. A peak appears with 275 (27.2%, n=1011) complaints having an estimate of one day between exposure and making the complaint, which means 27.2% individuals in Kansas made complaints the following day after consuming the suspect foods. The second day keeps complaints number as high as 198 (19.6%), following the third day with 133 (13.2%) complaints. In total, 844 (83.5%) individuals made complaints in the first week (first seven days) after they were exposed to

the suspect food. During the second week following consumption of the suspect food, this complaint number dropped to 63 (6.2%). In addition, 51 (5.0%) complaints did not have exposure-to-report days in record.

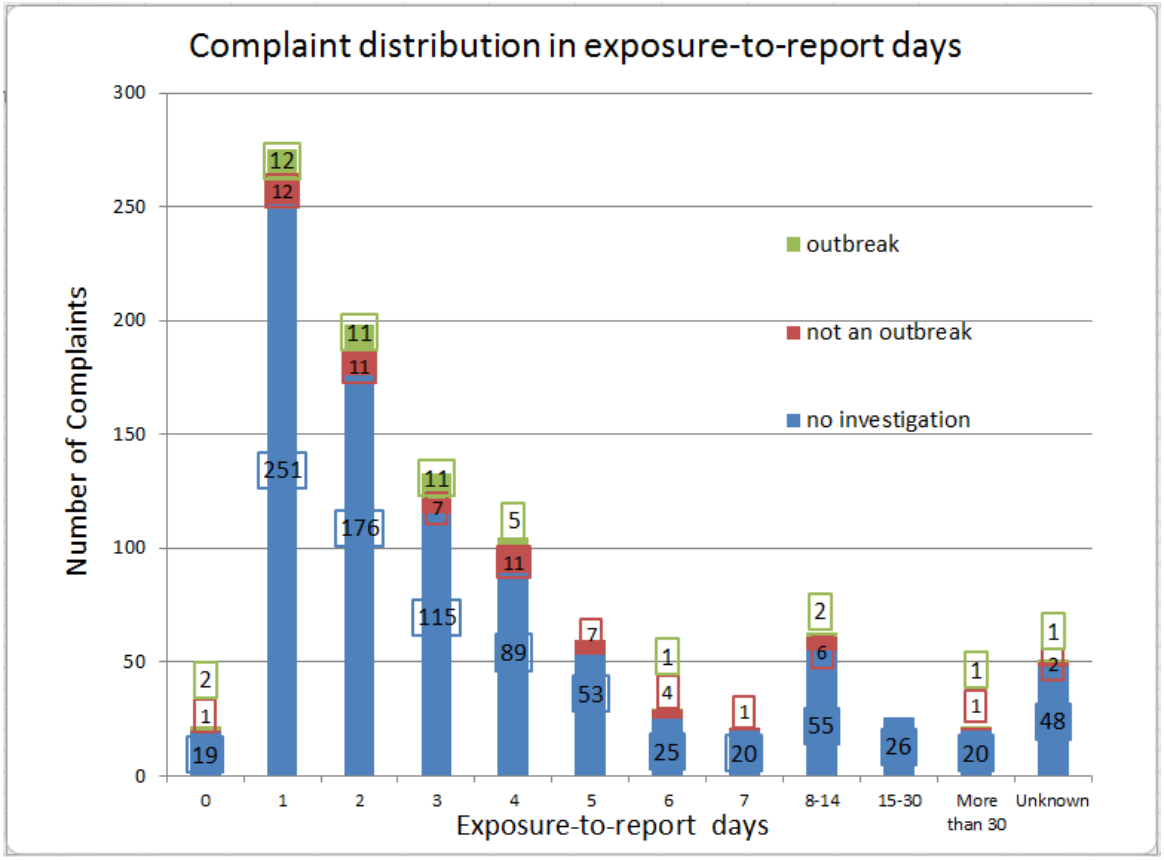

Figure 13: Distribution of restaurant-associated food-borne illness complaints received in Kansas by exposure-to-complaint days, 2009-2012

The illness-to-report days usually reflects how soon individuals would report their possible foodborne illness. There were 85 complaints made the same day that the individual got sick. However, the most frequent time appears to be the one day interval. A total of 292 (28.9%) complaints were received the first day following when individuals got sick from eating at a restaurant. A similar trend turn up with the exposure-to-report

days; the first week fallowing exposure had 835 complaints which is 82.6% reported their potential foodborne illness compare to 51 (5.0%) complaints of the second following week.

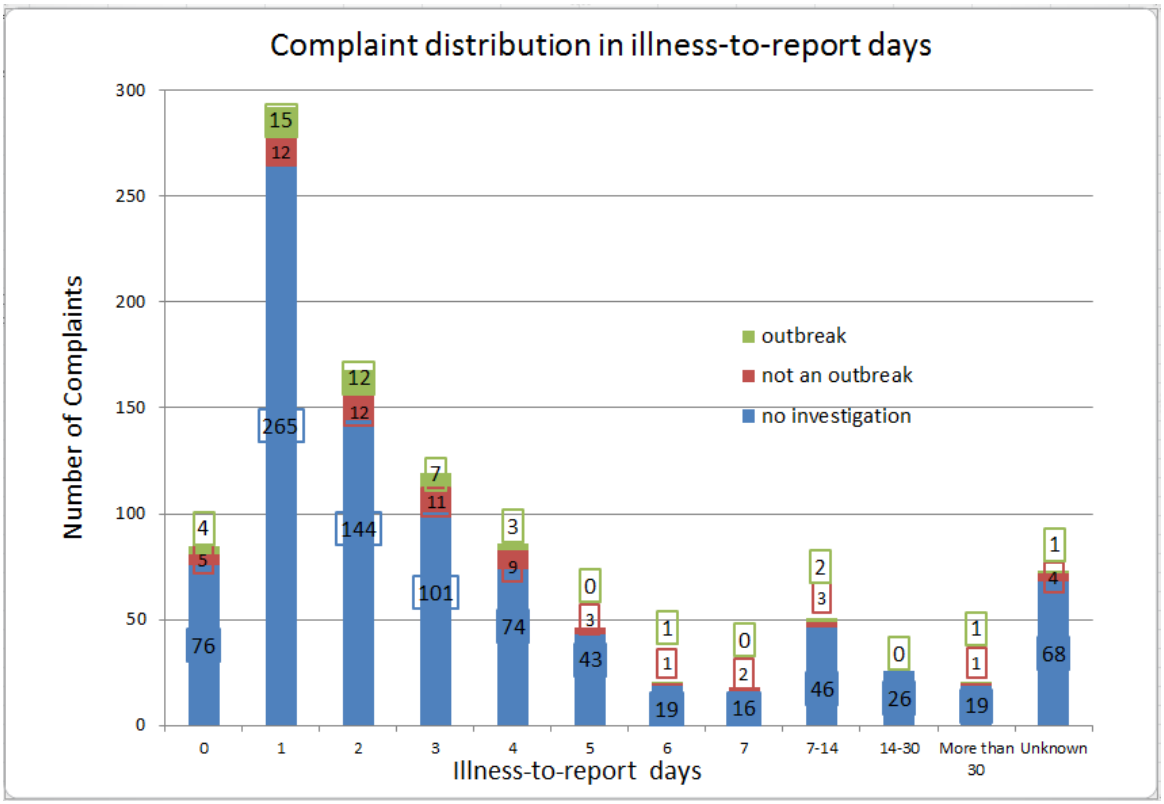

Figure 14: Distribution of restaurant-associated food-borne illness complaints received in Kansas by illness-to-complaint days, 2009-2012

When illness onset occurs the same day the food is consumed, individuals would think the last thing eaten made them sick and provide more detailed information which would be a big help for tracking back. If an investigation is filed, it can reduce the range of target food, and make the inspection more effective. In addition, the most common pathogen of foodborne illness is norovirus, with an incubation time of less than 24 hours.

In Figure 13 and Figure 14, the mode of both time periods falls in the Day 1 coordinate. Some reasons could include the following factors: Individuals may consume the foods in daytime but illness onset in early morning; they will wait until the next daytime to report; people cannot report an illness until they get sick; and it takes time from the possible exposure to start having symptoms. In addition, a person might be busy treating their symptoms or seeing a doctor so reporting the complaint is not the first priority at this time. People who ate with others would also likely check with their family or friends before making a complaint.

Summary

The aim of this data analysis was to describe the characteristics of restaurant-based foodborne illness complaints. Of the 1,011 complaints 109 were investigated, and 46 were confirmed as outbreaks. In other words, the investigation rate was 10.8%, and the outbreak rate was 42.2%. Only 39.1% of the outbreaks detected a pathogen, of which norovirus was 30.4% and *Salmonella* spp. was 8.7%. For the period of study (2009-2012), two-thirds of complaints were received by telephone, however, there is an increasing trend towards website-based reporting.

Received complaints were distributed all around Kansas; however, complaints were concentrated in Johnson, Sedgwick and Shawnee counties. The complaint distribution corresponds to the population distribution. In the urban county peer group with a high population density, 4.486 complaints were received per 10,000 people, while in the frontier county peer group with a low population density the rate is 1.058 complaints per 10,000 people.

Complaints have an unbalanced distribution throughout the week. Mondays have the most complaints. The possible reasons could include: Monday is the first working day of each week, and people are tend to eat in restaurants more on weekends.

The study also found complaints that involve multiple households are more likely to be classified as outbreaks.

For our data we calculated three intervals (exposure-to-illness days, exposure-to-report days, and illness-to-report days). More outbreaks were detected when a complaint was made within two days of exposure, compared to complaints made more than two days after exposure. This may be due to better food history recall among individuals who were recently exposed. Complaints made quickly after exposure may also lead to a higher chance of collected and testing laboratory specimens.

Measures of complaint submission: how to make and how to file a complete complaint is crucial. Currently, the KDA and KDHE have specialists to answer complaint calls. But on the KDA website, the anonymous option may easily result in an error. It is very simple to choose to make an anonymous complaint, and no personal information is required. This could be used by individuals to make a false complaint, and provides no way to track back.

Study limitations

The real art of conducting surveillance lies in collecting accurate and timely data, and in carefully and correctly interpreting the data (KDHE, 2008). Following are some study limitations that could potentially lead to bias and inaccuracy.

Under-reporting data: Initial data were obtained from KDA, and were collected via email or complaint calls. Cases that were not submitted into these databases would be left out. There will also be inevitable under-reporting of foodborne illnesses that were not covered in this study.

Invalid complaint: Invalid complaints included incomplete information in the complaint data, such as missing data fields, and no date of illness onset. In addition, complainants may be incorrectly thinking a restaurant caused an illness when it was actually something else.

Restaurant numbers in each county: Comparing complaint numbers with the number of restaurants in each county could provide more information, as could comparing complaint numbers with the population density. In this study, we assumed the number of restaurants per county corresponded with county population, and it would be more accurate to use the actual restaurant statistics. Currently, the KDA and the restaurant association could not provide those numbers.

Future study

A further study could focus on the complaint ratio, such as collect the number of restaurants in each county and the comparison of complaint ratio in each county. In addition, more classifications could be drawn and compared: size of restaurant, type of restaurant (buffet VS. fast food), and type of food (Mexican VS. Chinese). The incubation period can also be calculated based on hours, which will be more accurate for identifying an outbreak.

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Appendix

Note the appendix excerpted from Foodborne Illness and Outbreak Investigation Manual (KDHE, 2008).

A – Kansas reportable disease list

B - Foodborne outbreak investigation flowchart

C - CDC's "investigation of a Foodborne Outbreak" form (eFDR S)

D - Final epidemiology report

E - Flowchart for Kansas Department of Health and Environment inspectors

F - Flowchart for Kansas Department of Agriculture inspectors

G - KDHE Compliant Investigation Report

H - Foodborne illnesses etiologic agents characteristic

REPORTABLE DISEASES IN KANSAS for health care providers, hospitals, and laboratories
(K.S.A. 65-118, 65-128, 65-6001 - 65-6007, K.A.R. 28-1-2, 28-1-4, and 28-1-18. Changes effective as of 4/28/2006)

☎ - Indicates that a telephone report is required by law within four hours of *suspect or confirmed* cases to KDHE toll-free at 877-427-7317

ⓘ - Indicates that an isolates must be sent to: Division of Health and Environmental Laboratories
Forbes Field, Building #740, Topeka, KS 66620-0001
Phone: (785) 296-1633

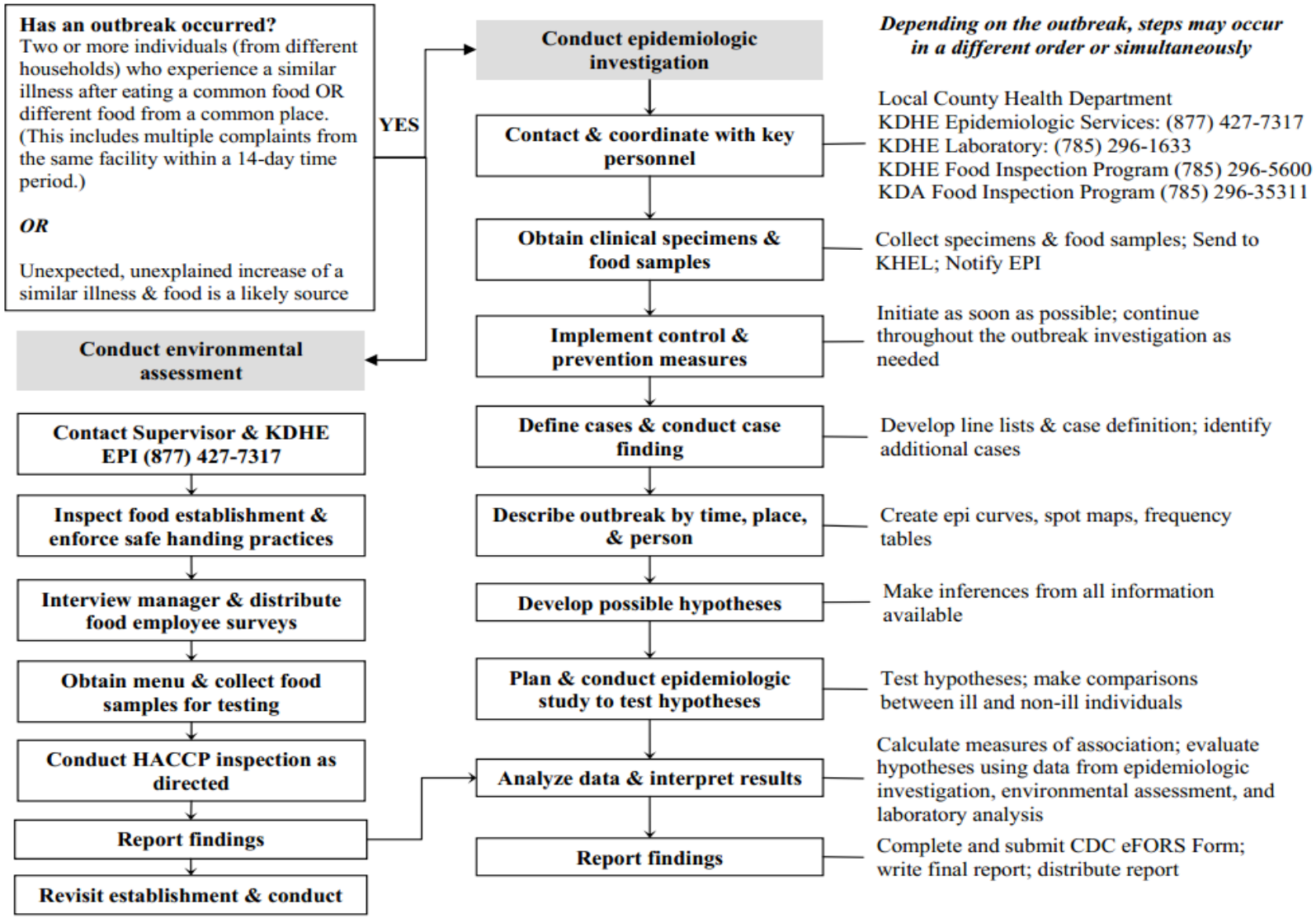
Acquired Immune Deficiency Syndrome (AIDS)
Amebiasis
Anthrax ☎
Arboviral disease (including West Nile virus, Western Equine encephalitis (WEE) and St. Louis encephalitis (SLE)) - indicate virus whenever possible
Botulism ☎
Brucellosis
Campylobacter infections
Chancroid
Chlamydia trachomatis genital infection
Cholera ☎
Cryptosporidiosis
Cyclospora infection
Diphtheria
Ehrlichiosis
Escherichia coli O157:H7 (and other shiga-toxin producing E. coli, also known as STEC) ⓘ
Giardiasis
Gonorrhea
Haemophilus influenza, invasive disease
Hantavirus Pulmonary Syndrome
Hemolytic uremic syndrome, postdiarrheal
Hepatitis, viral (acute and chronic)
Hepatitis B during pregnancy
Human Immunodeficiency Virus (HIV) (includes Viral Load Tests)
Influenza deaths in children <18 years of age
Legionellosis
Leprosy (Hansen disease)
Listeriosis
Lyme disease
Malaria
Measles (rubeola) ☎
Meningitis, bacterial ☎
Meningococcemia ⓘ ☎
Mumps ☎
Pertussis (whooping cough) ☎
Plague *(Yersinia pestis)* ☎
Poliomyelitis ☎
Psittacosis
Q Fever *(Coxiella burnetii)* ☎
Rabies, human and animal ☎
Rocky Mountain Spotted Fever
Rubella, including congenital rubella syndrome ☎
Salmonellosis, including typhoid fever ⓘ
Severe Acute Respiratory Syndrome (SARS) ⓘ ☎
Shigellosis ⓘ
Smallpox ☎
Streptococcal invasive, drug-resistant disease from Group A *Streptococcus* or *Streptococcus pneumoniae* ⓘ
Syphilis, including congenital syphilis
Tetanus
Toxic shock syndrome, streptococcal and staphylococcal
Transmissible Spongioform Encephalopathy (TSE) or prion disease (includes CJD)
Trichinosis
Tuberculosis, active disease ⓘ ☎
Tuberculosis, latent infection
Tularemia
Varicella (chickenpox)
Viral hemorrhagic fever ☎
Yellow fever

In addition, laboratories must report:
- Viral load results of reportable diseases
- ALL blood lead levels, as of 12/2002 (KCLPPP/ABLES)
- CD4+ T-lymphocyte count < 500/ µl or CD4+ T-lymphocytes <29% of total lymphocytes

Outbreaks, unusual occurrence of any disease, exotic or newly recognized diseases, and suspect acts of terrorism should be reported within 4 hours by telephone to the Epidemiology Hotline: 877-427-7317

Mail or fax reports to your local health department and/or to:
KDHE Office of Surveillance and Epidemiology, 1000 SW Jackson, Suite 210, Topeka, KS 66612-1274
Fax: 877-427-7318 (toll-free)

FOODBORNE OUTBREAK INVESTIGATION FLOWCHART



Electronic
Foodborne
Outbreak
Reporting
System

Investigation of a Foodborne Outbreak

This form is used to report foodborne disease outbreak investigations to CDC. It is also used to report *Salmonella* Enteritidis and *E. coli* O157:H7 outbreak investigations involving any mode of transmission. A foodborne outbreak is defined as the occurrence of two or more cases of a similar illness resulting from the ingestion of a common food in the United States. This form has 6 parts. Part 1 asks for the minimum or basic information needed and must be completed for the investigation to be counted in the CDC annual summary. Part 2 asks for additional information for any foodborne outbreak, while Parts 3 – 6 ask for information concerning specific vehicles or etiologies. Please complete as much of all parts as possible.

CDC Use Only
___-_____

State Use Only
_____

Part 1: Basic Information

1. Report Type

A.
☐ Please check if this a final report

B.
☐ Please check if data does not support a FOODBORNE outbreak

2. Number of Cases

Lab-confirmed cases_____(A)
Including _____ secondary cases

Probable cases_____(B)
Including _____ secondary cases

Estimated total ill_____
(If greater than sum A + B)

3. Dates

Please enter as many dates as possible

Date first case became ill __ __/__ __/__ __ __ __
Month Day Year

Date last case became ill __ __/__ __/__ __ __ __
Month Day Year

Date first known exposure __ __/__ __/__ __ __ __
Month Day Year

Date last known exposure __ __/__ __/__ __ __ __
Month Day Year

4. Location of Exposure

Reporting state _____

If multiple states involved:
☐ Exposure occurred in multiple states
☐ Exposure occurred in single state, but cases resided in multiple states
Other states: _____
_____
_____

Reporting county_____

If multiple counties involved:
☐ Exposure occurred in multiple counties
☐ Exposure occurreded in one county, but cases resided in multiple counties
Other counties: _____
_____
_____

5. Approximate Percentage of Cases in Each Age Group

<1 year _____% 20-49 yrs _____%
1-4 yrs _____% ≥50 yrs _____%
5-19 yrs ____% Unknown _____%

6. Sex

(Estimated percent of the total cases)

Male_____%

Female_____%

7. Investigation Methods (Check all that apply)

☐ Interviews of only cases
☐ Food preparation review
☐ Investigation at factory or production plant
☐ Investigation at original source (farm, marine estuary, etc.)
☐ Food product traceback
☐ Environment / food sample cultures
☐ Case-control study
☐ Cohort study

8. Implicated Food(s): (Please provide known information)

Name of Food	Main Ingredient(s)	Contaminated Ingredient(s)	Reason(s) Suspected (See codes just below)	Method of Preparation (See attached codes)
e.g., Lasagna	e.g., Pasta, sauce, eggs, beef	e.g., Eggs	e.g., 4	e.g., M1
1)				
2)				
3)				

☐ Food vehicle undetermined

Reason Suspected (List above all that apply)
1 - Statistical evidence from epidemiological investigation
2 - Laboratory evidence (e.g., identification of agent in food)
3 - Compelling supportive information
4 - Other data (e.g., same phage type found on farm that supplied eggs)
5 - Specific evidence lacking but prior experience makes it likely source

9. Etiology: (Name the bacteria, virus, parasite, or toxin. If available, include the serotype and other characteristics such as phage type, virulence factors, and metabolic profile. Confirmation criteria available at http://www.cdc.gov/ncidod/dbmd/outbreak/ or MMWR2000/Vol. 49/SS-1/App. B)

Etiology		Serotype	Other Characteristics (e.g., phage type)	Detected In (See codes just below)
1)	☐ Confirmed			
2)	☐ Confirmed			
3)	☐ Confirmed			

☐ Etiology undetermined

Detected In (List above all that apply)

1 - Patient Specimen(s) **3 -**Environment specimen(s)

2 - Food Specimen(s) **4 -** Food Worker specimen(s)

10. Isolate Subtype

State Lab ID	PFGE (PulseNet designation)	PFGE (PulseNet designation)	
1)			
2)			
3)			

11. Contributing Factors (Check all that apply. See attached codes and explanations)

☐ **Contributing factors unknown**

Contamination Factor

☐C1 ☐C2 ☐C3 ☐C4 ☐C5 ☐C6 ☐C7 ☐C8 ☐C9 ☐C10 ☐C11 ☐C12 ☐C13 ☐C14 ☐C15 (*describe in Comments)* ☐ N/A

Proliferation/Amplification Factor (bacterial outbreaks only)

☐P1 ☐P2 ☐P3 ☐P4 ☐P5 ☐P6 ☐P7 ☐P8 ☐P9 ☐P10 ☐P11 ☐P12 (*describe in Comments)* ☐ N/A

Survival Factor (microbial outbreaks only)

☐S1 ☐S2 ☐S3 ☐S4 ☐S5 (*describe in Comments)* ☐N/A

☐ **Was food-worker implicated as the source of contamination?** ☐ Yes ☐ No

If yes, please check **only one** of following

- ☐ laboratory *and* epidemiologic evidence
- ☐ epidemiologic evidence (w/o lab confirmation)
- ☐ lab evidence (w/o epidemiologic evidence)
- ☐ prior experience makes this the likely source (*please explain in Comments*)

Part 2: Additional Information

12. Symptoms, Signs and Outcomes

Feature	**Cases** with outcome/ feature	**Total cases** for whom you have information available
Healthcare provider visit		
Hospitalization		
Death		
Vomiting		
Diarrhea		
Bloody stools		
Fever		
Abdominal cramps		
HUS or TTP		
Asympomatic		
*		
*		
*		

13. Incubation Period

(Circle appropriate units)

Shortest_____(Hours, Days)
Longest_____(Hours, Days)
Median _____(Hours, Days)
□ Unknown

14. Duration of Illness

(Among those who recovered)
(Circle appropriate units)

Shortest_____(Hours, Days)
Longest_____(Hours, Days)
Median _____(Hours, Days)
□ Unknown

• Use the following terms, if appropriate, to describe other common characteristics of cases

Anaphylaxis	**Headache**	**Tachycardia**
Arthralgia	**Hypotension**	**Temperature reversal**
Bradycardia	**Itching**	**Thromobocytopenia**
Bullous skin lesions	**Jaundice**	**Urticaria**
Coma	**Lethargy**	**Wheezing**
Cough	**Myalgia**	
Descending paralysis	**Paresthesia**	
Diplopia	**Septicemia**	
Flushing	**Sore throat**	

15. If Cohort Investigation Conducted:

Attack rate* = _____ / _____ x 100 = _____%
(Exposed and ill / Total number exposed for whom you have illness information)

* The attack rate is applied to persons in a cohort who were exposed to the implicated vehicle. The numerator is the number of persons who were exposed and became ill; the denominator is the total number of persons exposed to the implicated vehicle. If the vehicle is unknown, then the attack rate should not be calculated.

16. Location Where Food Was Prepared

(Check all that apply)

□ Restaurant or deli
□ Nursing home
□ Day care center
□ Prison, jail
□ School
□ Private home
□ Office setting
□ Workplace, not cafeteria
□ Workplace cafeteria
□ Wedding reception
□ Banquet Facility
□ Church, temple, etc
□ Picnic
□ Camp
□ Caterer
□ Contaminated food imported into U.S.
□ Grocery Store
□ Hospital
□ Fair, festival, other temporary/ mobile services
□ Commercial product, served without further preparation
□ Unknown or undetermined
□ Other (Describe) _____

17. Location of Exposure or Where Food Was Eaten

(Check all that apply)

□ Restaurant or deli
□ Nursing Home
□ Day care center
□ Prison, jail
□ School
□ Private home
□ Office Setting
□ Workplace, not cafeteria
□ Workplace cafeteria
□ Wedding Reception
□ Banquet Facility
□ Church, temple, etc.
□ Picnic
□ Camp
□ Grocery Store
□ Hospital
□ Fair, festival, temporary/ mobile service
□ Unknown or undetermined
□ Other (Describe) _____

18. Trace back

□ Please check if trace back conducted

Source to which trace back led:

Source (e.g., Chicken farm, Tomato processing plant)	**Location of Source** **State**	**Country**	**Comments**

19. Recall

☐ Please check if any food product recalled

Recall Comments

_____
_____
_____
_____
_____

20. Available Reports (Pease attach)

☐ Unpublished agency report

☐ Epi-Aid report

☐ Publication (please reference if not attached)

_____
_____

21. Agency reporting this outbreak

_____

Contact person:

Name _____

Title _____

Phone _____

Fax _____

E-mail _____

22. Remarks

Briefly describe important aspects of the outbreak not covered above (e.g., restaurant closure, immunoglobin administration, economic impact, etc)

_____
_____
_____
_____
_____

Part 3: School Questions

1. Did the outbreak involve a single or multiple schools?

☐ Single

☐ Multiple (*If yes*, number of schools____)

2. School characteristics (for all involved students in all involved schools)

a. Total approximate enrollment

_____ (number of students)

☐ Unknown or Undetermined

b. Grade level(s) (Please check all grades affected)

☐ Preschool

☐ Grade School (grades K-12)

Please check all grades affected: ☐K ☐1st ☐2nd ☐3rd ☐4th ☐5th ☐6th ☐7th ☐8th ☐9th ☐10th ☐11th ☐12th

☐ College/University/Technical School

☐ Unknown or Undetermined

c. Primary funding of involved school(s)

☐ Public ☐ Private ☐ Unknown or Undetermined

3. Describe the preparation of the implicated item:

☐ Heat and serve (item mostly prepared or cooked off-site, reheated on-site)

☐ Served a-la-carte

☐ Serve only (preheated or served cold)

☐ Cooked on site using primary ingredients

☐ Provided by a food service management company

☐ Provided by a fast food vendor

☐ Provided by a pre-plate company

☐ Part of a club/ fundraising event

☐ Made in the classroom

☐ Brought by a student/teacher/parent

☐ Other _____

☐ Unknown or Undetermined

4. How many times has the state, county or local health department inspected this school cafeteria or kitchen in the 12 months before the outbreak?*

☐ Once

☐ Twice

☐ More than two times

☐ Not inspected

☐ Unknown or Undetermined

5. Does the school have a HACCP plan in place for the school feeding program?*

☐ Yes

☐ No

☐ Unknown or Undetermined

*If there are multiple schools involved, please answer according to the most affected school

6. Was implicated food item provided to the school through the National School Lunch/Breakfast Program?

- ☐ Yes
- ☐ No
- ☐ Unknown or Undetermined

***If Yes,* Was the implicated food item donated/purchased by :**

- ☐ USDA through the Commodity Distribution Program
- ☐ Purchased commercially by the state/school authority
- ☐ Other_____
- ☐ Unknown or Undetermined

Part 4: Ground Beef

1. What percentage of ill persons (for whom information is available) ate ground beef raw or undercooked? _____%

2. Was ground beef case ready? (Ground beef that comes from a manufacturer packaged for sale and not altered or repackaged by the retailer)

- ☐ Yes
- ☐ No
- ☐ Unknown or Undetermined

3. Was the beef ground or reground by the retailer?

- ☐ Yes
- ☐ No
- ☐ Unknown or Undetermined

If yes, was anything added to the beef during grinding (e.g., shop trim or any product to alter the fat content)_____

Part 5: Mode of Transmission

(Enterohemorrhagic *E. coli* or *Salmonella* Enteritidis only)

1. Mode of Transmission (for greater than 50% of cases)

Select one:

- ☐ Food
- ☐ Person to person
- ☐ Swimming or recreational water
- ☐ Drinking water
- ☐ Contact with animals or their environment
- ☐ Unknown or Undetermined

Part 6: Additional Egg Questions

1. Were Eggs: (Check all that apply)

- ☐ in-shell, un-pasteurized?
- ☐ in-shell, pasteurized?
- ☐ liquid or dry egg product?
- ☐ stored with inadequate refrigeration during or after sale?
- ☐ consumed raw?
- ☐ consumed undercooked?
- ☐ pooled?

2. If eggs traced back to farm, was *Salmonella* Enteritidis found on the farm?

- ☐ Yes
- ☐ No
- ☐ Unknown or Undetermined

Comment:_____

Contamination Factors:[1]

C1 - Toxic substance part of tissue (e.g., ciguatera)
C2 - Poisonous substance intentionally added (e.g., cyanide or phenolphthalein added to cause illness)
C3 - Poisonous or physical substance accidentally/incidentally added (e.g., sanitizer or cleaning compound)
C4 - Addition of excessive quantities of ingredients that are toxic under these situations (e.g., niacin poisoning in bread)
C5 - Toxic container or pipelines (e.g., galvanized containers with acid food, copper pipe with carbonated beverages)
C6 - Raw product/ingredient contaminated by pathogens from animal or environment (e.g., *Salmonella* enteriditis in egg, Norwalk in shellfish, *E. coli* in sprouts)
C7 - Ingestion of contaminated raw products (e.g., raw shellfish, produce, eggs)
C8 - Obtaining foods from polluted sources (e.g., shellfish)
C9 - Cross-contamination from raw ingredient of animal origin (e.g., raw poultry on the cutting board)
C10 - Bare-handed contact by handler/worker/preparer (e.g., with ready-to-eat food)
C11 - Glove-handed contact by handler/worker/preparer (e.g., with ready-to-eat food)
C12 - Handling by an infected person or carrier of pathogen (e.g., *Staphylococcus*, *Salmonella*, Norwalk agent)
C13 - Inadequate cleaning of processing/preparation equipment/utensils B leads to contamination of vehicle (e.g., cutting boards)
C14 - Storage in contaminated environment B leads to contamination of vehicle (e.g., store room, refrigerator)
C15 - Other source of contamination (*please describe in Comments*)

Proliferation/Amplification Factors:[1]

P1 - Allowing foods to remain at room or warm outdoor temperature for several hours (e.g., during preparation or holding for service)
P2 - Slow cooling (e.g., deep containers or large roasts)
P3 - Inadequate cold-holding temperatures (e.g., refrigerator inadequate/not working, iced holding inadequate)
P4 - Preparing foods a half day or more before serving (e.g., banquet preparation a day in advance)
P5 - Prolonged cold storage for several weeks (e.g., permits slow growth of psychrophilic pathogens)
P6 - Insufficient time and/or temperature during hot holding (e.g., malfunctioning equipment, too large a mass of food)
P7 - Insufficient acidification (e.g., home canned foods)
P8 - Insufficiently low water activity (e.g., smoked/salted fish)
P9 - Inadequate thawing of frozen products (e.g., room thawing)
P10 - Anaerobic packaging/Modified atmosphere (e.g., vacuum packed fish, salad in gas flushed bag)
P11 - Inadequate fermentation (e.g., processed meat, cheese)
P12 - Other situations that promote or allow microbial growth or toxic production (*please describe in Comments*)

Survival Factors:[1]

S1 - Insufficient time and/or temperature during initial cooking/heat processing (e.g., roasted meats/poultry, canned foods, pasteurization)
S2 - Insufficient time and/or temperature during reheating (e.g., sauces, roasts)
S3 - Inadequate acidification (e.g., mayonnaise, tomatoes canned)
S4 - Insufficient thawing, followed by insufficient cooking (e.g., frozen turkey)
S5 - Other process failures that permit the agent to survive (*please describe in Comments*)

Method of Preparation:[2]

M1 - Foods eaten raw or lightly cooked (e.g., hard shell clams, sunny side up eggs)
M2 - Solid masses of potentially hazardous foods (e.g., casseroles, lasagna, stuffing)
M3 - Multiple foods (e.g., smorgasbord, buffet)
M4 - Cook/serve foods (e.g., steak, fish fillet)
M5 - Natural toxicant (e.g., poisonous mushrooms, paralytic shellfish poisoning)
M6 - Roasted meat/poultry (e.g., roast beef, roast turkey)
M7 - Salads prepared with one or more cooked ingredients (e.g., macaroni, potato, tuna)
M8 - Liquid or semi-solid mixtures of potentially hazardous foods (e.g., gravy, chili, sauce)
M9 - Chemical contamination (e.g., heavy metal, pesticide)
M10 - Baked goods (e.g., pies, eclairs)
M11 - Commercially processed foods (e.g., canned fruits and vegetables, ice cream)
M12 - Sandwiches (e.g., hot dog, hamburger, Monte Cristo)
M13 - Beverages (e.g., carbonated and non-carbonated, milk)
M14 - Salads with raw ingredients (e.g., green salad, fruit salad)
M15 - Other, does not fit into above categories *(please describe in Comments)*
M16 - Unknown, vehicle was not identified

[1] Frank L. Bryan, John J. Guzewich, and Ewen C. D. Todd. Surveillance of Foodborne Disease III. Summary and Presentation of Data on Vehicles and Contributory Factors; Their Value and Limitations. Journal of Food Protection, 60; 6:701-714, 1997.
[2] Weingold, S. E., Guzewich JJ, and Fudala JK. Use of foodborne disease data for HACCP risk assessment. Journal of Food Protection, 57; 9:820-830, 1994.

Final Epidemiology Report

FORMAT FOR WRITING AN OUTBREAK REPORT

The following is a standard format of a written outbreak report. The format may be modified depending on the complexity of the outbreak.

INTRODUCTION
BACKGROUND
METHODS
- Epidemiologic Investigation
- Laboratory Analysis
- Environmental Assessment

RESULTS
- Epidemiologic Investigation
- Laboratory Analysis
- Environmental Assessment

DISCUSSION
RECOMMENDATIONS
ACKNOWLEDGEMENTS
SUPPORTING DOCUMENTS

The **INTRODUCTION** should include the following information:
- Who first reported the outbreak?
- When was the outbreak reported?
- What steps were taken to determine that an outbreak had occurred?
- What entities were involved with initiating the outbreak investigation?

The **BACKGROUND** should include the following information:
- What are the circumstances surrounding the outbreak?
- Where did the outbreak occur?
- What preliminary information was known?
  - Demographics of the affected group
  - Number of persons exposed
  - Number of persons ill
  - Severity and clinical picture of ill persons

The **METHODS** section should include epidemiologic, environmental, and laboratory or clinical information:
- Epidemiologic Investigation
  - What was the case definition?
  - What investigation tools were used to collect or organize the information?
    - Line list
    - Epidemic curves
    - Maps

        - Chart reviews
        - Communication with health care providers
        - Questionnaire
    - If a questionnaire was administered, how was it administered?
        - Self-administered?
        - By phone?
        - In person?
        - Electronically?
    - What type of study was conducted?
    - What statistical analyses were conducted?
    - What hypotheses were generated?
    - What prevention and control measures were implemented?
    - What entities were involved?
    - What specific tasks were conducted?
- Laboratory analysis
    - Were stool samples collected for testing?
    - Were food samples collected for testing?
    - What tests were conducted?
    - Where was testing performed?
- Environmental assessment
    - What kind of environmental assessment was conducted?
    - What was the physical layout of the outbreak?
    - Was a HACCP investigation performed?
    - Were there any tracebacks?

The **RESULTS** section should also include epidemiologic, environmental, and laboratory or clinical information:

- Epidemiologic Investigation
    - Total number of persons exposed (cohort study)
    - For all individuals (cohort or case-control study)
        - Number and percentage of persons by age group
        - Number and percentage of persons by sex
        - Number and percentage of other demographics collected
    - Number and percentage of ill and not-ill or of cases and controls
    - For ill persons or cases (cohort or case-control study)
        - Number and percentage of each symptom experienced
        - Number of samples collected
        - Number and percentage of positive results
        - Number and percentage of persons hospitalized
        - Number and percentage of medical visits
        - Incubation period (median and range)
        - Recovery period (median and range)
    - Overall attack rates and food-specific attack rates (cohort study)
    - Measures of association
        - Relative risk (cohort study)
        - Odds ratio (case-control study)

    - Any additional results
- Laboratory analysis
    - What were the results of the human samples submitted?
    - What were the results of any food samples tested?
- Environmental assessment
    - What were the results of the investigation or inspection, including any HACCP assessment?
    - What were the results of any food tracebacks, if done?
    - What were potential environmental factors that may have contributed to the outbreak?

The **DISCUSSION** section should make interpretations of all the information collected during the outbreak investigation.

- Taking into account all the information collected, what can be concluded about the outbreak?
- Did the results from the epidemiologic investigation, laboratory analysis, and environmental assessment support the hypotheses generated?
- Were there any important or interesting outcomes or findings?
- What were the strengths and limitations of the study conducted?

The **RECOMMENDATIONS** section should provide educational information to aid others in outbreak investigations.

- What can be learned from this outbreak?
- Were the prevention and control measures implemented successful?
- What measures would prevent future occurrences?

The **ACKNOWLEDGEMENTS** section should recognize personnel who assisted in the outbreak investigation.

The **SUPPORTING DOCUMENTS** section should include any relevant information. Important documentation includes the following:

- Copy of the questionnaire or survey tool used
- Tables, epidemic curves, or maps
- Inspection reports
- Fact sheets of the disease

FOODBORNE ILLNESS AND OUTBREAK INVESTIGATION
KDHE Bureau of Consumer Health

Foodborne illness complaint or any issue with a potential public health risk

↓

Does complaint meet the definition of a foodborne disease outbreak†?

NO ↓

Complete and submit Complaint Report Form and inspection report to the KDHE BCH Topeka Office

YES →

Notify the following:
Supervisor or Contract Manager
KDHE EPI at (877) 427-7317, option '5'
KDHE BCH at (785) 296-5600
Local Health Department

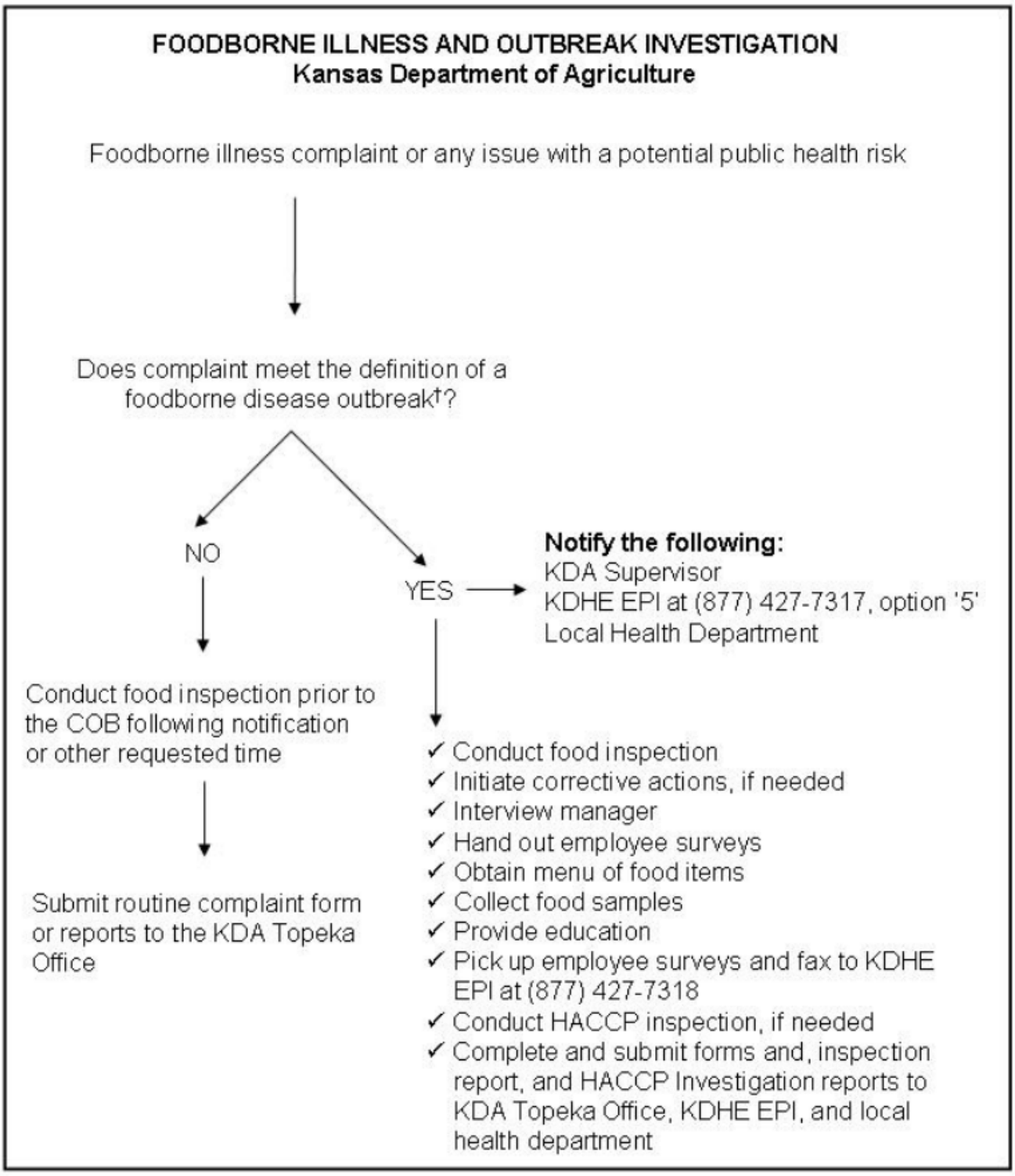
↓

- ✓ Conduct food inspection within 24 hours
- ✓ Initiate corrective actions, if needed
- ✓ Interview manager
- ✓ Hand out employee surveys
- ✓ Obtain menu of food items
- ✓ Collect food samples
- ✓ Provide education
- ✓ Pick up employee surveys and fax to KDHE EPI at (877) 427-7318
- ✓ Conduct HACCP inspection, if needed
- ✓ Complete and submit Complaint Report Form, inspection report, and HACCP Investigation reports to BCH Topeka Office, KDHE EPI, and local health department

† (1) Two or more individuals (from different households) who experience a similar illness after eating a common food or different food from a common place **OR** (2) Two or more foodborne illness complaints from the same facility within a 14-day time period **OR** (3) An unexplained, unexpected increase of a similar illness, and food is a likely source

Revised 03/2008

FOODBORNE ILLNESS AND OUTBREAK INVESTIGATION
Kansas Department of Agriculture



† (1) Two or more individuals (from different households) who experience a similar illness after eating a common food or different food from a common place **OR** (2) Two or more foodborne illness complaints from the same facility within a 14-day time period **OR** (3) An unexplained, unexpected increase of a similar illness, and food is a likely source

Revised 03/2008

COMPLAINT INVESTIGATION REPORT

KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
BUREAU OF CONSUMER HEALTH
FOOD SAFETY & CONSUMER PROTECTION

Establishment Name: _____ Est ID #: _____ Type: _____

Date Received: _____ Received By: _____ Occurrence Date: _____ Occurrence Time: _____

Complainant: s _____ Phone: ( ) _____ Email: _____

Please check **one** major complaint type:

- ☐ 1 Alleged Foodborne Illness / Outbreak (see below)
- ☐ 2 Personal Health / Hygiene
- ☐ 3 Food Source (sound condition; spoilage; approved
- ☐ 4 Labeling / Expiration
- ☐ 5 Food Protection (temperatures)
- ☐ 6 Water / Plumbing Sewage
- ☐ 7 General Sanitation
- ☐ 8 Insect, Rodent, Animal
- ☐ 9 Other

COMPLAINANT'S CONCERN:

Alleged Foodborne Illness:

Symptoms (✔ All that Apply): ☐ Vomiting ☐ Diarrhea ☐ Nausea ☐ Abdominal Cramps ☐ Fever ☐ Other ____

Date of Illness Onset: _____ Time: _____ # Persons Ill: _____ # Persons Served: _____ # Households involved: _____

Doctor Visited?: Hospitalizations?: Stool sample taken?: Food samples available?:

Food/Beverage Eaten: _____

Any other commonalities/meals shared?: **N** If yes, which meal(s): _____

INSPECTOR COMMENTS:

Date Worked: _____ VALID: _____ INVALID: _____ UNDETERMINED: _____

Date Complainant Notified: _____ Via: Letter/email (copy attached)___ Phone___ Other____

ORIGINAL INSPECTION REPORT & COMPLAINT REPORT FORMS TO TOPEKA OFFICE

Foodborne Illnesses (Bacterial)

Etiology	Incubation Period	Signs and Symptoms	Duration of Illness	Associated Foods	Laboratory Testing	Treatment
Bacillus anthracis	2 days to weeks	Nausea, vomiting, malaise, bloody diarrhea, acute abdominal pain.	Weeks	Insufficiently cooked contaminated meat.	Blood.	Penicillin is first choice for naturally acquired gastrointestinal anthrax. Ciprofloxacin is second option.
Bacillus cereus (preformed enterotoxin)	1–6 hrs	Sudden onset of severe nausea and vomiting. Diarrhea may be present.	24 hrs	Improperly refrigerated cooked or fried rice, meats.	Normally a clinical diagnosis. Clinical laboratories do not routinely identify this organism. If indicated, send stool and food specimens to reference laboratory for culture and toxin identification.	Supportive care.
Bacillus cereus (diarrheal toxin)	10–16 hours	Abdominal cramps, watery diarrhea, nausea.	24–48 hours	Meats, stews, gravies, vanilla sauce.	Testing not necessary, self-limiting (consider testing food and stool for toxin in outbreaks).	Supportive care.
Brucella abortus, B. melitensis, and *B. suis*	7–21 days	Fever, chills, sweating, weakness, headache, muscle and joint pain, diarrhea, bloody stools during acute phase.	Weeks	Raw milk, goat cheese made from unpasteurized milk, contaminated meats.	Blood culture and positive serology.	*Acute:* Rifampin and doxycycline daily for ≥6 weeks. Infections with complications require combination therapy with rifampin, tetracycline, and an aminoglycoside.
Campylobacter jejuni	2–5 days	Diarrhea, cramps, fever, and vomiting; diarrhea may be bloody.	2–10 days	Raw and undercooked poultry, unpasturized milk, contaminated water.	Routine stool culture; *Campylobacter* requires special media and incubation at 42°C to grow.	Supportive care. For severe cases, antibiotics such as erythromycin and quinolones may be indicated early in the diarrheal disease. Guillain-Barré syndrome can be a sequela.
Clostridium botulinum—children and adults (preformed toxin)	12–72 hrs	Vomiting, diarrhea, blurred vision, diplopia, dysphagia, and descending muscle weakness.	Variable (from days to months). Can be complicated by respiratory failure and death.	Home-canned foods with a low acid content, improperly canned commercial foods, home-canned or fermented fish, herb-infused oils, baked potatoes in aluminium foil, cheese sauce, bottled garlic, foods held warm for extended periods of time (eg, in a warm oven).	Stool, serum, and food can be tested for toxin. Stool and food can also be cultured for the organism. These tests can be performed at some state health department laboratories and CDC.	Supportive care. Botulinum antitoxin is helpful if given early in the course of the illness. Contact the state health department. The 24-hour number for state health departments to call is (770) 488-7100.
Clostridium botulinum—infants	3–30 days	In infants <12 months, lethargy, weakness, poor feeding, constipation, hypotonia, poor head control, poor gag and sucking reflex.	Variable	Honey, home-canned vegetables and fruits, corn syrup.	Stool, serum, and food can be tested for toxin. Stool and food can also be cultured for the organism. These tests can be performed at some state health department laboratories and CDC.	Supportive care. Botulism immune globulin can be obtained from the Infant Botulism Prevention Program, Health and Human Services, California (510-540-2646). Botulinum antitoxin is generally not recommended for infants.
Clostridium perfringens toxin	8–16 hrs	Watery diarrhea, nausea, abdominal cramps; fever is rare.	24–48 hrs	Meats, poultry, gravy, dried or precooked foods, time- and/or temperature-abused food.	Stools can be tested for enterotoxin and cultured for organism. Because *Clostridium perfringens* can normally be found in stool, quantitative cultures must be done.	Supportive care. Antibiotics not indicated.
Enterohemorrhagic *E. coli* (EHEC) including *E. coli* O157:H7 and other Shiga toxin-producing *E. coli* (STEC)	1–8 days	Severe diarrhea that is often bloody, abdominal pain and vomiting. Usually, little or no fever is present. More common in children <4 years.	5–10 days	Undercooked beef especially hamburger, unpasteurized milk and juice, raw fruits and vegetables (eg. sprouts), salami (rarely), and contaminated water.	Stool culture; *E. coli* O157:H7 requires special media to grow. If *E. coli* O157:H7 is suspected, specific testing must be requested. Shiga toxin testing may be done using commercial kits; positive isolates should be forwarded to public health laboratories for confirmation and serotyping.	Supportive care, monitor renal function, hemoglobin, and platelets closely. *E. coli* O157:H7 infection is also associated with hemolytic uremic syndrome (HUS), which can cause lifelong complications. Studies indicate that antibiotics may promote the development of HUS.

Foodborne Illnesses (Bacterial) (*Continued*)

Etiology	Incubation Period	Signs and Symptoms	Duration of Illness	Associated Foods	Laboratory Testing	Treatment
Enterotoxigenic *E. coli* (ETEC)	1–3 days	Watery diarrhea, abdominal cramps, some vomiting.	3 to >7 days	Water or food contaminated with human feces.	Stool culture. ETEC requires special laboratory techniques for identification. If suspected, must request specific testing.	Supportive care. Antibiotics are rarely needed except in severe cases. Recommended antibiotics include TMP-SMX and quinolones.
Listeria monocytogenes	9–48 hrs for gastrointestinal symptoms, 2–6 weeks for invasive disease	Fever, muscle aches, and nausea or diarrhea. Pregnant women may have mild flu-like illness, and infection can lead to premature delivery or stillbirth. Elderly or immunocompromised patients may have bacteremia or meningitis.	Variable	Fresh soft cheeses, unpasteurized milk, inadequately pasteurized milk, ready-to-eat deli meats, hot dogs.	Blood or cerebrospinal fluid cultures. Asymptomatic fecal carriage occurs; therefore, stool culture usually not helpful. Antibody to listerolysin O may be helpful to identify outbreak retrospectively.	Supportive care and antibiotics; Intravenous ampicillin, penicillin, or TMP-SMX are recommended for invasive disease.
	At birth and infancy	Infants infected from mother at risk for sepsis or meningitis.				
Salmonella spp.	1–3 days	Diarrhea, fever, abdominal cramps, vomiting. *S.* Typhi and *S.* Paratyphi produce typhoid with insidious onset characterized by fever, headache, constipation, malaise, chills, and myalgia; diarrhea is uncommon, and vomiting is not usually severe.	4–7 days	Contaminated eggs, poultry, unpasteurized milk or juice, cheese, contaminated raw fruits and vegetables (alfalfa sprouts, melons). *S.* Typhi epidemics are often related to fecal contamination of water supplies or street-vended foods.	Routine stool cultures.	Supportive care. Other than for *S.* Typhi and *S.* Paratyphi, antibiotics are not indicated unless there is extra-intestinal spread, or the risk of extra-intestinal spread, of the infection. Consider ampicillin, gentamicin, TMP-SMX, or quinolones if indicated. A vaccine exists for *S.* Typhi.
Shigella spp.	24–48 hrs	Abdominal cramps, fever, and diarrhea. Stools may contain blood and mucus.	4–7 days	Food or water contaminated with human fecal material. Usually person-to-person spread, fecal–oral transmission. Ready-to-eat foods touched by infected food workers, eg, raw vegetables, salads, sandwiches.	Routine stool cultures.	Supportive care. TMP-SMX recommended in the US if organism is susceptible; nalidixic acid or other quinolones may be indicated if organism is resistant, especially in developing countries.
Staphylococcus aureus (preformed enterotoxin)	1–6 hrs	Sudden onset of severe nausea and vomiting. Abdominal cramps. Diarrhea and fever may be present.	24–48 hrs	Unrefrigerated or improperly refrigerated meats, potato and egg salads, cream pastries.	Normally a clinical diagnosis. Stool, vomitus, and food can be tested for toxin and cultured if indicated.	Supportive care.
Vibrio cholerae (toxin)	24–72 hrs	Profuse watery diarrhea and vomiting, which can lead to severe dehydration and death within hours.	3–7 days. Causes life-threatening dehydration.	Contaminated water, fish, shellfish, street-vended food typically from Latin America or Asia.	Stool culture; *Vibrio cholerae* requires special media to grow. If *V. cholerae* is suspected, must request specific testing.	Supportive care with aggressive oral and intravenous rehydration. In cases of confirmed cholera, tetracycline or doxycycline is recommended for adults, and TMP-SMX for children (<8 years).
Vibrio parahaemolyticus	2–48 hrs	Watery diarrhea, abdominal cramps, nausea, vomiting.	2–5 days	Undercooked or raw seafood, such as fish, shellfish.	Stool cultures. *Vibrio parahaemolyticus* requires special media to grow. If *V. parahaemolyticus* is suspected, must request specific testing.	Supportive care. Antibiotics are recommended in severe cases: tetracycline, doxycycline, gentamicin, and cefotaxime.
Vibrio vulnificus	1–7 days	Vomiting, diarrhea, abdominal pain, bacteremia, and wound infections. More common in the immunocompromised, or in patients with chronic liver disease (presenting with bullous skin lesions). Can be fatal in patients with liver disease and the immunocompromised.	2–8 days	Undercooked or raw shellfish, especially oysters, other contaminated seafood, and open wounds exposed to sea water.	Stool, wound, or blood cultures. *Vibrio vulnificus* requires special media to grow. If *V. vulnificus* is suspected, must request specific testing.	Supportive care and antibiotics; tetracycline, doxycycline, and ceftazidime are recommended.

Foodborne Illnesses (Bacterial) (*Continued*)

Etiology	Incubation Period	Signs and Symptoms	Duration of Illness	Associated Foods	Laboratory Testing	Treatment
Yersinia enterocolytica and *Y. pseudotuberculosis*	24–48 hrs	Appendicitis-like symptoms (diarrhea and vomiting, fever, and abdominal pain) occur primarily in older children and young adults. May have a scarlitiniform rash with *Y. pseudotuberculosis*.	1–3 weeks, usually self-limiting	Undercooked pork, unpasteurized milk, tofu, contaminated water. Infection has occurred in infants whose caregivers handled chitterlings.	Stool, vomitus, or blood culture. *Yersinia* requires special media to grow. If suspected, must request specific testing. Serology is available in research and reference laboratories.	Supportive care. If septicemia or other invasive disease occurs, antibiotic therapy with gentamicin or cefotaxime (doxycycline and ciprofloxacin also effective).

Foodborne Illnesses (Viral)

Etiology	Incubation Period	Signs and Symptoms	Duration of Illness	Associated Foods	Laboratory Testing	Treatment
Hepatitis A	28 days average (15–50 days)	Diarrhea, dark urine, jaundice, and flu-like symptoms, i.e., fever, headache, nausea, and abdominal pain.	Variable, 2 weeks – 3 months	Shellfish harvested from contaminated waters, raw produce, contaminated drinking water, uncooked foods and cooked foods that are not reheated after contact with infected food handler.	Increase in ALT, bilirubin. Positive IgM and anti-hepatitis A antibodies.	Supportive care. Prevention with immunization.
Noroviruses (and other caliciviruses)	12–48 hrs	Nausea, vomiting, abdominal cramping, diarrhea, fever, myalgia, and some headache. Diarrhea is more prevalent in adults and vomiting is more prevalent in children.	12–60 hrs	Shellfish, fecally contaminated foods, ready-to-eat foods touched by infected food workers (salads, sandwiches, ice, cookies, fruit).	Routine RT-PCR and EM on fresh unpreserved stool samples. Clinical diagnosis, negative bacterial cultures. Stool is negative for WBCs.	Supportive care such as rehydration. Good hygiene.
Rotavirus	1–3 days	Vomiting, watery diarrhea, low-grade fever. Temporary lactose intolerance may occur. Infants and children, elderly, and immunocompromised are especially vulnerable.	4–8 days	Fecally contaminated foods. Ready-to-eat foods touched by infected food workers (salads, fruits).	Identification of virus in stool via immunoassay.	Supportive care. Severe diarrhea may require fluid and electrolyte replacement.
Other viral agents (astroviruses, adenoviruses, parvoviruses)	10–70 hrs	Nausea, vomiting, diarrhea, malaise, abdominal pain, headache, fever.	2–9 days	Fecally contaminated foods. Ready-to-eat foods touched by infected food workers. Some shellfish.	Identification of the virus in early acute stool samples. Serology. Commercial ELISA kits are now available for adenoviruses and astroviruses.	Supportive care, usually mild, self-limiting. Good hygiene.

Foodborne Illnesses (Parasitic)

Etiology	Incubation Period	Signs and Symptoms	Duration of Illness	Associated Foods	Laboratory Testing	Treatment
Angiostrongylus cantonensis	1 week to ≥1 month	Severe headaches, nausea, vomiting, neck stiffness, paresthesias, hyperesthesias, seizures, and other neurologic abnormalities.	Several weeks to several months	Raw or undercooked intermediate hosts (eg, snails or slugs), infected paratenic (transport) hosts (eg, crabs, fresh water shrimp), fresh produce contaminated with intermediate or transport hosts.	Examination of CSF for elevated pressure, protein, leukocytes, and eosinophils; serologic testing using ELISA to detect antibodies to *Angiostrongylus cantonensis*.	Supportive care. Repeat lumbar punctures and use of corticosteroid therapy may be used for more severely ill patients.
Cryptosporidium	2–10 days	Diarrhea (usually watery), stomach cramps, upset stomach, slight fever.	May be remitting and relapsing over weeks to months	Any uncooked food or food contaminated by an ill food handler after cooking, drinking water.	Request specific examination of the stool for *Cryptosporidium*. May need to examine water or food.	Supportive care, self-limited. If severe consider paromomycin for 7 days. For children aged 1–11 years, consider nitazoxanide for 3 days.
Cyclospora cayetanensis	1–14 days, usually at least 1 week	Diarrhea (usually watery), loss of appetite, substantial loss of weight, stomach cramps, nausea, vomiting, fatigue.	May be remitting and relapsing over weeks to months	Various types of fresh produce (imported berries, lettuce).	Request specific examination of the stool for *Cyclospora*. May need to examine water or food.	TMP-SMX for 7 days.

Foodborne Illnesses (Parasitic) (*Continued*)

Etiology	Incubation Period	Signs and Symptoms	Duration of Illness	Associated Foods	Laboratory Testing	Treatment
Entamoeba histolytica	2–3 days to 1–4 weeks	Diarrhea (often bloody), frequent bowel movements, lower abdominal pain.	May be protracted (several weeks to several months)	Any uncooked food or food contaminated by an ill food handler after cooking, drinking water.	Examination of stool for cysts and parasites—may need at least 3 samples. Serology for long-term infections.	Metronidazole and a luminal agent (iodoquinol or paromomycin).
Giardia lamblia	1–2 weeks	Diarrhea, stomach cramps, gas.	Days to weeks	Any uncooked food or food contaminated by an ill food handler after cooking, drinking water.	Examination of stool for ova and parasites — may need at least 3 samples.	Metronidazole.
Toxoplasma gondii	5–23 days	Generally asymptomatic, 20% may develop cervical lymphadenopathy and/or a flu-like illness. In immunocompromised patients: central nervous system (CNS) disease, myocarditis, or pneumonitis is often seen.	Months	Accidental ingestion of contaminated substances (eg, soil contaminated with cat feces on fruits and vegetables), raw or partly cooked meat (especially pork, lamb, or venison).	Isolation of parasites from blood or other body fluids; observation of parasites in patient specimens via microscopy or histology. Detection of organisms is rare; serology (reference laboratory needed) can be a useful adjunct in diagnosing toxoplasmosis. However, IgM antibodies may persist for 6–18 months and thus may not necessarily indicate recent infection. PCR of bodily fluids. For congenital infection: isolation of *T. gondii* from placenta, umbilical cord, or infant blood. PCR of white blood cells, CSF, or amniotic fluid, or IgM and IgA serology, performed by a reference laboratory.	Asymptomatic healthy, but infected, persons do not require treatment. Spiramycin or pyrimethamine plus sulfadiazine may be used for pregnant women. Pyrimethamine plus sulfadiazine may be used for immunocompromised persons, in specific cases. Pyrimethamine plus sulfadiazine (with or without steroids) may be given for ocular disease when indicated. Folinic acid is given with pyrimethamine plus sulfadiazine to counteract bone marrow suppression.
Toxoplasma gondii (congenital infection)	In infants at birth	Treatment of the mother may reduce severity and/or incidence of congenital infection. Most infected infants have few symptoms at birth. Later, they will generally develop signs of congenital toxoplasmosis (mental retardation, severely impaired eyesight, cerebral palsy, seizures), unless the infection is treated.	Months	Passed from mother (who acquired acute infection during pregnancy) to child.		
Trichinella spiralis	1–2 days for initial symptoms; others begin 2–8 weeks after infection	Acute: nausea, diarrhea, vomiting, fatigue, fever, abdominal discomfort followed by muscle soreness, weakness, and occasional cardiac and neurologic complications.	Months	Raw or undercooked contaminated meat, usually pork or wild game meat (eg, bear or moose).	Positive serology or demonstration of larvae via muscle biopsy. Increase in eosinophils.	Supportive care plus mebendazole or albendazole.

Foodborne Illnesses (Noninfectious)

Etiology	Incubation Period	Signs and Symptoms	Duration of Illness	Associated Foods	Laboratory Testing	Treatment
Antimony	5 min – 8 hrs. usually <1 hr	Vomiting, metallic taste.	Usually self-limited	Metallic container.	Identification of metal in beverage or food.	Supportive care.
Arsenic	Few hrs	Vomiting, colic, diarrhea.	Several days	Contaminated food.	Urine. May cause eosinophilia.	Gastric lavage, BAL (dimercaprol).
Cadmium	5 min – 8 hrs. usually <1 hr	Nausea, vomiting, myalgia, increase in salivation, stomach pain.	Usually self-limited	Seafood, oysters, clams, lobster, grains, peanuts.	Identification of metal in food.	Supportive care.
Ciguatera fish poisoning (ciguatera toxin)	2–6 hrs 3 hrs 2–5 days	GI: abdominal pain, nausea, vomiting, diarrhea. Neurologic: paresthesias, reversal of hot or cold, pain, weakness. Cardiovascular: bradycardia, hypotension, increase in T wave abnormalities.	Days to weeks to months	A variety of large reef fish. Grouper, red snapper, amberjack, and barracuda (most common).	Radioassay for toxin in fish or a consistent history.	Supportive care, IV mannitol. Children more vulnerable.
Copper	5 min – 8 hrs. usually <1 hr	Nausea, vomiting, blue or green vomitus.	Usually self-limited	Metallic container.	Identification of metal in beverage or food.	Supportive care.
Mercury	1 week or longer	Numbness, weakness of legs, spastic paralysis, impaired vision, blindness, coma. Pregnant women and the developing fetus are especially vulnerable.	May be protracted	Fish exposed to organic mercury, grains treated with mercury fungicides.	Analysis of blood, hair.	Supportive care.
Mushroom toxins, short-acting (muscinol, muscarine, psilocybin, coprius artemetaris, ibotenic acid)	<2 hrs	Vomiting, diarrhea, confusion, visual disturbance, salivation, diaphoresis, hallucinations, disulfiram-like reaction, confusion, visual disturbance.	Self-limited	Wild mushrooms (cooking may not destroy these toxins).	Typical syndrome and mushroom identified or demonstration of the toxin.	Supportive care.
Mushroom toxin, long-acting (amanitin)	4–8 hrs diarrhea; 24–48 hrs liver failure	Diarrhea, abdominal cramps, leading to hepatic and renal failure.	Often fatal	Mushrooms.	Typical syndrome and mushroom identified and/or demonstration of the toxin.	Supportive care, life-threatening, may need life support.
Nitrite poisoning	1–2 hrs	Nausea, vomiting, cyanosis, headache, dizziness, weakness, loss of consciousness, chocolate-brown colored blood.	Usually self-limited	Cured meats, any contaminated foods, spinach exposed to excessive nitrification.	Analysis of the food, blood.	Supportive care, methylene blue.
Pesticides (organophosphates or carbamates)	Few min to few hrs	Nausea, vomiting, abdominal cramps, diarrhea, headache, nervousness, blurred vision, twitching, convulsions, salivation and meiosis.	Usually self-limited	Any contaminated food.	Analysis of the food, blood.	Atropine; 2-PAM (Pralidoxime) is used when atropine is not able to control symptoms and is rarely necessary in carbamate poisoning.
Puffer fish (tetrodotoxin)	<30 min	Parasthesias, vomiting, diarrhea, abdominal pain, ascending paralysis, respiratory failure.	Death usually in 4–6 hours	Puffer fish.	Detection of tetrodotoxin in fish.	Life-threatening, may need respiratory support.
Scombroid (histamine)	1 min – 3 hrs	Flushing, rash, burning sensation of skin, mouth and throat, dizziness, urticaria, parasthesias.	3–6 hrs	Fish: bluefin, tuna, skipjack, mackerel, marlin, escolar, and mahi mahi.	Demonstration of histamine in food or clinical diagnosis.	Supportive care, antihistamines.

Foodborne Illnesses (Noninfectious) (*Continued*)

Etiology	Incubation Period	Signs and Symptoms	Duration of Illness	Associated Foods	Laboratory Testing	Treatment
Shellfish toxins (diarrheic, neurotoxic, amnesic)	Diarrheic shellfish poisoning (DSP) — 30 min to 2 hrs	Nausea, vomiting, diarrhea, and abdominal pain accompanied by chills, headache, and fever.	Hrs to 2–3 days	A variety of shellfish, primarily mussels, oysters, scallops, and shellfish from the Florida coast and the Gulf of Mexico.	Detection of the toxin in shellfish; high-pressure liquid chromatography.	Supportive care, generally self-limiting. Elderly are especially sensitive to ASP.
	Neurotoxic shellfish poisoning (NSP) — few min to hours	Tingling and numbness of lips, tongue, and throat, muscular aches, dizziness, reversal of the sensations of hot and cold, diarrhea, and vomiting.				
	Amnesic shellfish poisoning (ASP) — 24–48 hrs	Vomiting, diarrhea, abdominal pain and neurologic problems such as confusion, memory loss, disorientation, seizure, coma.				
Shellfish toxins (paralytic shellfish poisoning)	30 min – 3 hrs	Diarrhea, nausea, vomiting leading to parasthesias of mouth, lips, weakness, dysphasia, dysphonia, respiratory paralysis.	Days	Scallops, mussels, clams, cockles.	Detection of toxin in food or water where fish are located; high-pressure liquid chromatography.	Life-threatening, may need respiratory support.
Sodium fluoride	Few min to 2 hrs	Salty or soapy taste, numbness of mouth, vomiting, diarrhea, dilated pupils, spasms, pallor, shock, collapse.	Usually self-limited	Dry foods (eg, dry milk, flour, baking powder, cake mixes) contaminated with sodium fluoride–containing insecticides and rodenticides.	Testing of vomitus or gastric washings. Analysis of the food.	Supportive care.
Thallium	Few hrs	Nausea, vomiting, diarrhea, painful parathesias, motor polyneuropathy, hair loss.	Several days	Contaminated food.	Urine, hair.	Supportive care.
Tin	5 min – 8 hrs. usually <1 hr	Nausea, vomiting, diarrhea.	Usually self-limited	Metallic container.	Analysis of the food.	Supportive care.
Vomitoxin	Few min to 3 hrs	Nausea, headache, abdominal pain, vomiting.	Usually self-limited	Grains such as wheat, corn, barley.	Analysis of the food.	Supportive care.
Zinc	Few hrs	Stomach cramps, nausea, vomiting, diarrhea, myalgias.	Usually self-limited	Metallic container.	Analysis of the food, blood and feces, saliva or urine.	Supportive care.