

## Introduction

Many enteric pathogens are reportable in West Virginia as per the WV Reportable Disease Rule, 64 CSR 7. Cases of these reportable conditions are investigated by local health department staff and reported to the Division of Infectious Disease Epidemiology and subsequently the Centers for Disease Control and Prevention (CDC) via the West Virginia Electronic Disease Surveillance System (WVEDSS).

For this report the top 4 most commonly reported enteric pathogens (Campylobacteriosis, Giardiasis, Salmonellosis and Shiga toxin-producing *E. coli*) were selected for analysis and presented in alphabetical order.

## Methods

Cases were ascertained according to the CDC National Notifiable Disease Surveillance System (NNDSS) case definitions in effect for 2014 as proposed by the Council of State and Territorial Epidemiologists (CSTE).

Data was extracted from WVEDSS, then analyzed with and summarized using Microsoft Excel. Data included case information for all cases of the 4 selected pathogens reported from 2011 through 2014. The date the case investigation is created in WVEDSS is used to determine year of report.

## Campylobacteriosis

Campylobacteriosis is caused by the gram negative bacterium *Campylobacter*. It is characterized by acute onset of diarrhea, vomiting, abdominal pain, fever and malaise. Symptoms generally occur within 2-5 days of infection. Campylobacteriosis has recently become the most common bacterial enteric infection reported in West Virginia. It is of worldwide epidemiologic importance due to the fecal-oral route of infection and the extensive reservoir of the organism in both wild and domestic animals. Many cases are thought to result from eating raw or undercooked meat (in particular, poultry) or through cross-contamination of uncooked or ready-to-eat foods.

In 2014, West Virginia's rate of 14.6 cases per 100,000 people was 1.7 times the 2020 national health objective of 8.5 per 100,000. Although the cause of this increased incidence in West Virginia is not entirely known, much of the increase is due to the new availability of rapid diagnostic tests for *Campylobacter* in clinical laboratories. Children under 5 years of age have the highest rates of illness (Figure 3). Infections occur year-round, with peak incidence in the summer months (Figure 2).

Campylobacteriosis was not made a nationally notifiable condition until 2015, however, U.S. estimates of disease are available from the FoodNet program (an active surveillance system in some areas of the country for selected enteric diseases). FoodNet data indicated that in 2013, campylobacteriosis incidence was about 14 cases per 100,000 people, an increase of 13% compared to 2006-2008. Campylobacteriosis has been reportable for many years in West Virginia, and this significant increase is also seen here, as the incidence of cases has more than doubled between 2011 and 2014 (Figure 1). This steady increase in reporting of campylobacteriosis, coincides with increased use of culture-independent diagnostic tests (CIDT) for enteric bacteria among clinical laboratories. The inclusion of positive CIDT results in the case definition for reporting of cases was implemented in 2013. Cases that are confirmed by bacterial culture are delineated as confirmed cases and those that have only been tested by CIDT are delineated as suspect.

Most illnesses are sporadic, but outbreaks may be associated with undercooked meat (often chicken), unpasteurized milk, direct contact with animals or untreated water. West Virginia had one reported campylobacteriosis outbreak in 2014 which was caused by consumption of unpasteurized milk from an out of state dairy farm. Although the distribution of unpasteurized milk is prohibited in West Virginia, it is allowed in our surrounding states and often cases report buying or obtaining raw milk in these neighboring states. The most frequently reported risk factors among West Virginia cases in 2014 were contact with poultry and consumption of untreated water, both at 11% of cases, and exposure to recreational water at 10% of cases (Table 1).

Figure 1

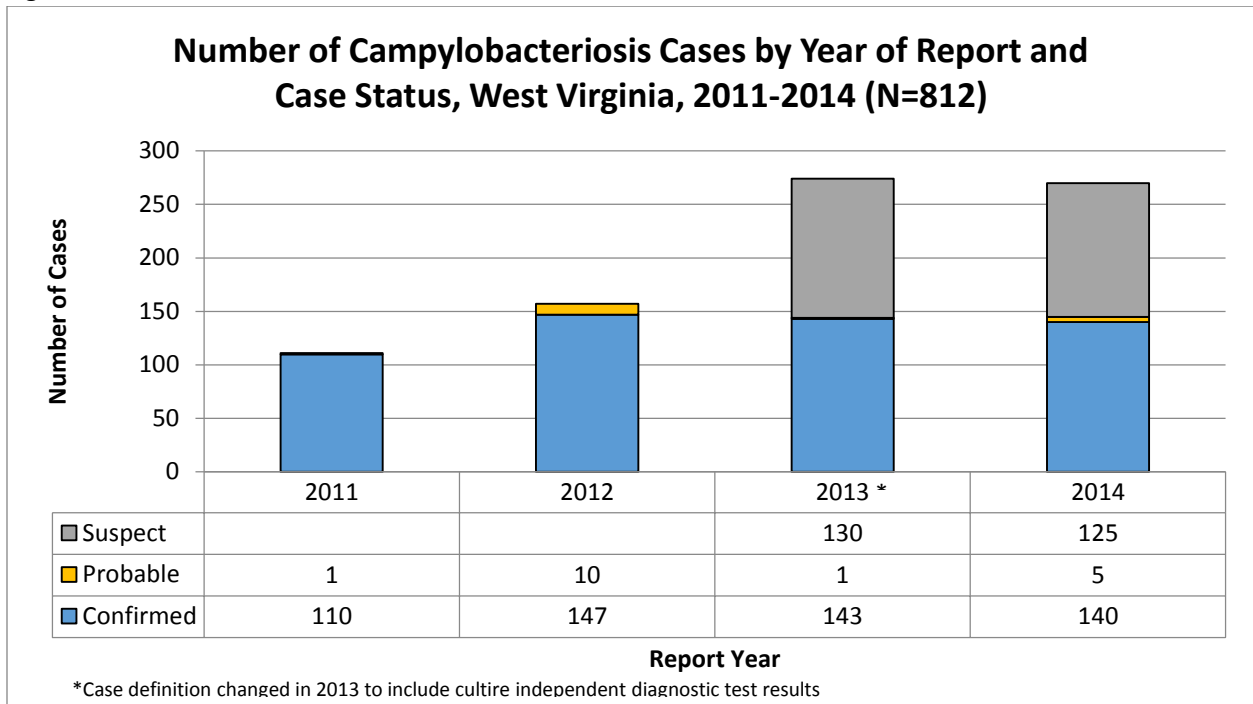


Figure 2

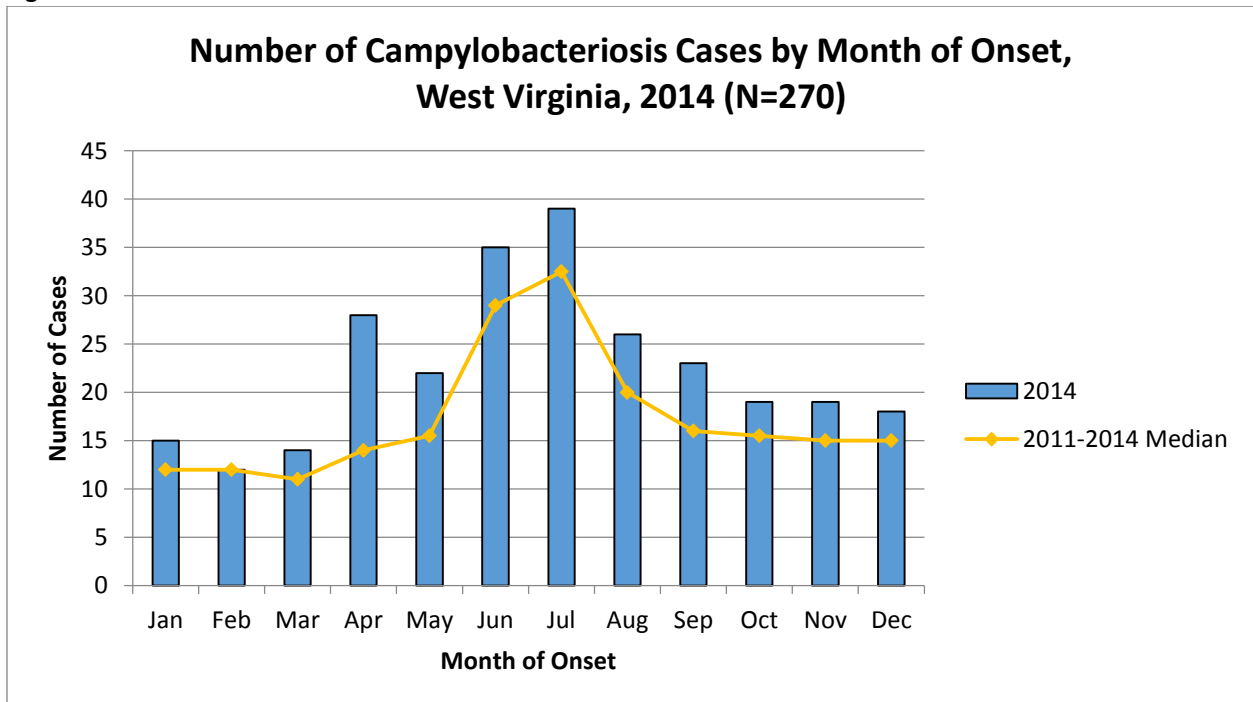


Figure 3

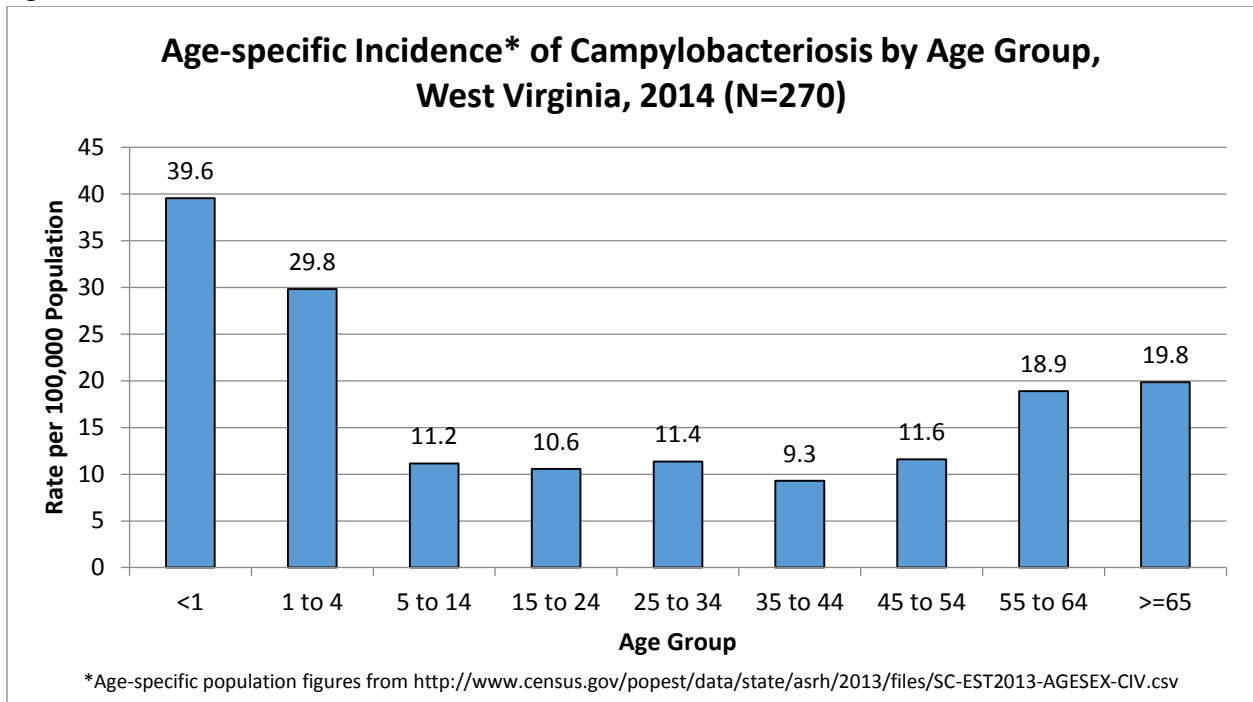
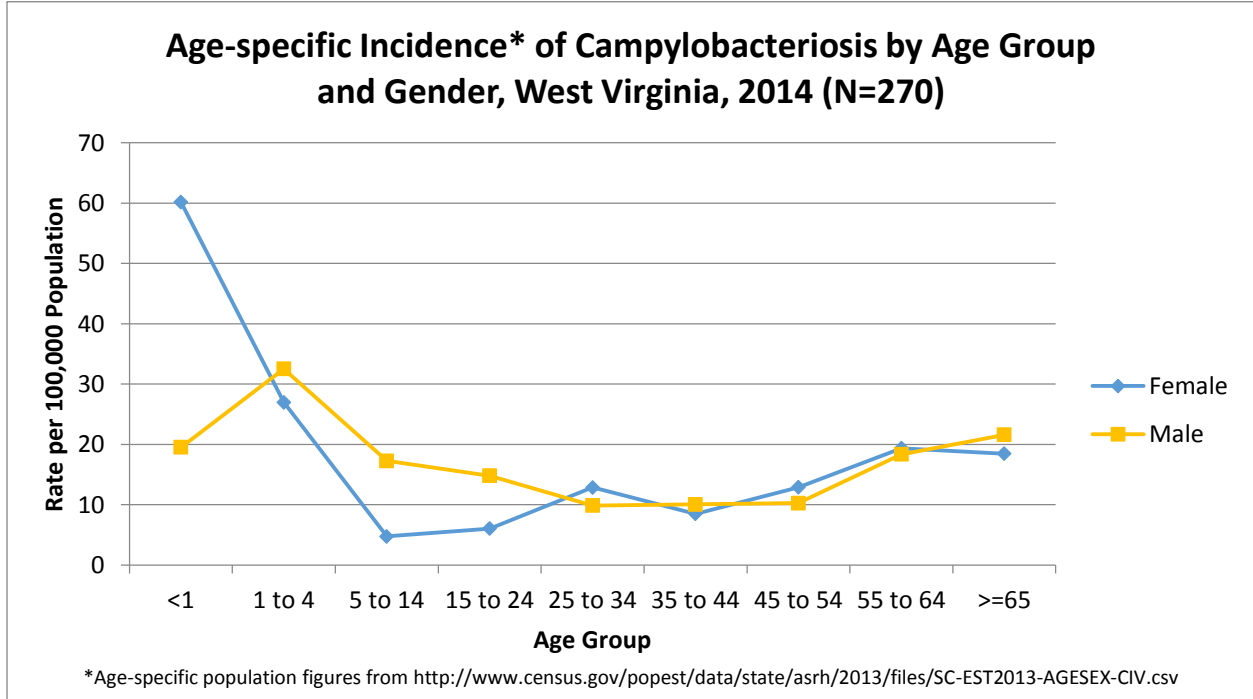
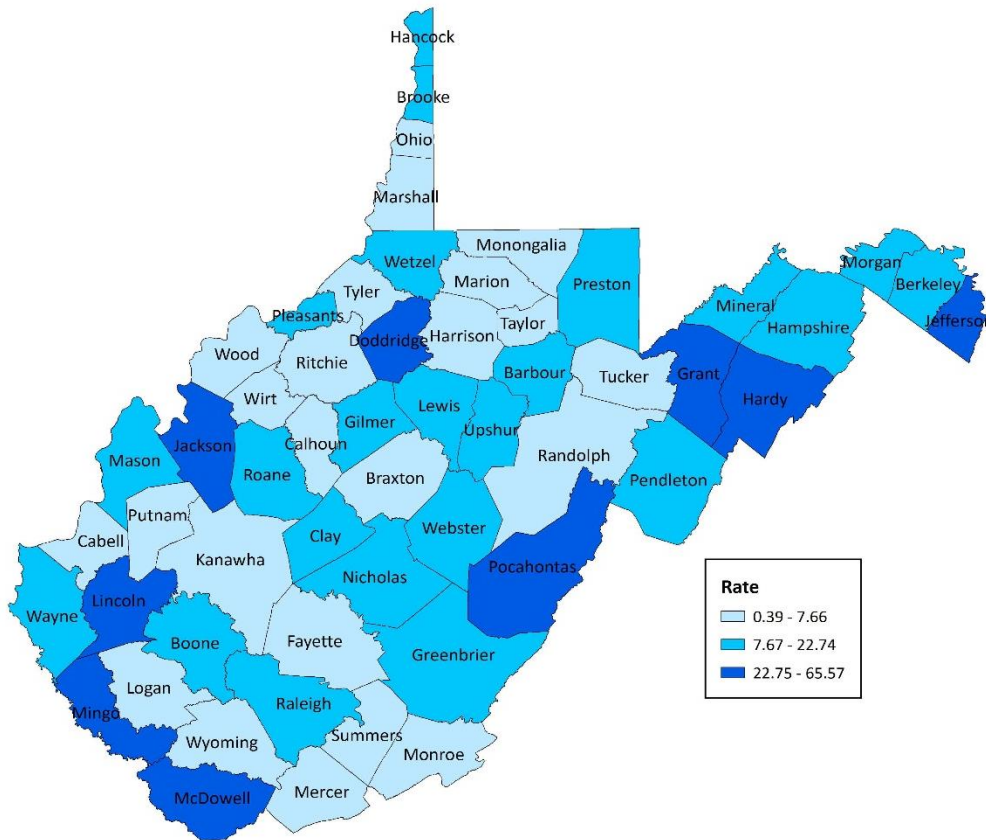


Figure 4



**Figure 5**

Average Annual County Specific Incidence\* of Campylobacteriosis per 100,000 population, West Virginia, Reported 2011-2014



\*Age-specific population figures from <http://www.census.gov/popest/data/state/asrh/2013/files/SC-EST2013-AGESEX-CIV.csv>

**Table 1**

Exposure/Risk Factor	Number of Cases	Percentage of Cases
Poultry Contact	31	11%
Consuming untreated water	29	11%
Recreational Water	28	10%
Consuming Raw Milk*	9	3%
Consuming Undercooked Poultry	7	3%

\*The sale or distribution of raw milk is currently prohibited in West Virginia.

**Campylobacteriosis Prevention:**

- Do not drink raw milk and do not eat foods that have unpasteurized milk in them.
- Wash hands with soap and warm water before preparing food and after using the bathroom.
- Thoroughly wash hands after direct contact with live poultry or contact with animal feces.
- Do not consume untreated water.
- Cook all products of animal origin, especially poultry products thoroughly and prevent cross contamination in the kitchen.

## Giardiasis

*Giardia intestinalis*, the flagellated protozoan also known as *G. lamblia*, or *G. duodenalis*, is the most commonly identified parasitic pathogen in the United States. Hunters and campers (from drinking unfiltered, untreated water), persons drinking from shallow wells, and travelers to disease-endemic areas are most at risk. Due to person-to-person transmission, children in daycare, their close contacts and men who have sex with men are also at increased risk. *Giardia* cysts can be excreted in the stool intermittently for weeks or months, resulting in a protracted period of communicability. Transmission occurs when as few as 10 cysts are ingested through person-to-person or animal-to-person contact, or by ingesting fecally contaminated water or food. Because many human cases follow person-to-person transmission, identification and treatment of giardiasis as well as management of their contacts should prevent further spread of infection. The most common reported risk factors for West Virginia's cases in 2014 are listed in Table 2.

Most *Giardia* infections occur without symptoms. When symptomatic, patients report chronic diarrhea, abdominal cramps, bloating, frequent loose and pale, greasy stools, fatigue, and weight loss.

In 2014, the reported incidence of giardiasis in West Virginia was 3.6 cases per 100,000 population. This is below the most recent U.S. rate which was 5.8 cases per 100,000 persons in 2012. During 2014, all of the cases were reported as sporadic; no outbreaks were reported. Children less than 5 years of age have the highest incidence, with 6 cases per 100,000 population (Figure 8). Rates of infection tend to be higher in the summer months with transmission related to outdoor activities in or near untreated water, however there was an unexplained, atypical high number of cases in December of 2014 (Figure 7).

Figure 6

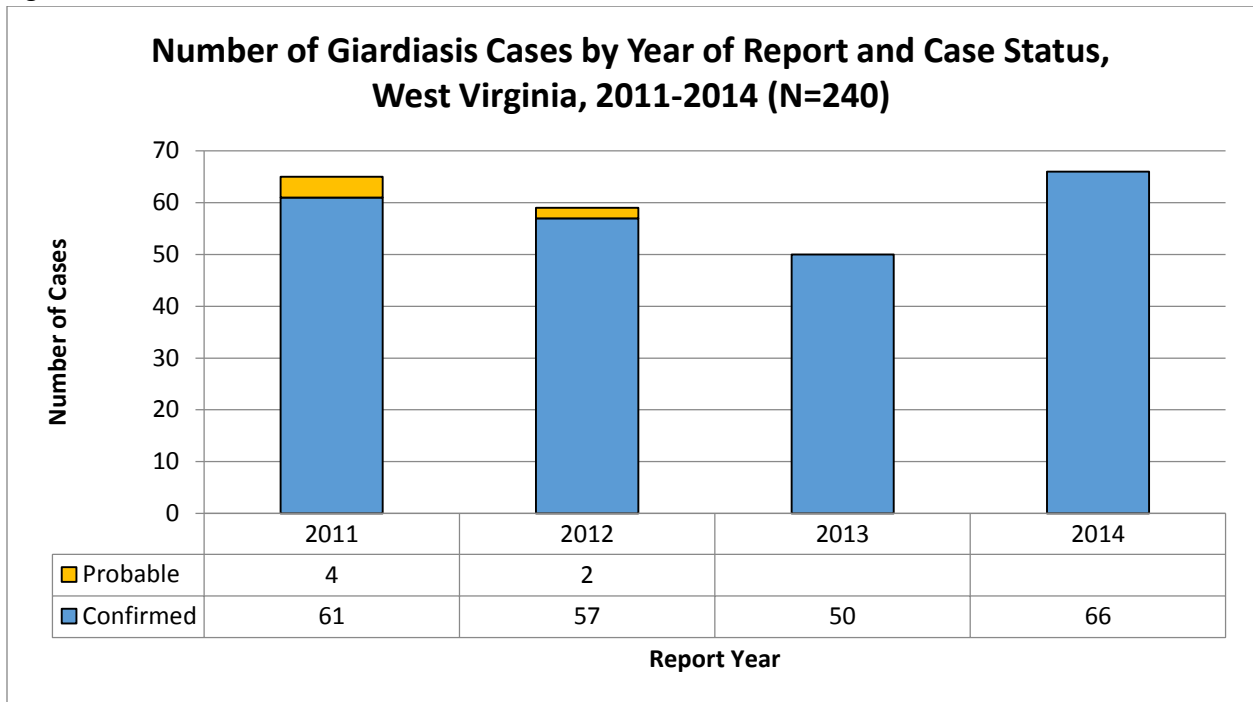


Figure 7

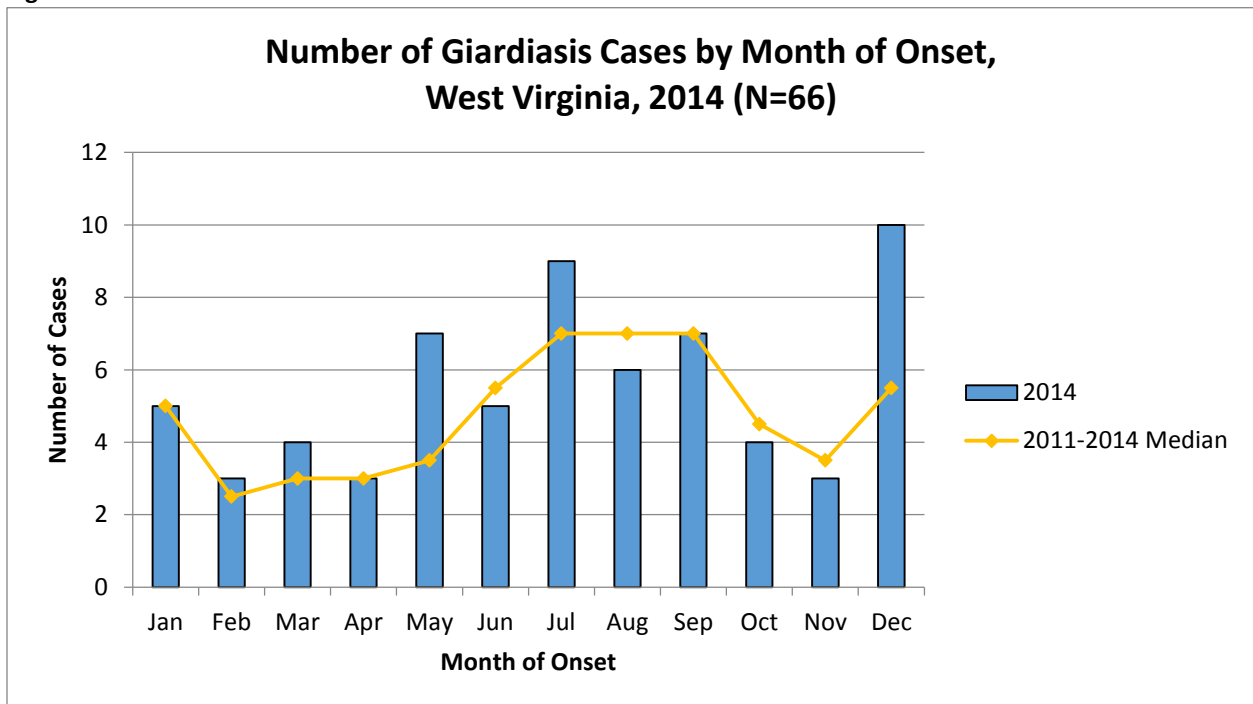




Figure 8

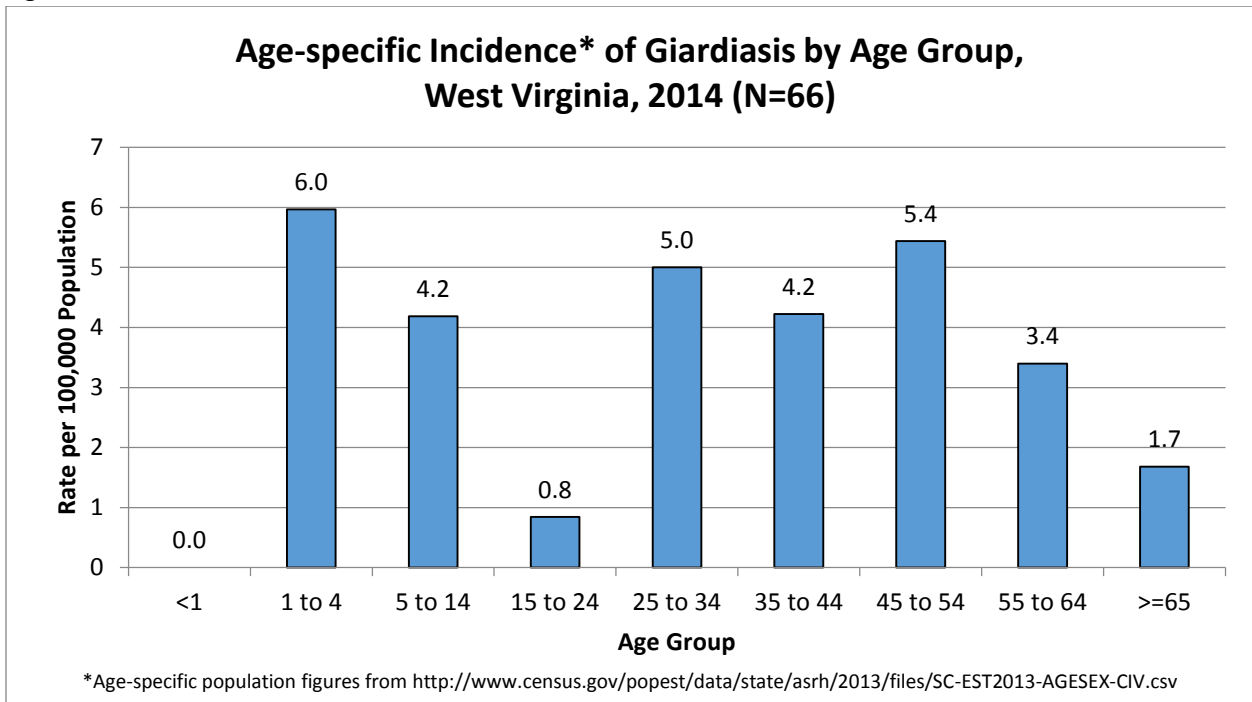


Figure 9

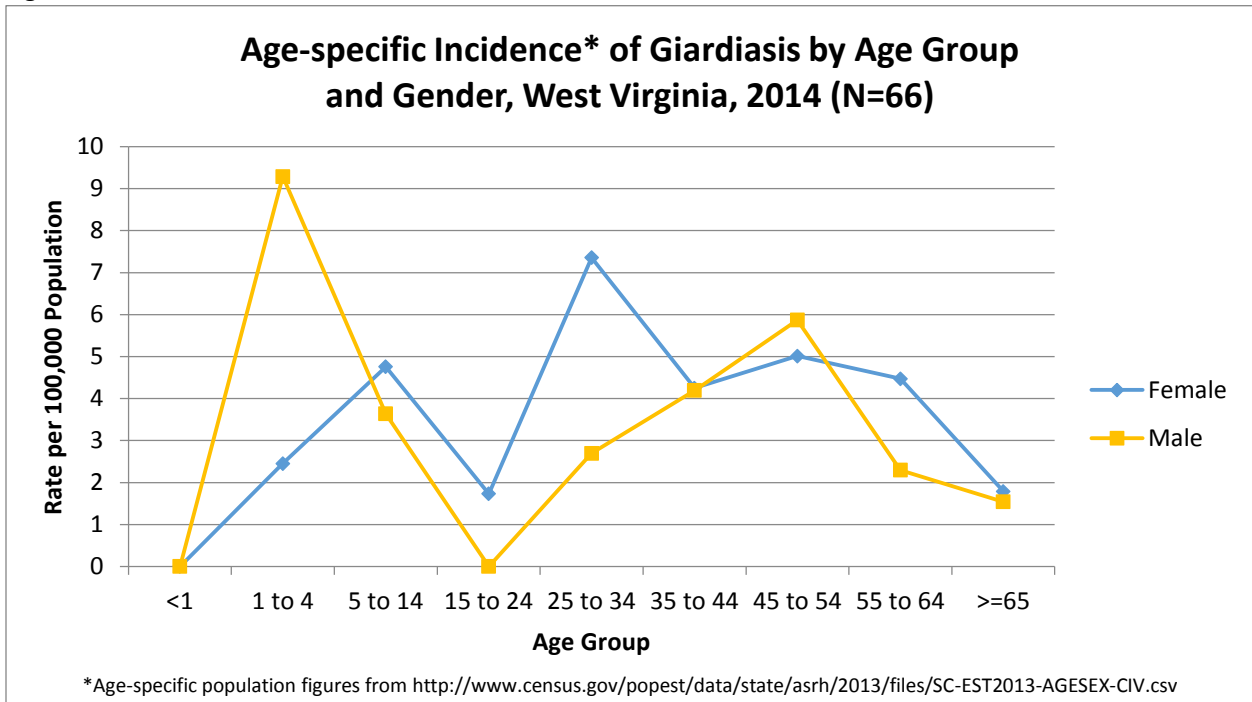
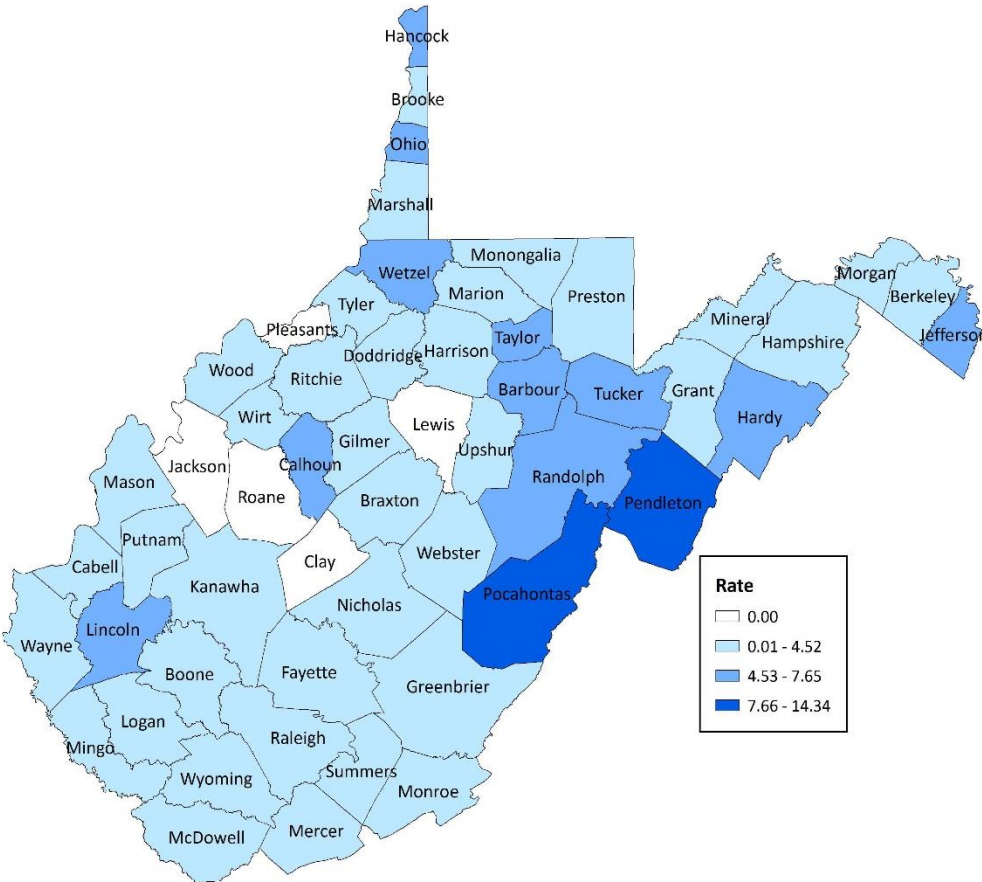


Figure 10

Average Annual County Specific Incidence\* of Giardiasis per 100,000 population, West Virginia, Reported 2011-2014



\*Age-specific population figures from <http://www.census.gov/popest/data/state/asrh/2013/files/SC-EST2013-AGESEX-CIV.csv>

Table 2

Exposure/Risk Factor	Number of Cases	Percentage of Cases
Pet Exposure	43	63%
Consuming Untreated Water	19	28%
Recreational Water	16	24%
Out of State Travel	16	24%
Contact with a Daycare Attendee	4	6%

Giardiasis Prevention:

- Do not drink untreated surface water.
- Wash hands with soap carefully and frequently, especially before preparing food and after going to the bathroom, after changing diapers, or after touching livestock. Supervise hand washing of toddlers and small children after they use the toilet.
- Do not work or attend daycare, serve or prepare food, or work in health care while ill with diarrhea.
- Refrain from recreational water activities (pools, hot tubs, splash pads) for 2 weeks after symptoms from a bout of giardiasis subside.

## Salmonellosis

Salmonellosis is a bacterial illness characterized by acute abdominal pain, diarrhea, and often fever, which usually begins 12 to 36 hours after exposure. Excretion of *Salmonella* may persist for several days or even months beyond the acute phase of illness. Antibiotics are not needed by most patients (the exceptions being those at high risk of invasive infection), and may increase the duration of excretion.

A wide range of domestic and wild animals are carriers of *Salmonella*, including poultry, swine, cattle, rodents, reptiles, dogs and cats. Ingestion of contaminated food, most often of animal origin, is the predominant mode of transmission. Raw or undercooked foods of animal origin – such as eggs, milk, meat and poultry – have been implicated as common sources in salmonellosis outbreaks, along with produce and other processed food items. In recent years, numerous large outbreaks have also been linked to contact with high-risk animals including live poultry in backyard flocks, reptiles (especially small turtles) and amphibians. Person-to-person transmission of salmonellosis is well documented, although it is not as common as with *Escherichia coli* O157 infection. The incidence of reported infection is highest among children <1 year of age (Figure 13). The most commonly reported risk factors for West Virginia cases in 2014 are found in Table 3.

Of approximately 2500 known serotypes, only about 200 are detected in the United States in any given year. In West Virginia, *S. Typhimurium* and *S. Enteritidis* have historically been the two most commonly reported serotypes, comprising 34% and 19% of lab-confirmed isolates in 2014, respectively. An outbreak of *S. Newport* and *S. Infantis* infections associated with live poultry (chicks and ducklings) caused those serotypes to be ranked 3<sup>rd</sup> and 4<sup>th</sup> in 2014.

In 2014, 180 salmonellosis cases were reported in West Virginia, down slightly from 2012 and 2013 which had 219 and 194 cases reported respectively (Figure 11). One large outbreak with 18 cases in West Virginia was linked to a multi-state outbreak of human *Salmonella* Newport and Infantis infections linked to live poultry.

Figure 11

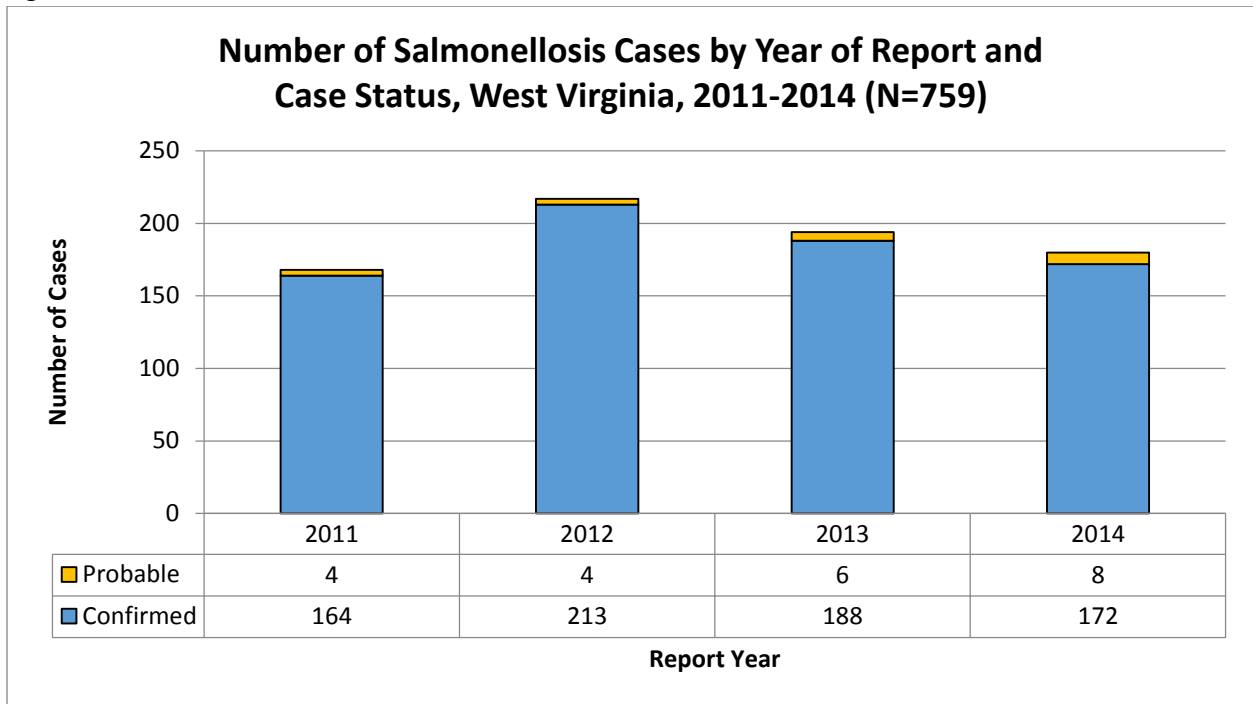


Figure 12

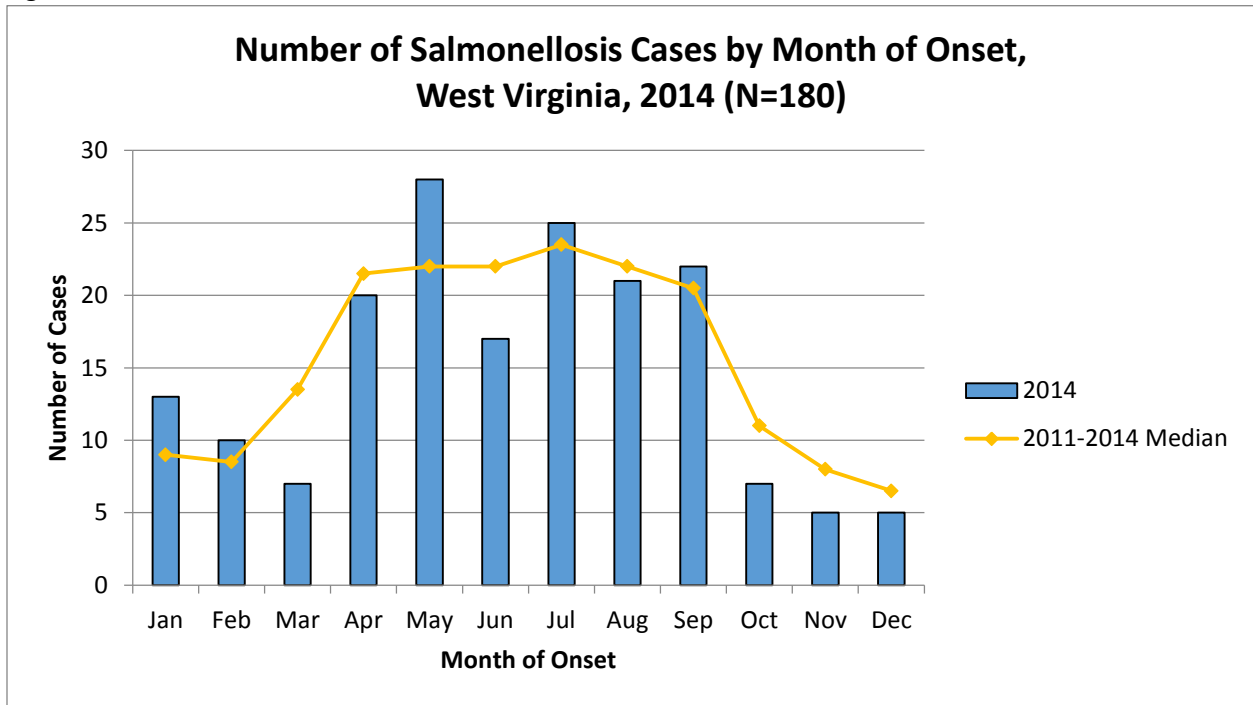


Figure 13

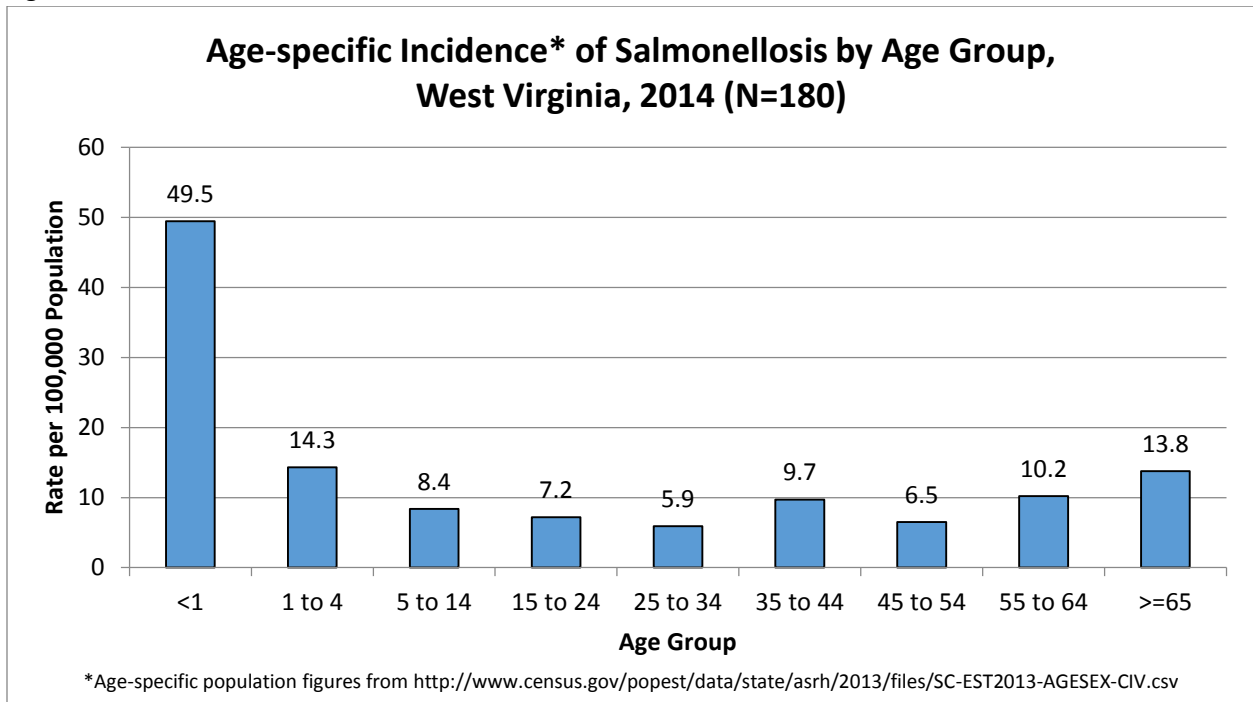


Figure 14

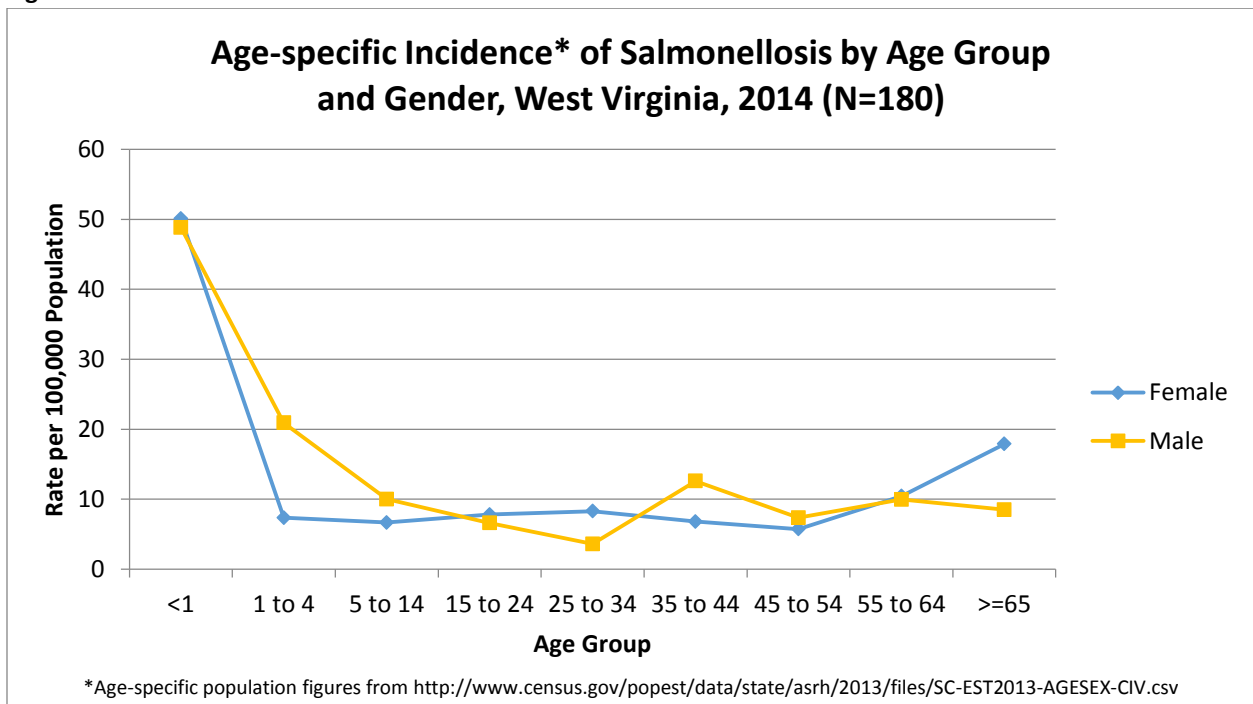
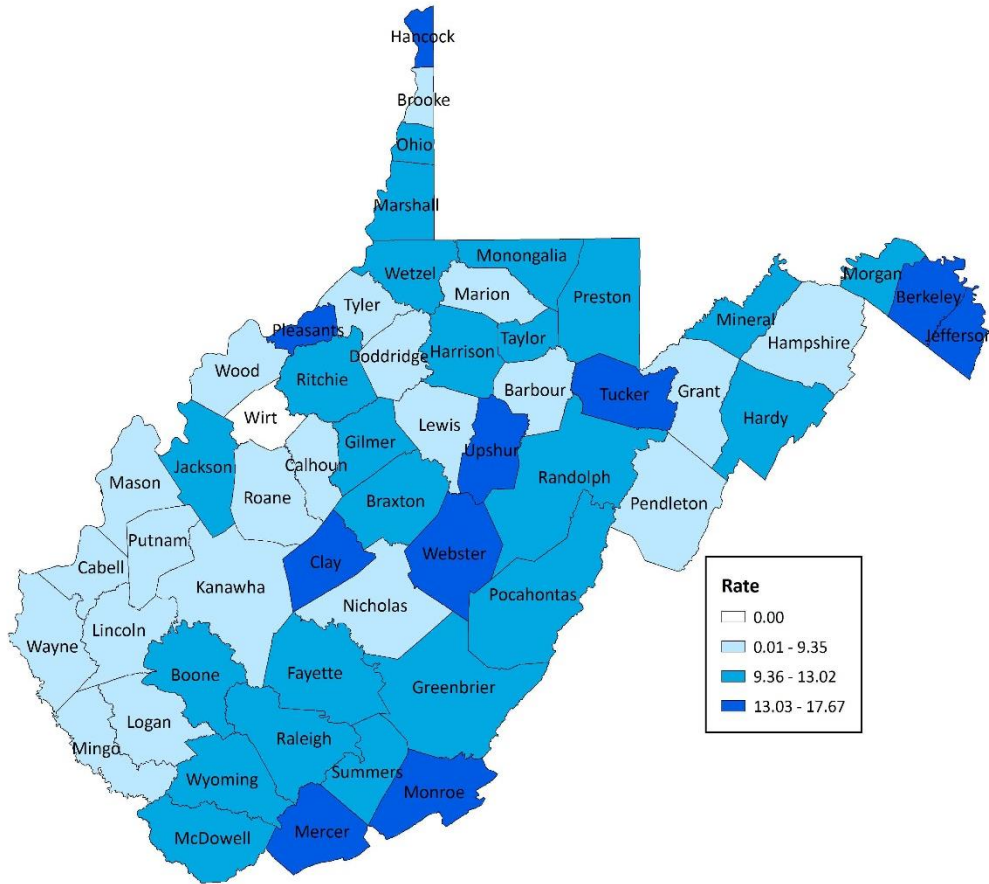


Figure 15

Average Annual County Specific Incidence\* of Salmonellosis per 100,000 population, West Virginia, Reported 2011-2014



\*Age-specific population figures from <http://www.census.gov/popest/data/state/asrh/2013/files/SC-EST2013-AGESEX-CIV.csv>

Table 3

Exposure/Risk Factor	Number of Cases	Percentage of Cases
Consuming Raw Fruits/Vegetables	74	41%
Animal Exposure	47	26%
Consuming Fresh Shell Eggs	28	16%
Consuming Undercooked Poultry	3	2%

**Salmonellosis Prevention:**

- Wash hands with soap and warm water before preparing food and after using the bathroom.
- Wash hands with soap and warm water after handling reptiles, birds, or baby chicks, and after contact with pet feces.
- Cook poultry, ground beef and eggs thoroughly.
- Do not eat or drink foods containing raw eggs, or raw (unpasteurized) milk.
- Avoid direct or even indirect contact between reptiles (turtles, iguanas, other lizards, snakes) and infants or immunocompromised persons.



## Shiga toxin-producing *Escherichia coli* (STEC) infections including *E.coli* O157

Shiga toxin-producing *E. coli*, the most notorious being *E. coli* O157, are one of the most dreaded causes of infectious gastroenteritis. Bloody diarrhea is a hallmark of this pathogen, but the real danger is post-diarrheal hemolytic uremic syndrome (HUS). Spread by the fecal-oral route STEC has a number of animal reservoirs, the most important of which are ruminants: cattle, goats, sheep, deer, etc. Transmission often occurs from consumption of contaminated food or water, as well as direct person-to-person spread and environmental exposures. Mid-to-late summer is the peak season for STEC infections. The most commonly reported risk factors for West Virginia's cases in 2014 are found in Table 4.

The increasing use of diagnostic kits that identify STEC (not just *E.coli* O157) has illuminated the significant role that other STEC play in human illness. In the U.S. O26, O45, O103, O111, O121, and O145 are the most common "other" serogroups of *E.coli*, making up about half of the reported cases. O157 infections are much more likely to result in HUS than is infection by other STEC serogroups. Since 2010 the number of STEC positive specimens received at the WV Office of Laboratory Services for serotyping has illustrated the large increase in non O157 serogroups with nearly double the number of non O157 isolates and O157 (28-O157 isolates versus 47- non O157).

More labs are testing for the presence of Shiga toxin rather than just testing for O157. Unfortunately, at the same time, many labs are dropping culture-based methods, leaving clinicians (and epidemiologists) in the dark as to the specifics of the etiologic agent, and putting more of the diagnostic burden on the public health reference lab.

Over the past 4 years, the number of cases reported statewide has ranged from 13 to 36 annually (Figure 16). Cases that are confirmed by bacterial culture are delineated as confirmed cases and those that have only been tested for the presence of shiga toxin are delineated as suspect. There were no STEC outbreaks investigated in 2014.

Figure 16

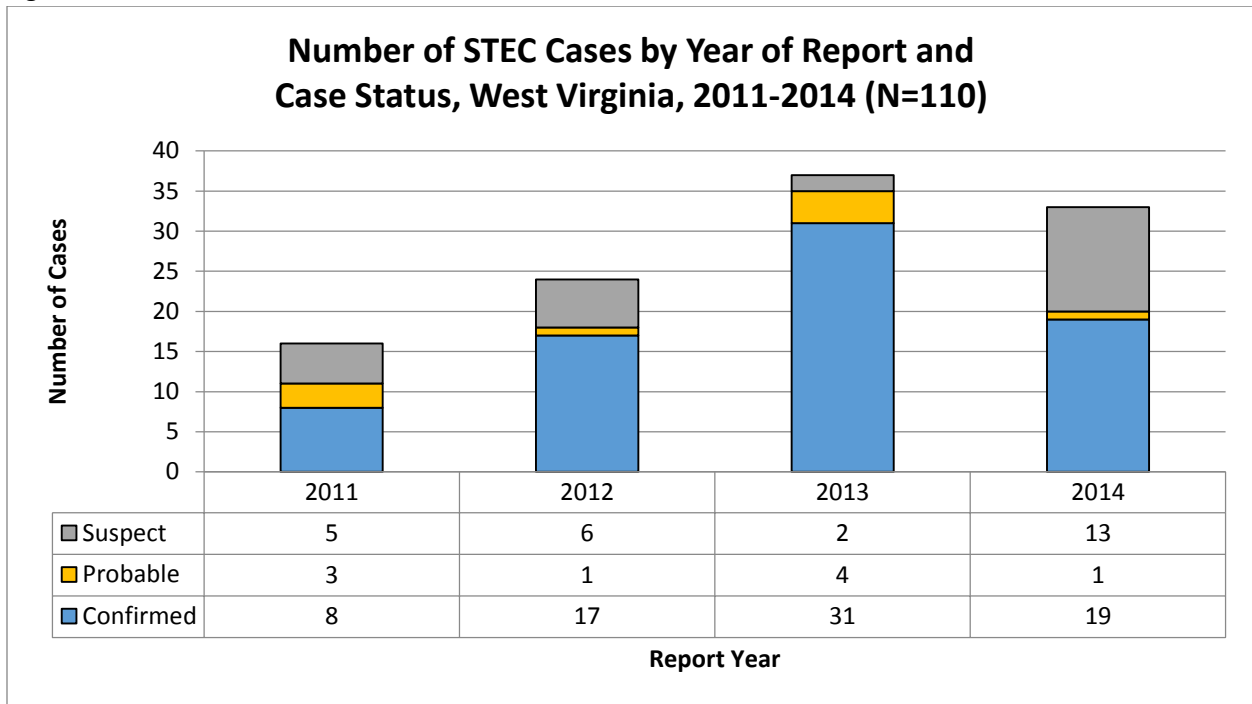


Figure 17

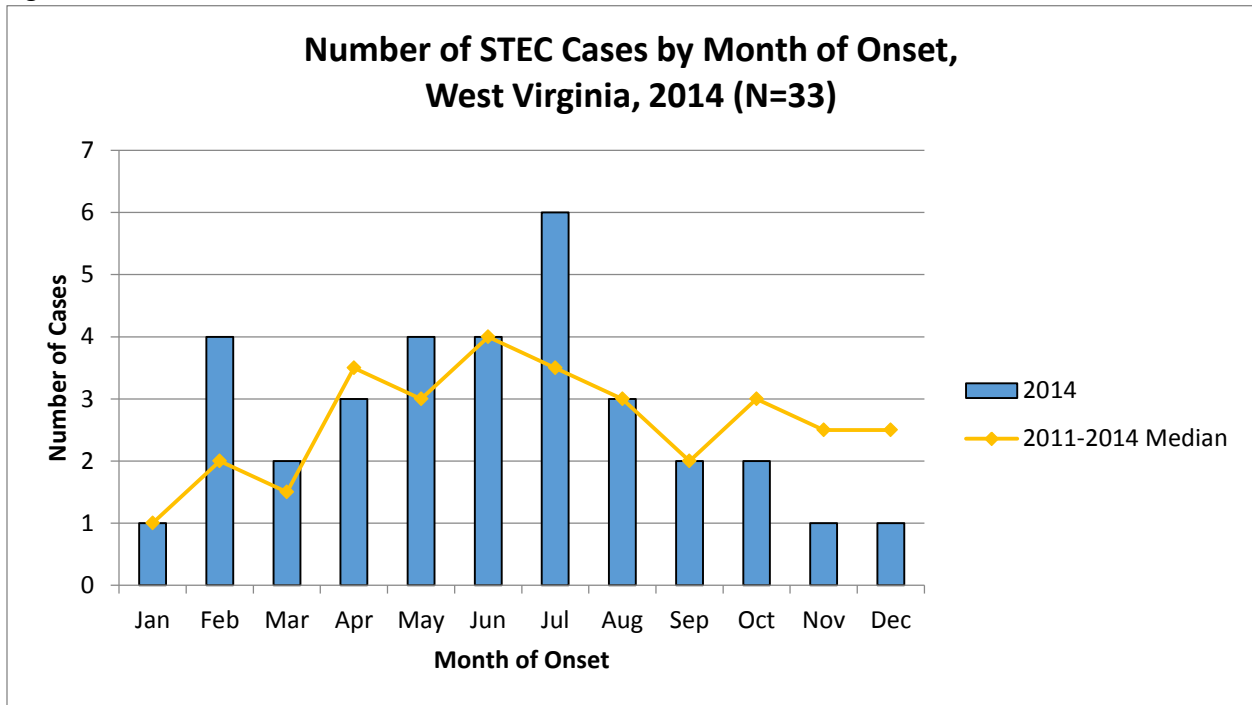


Figure 18

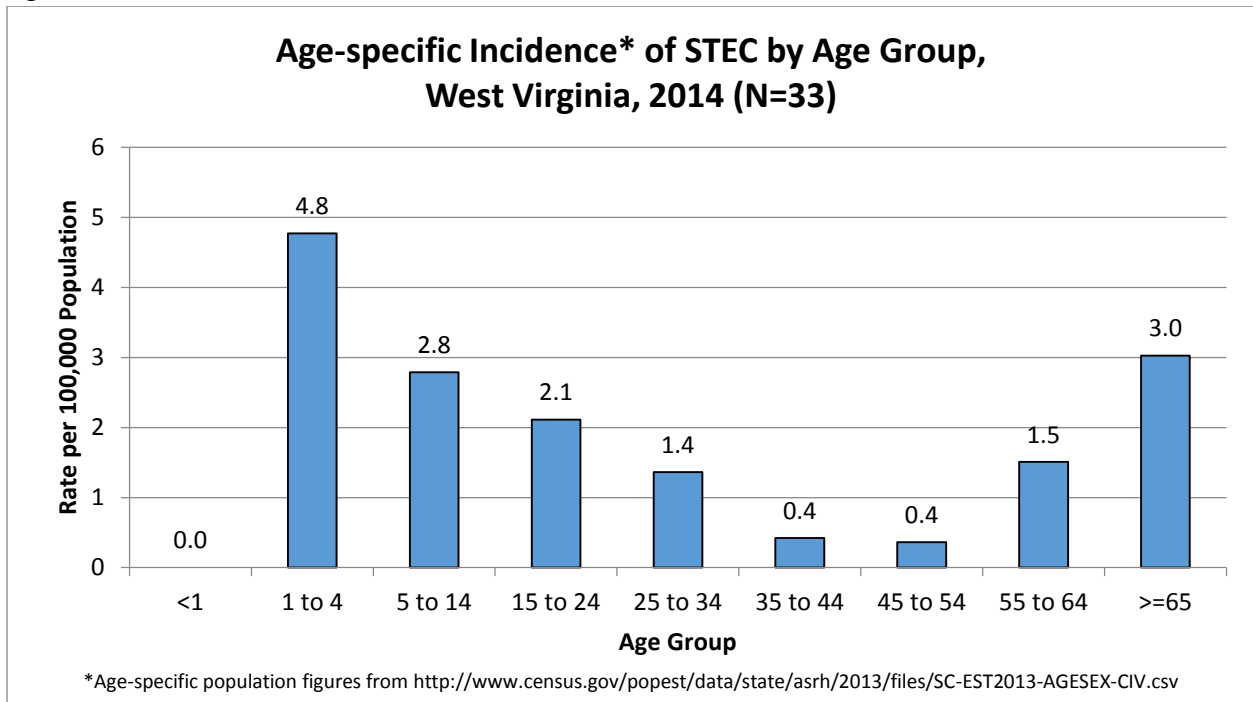
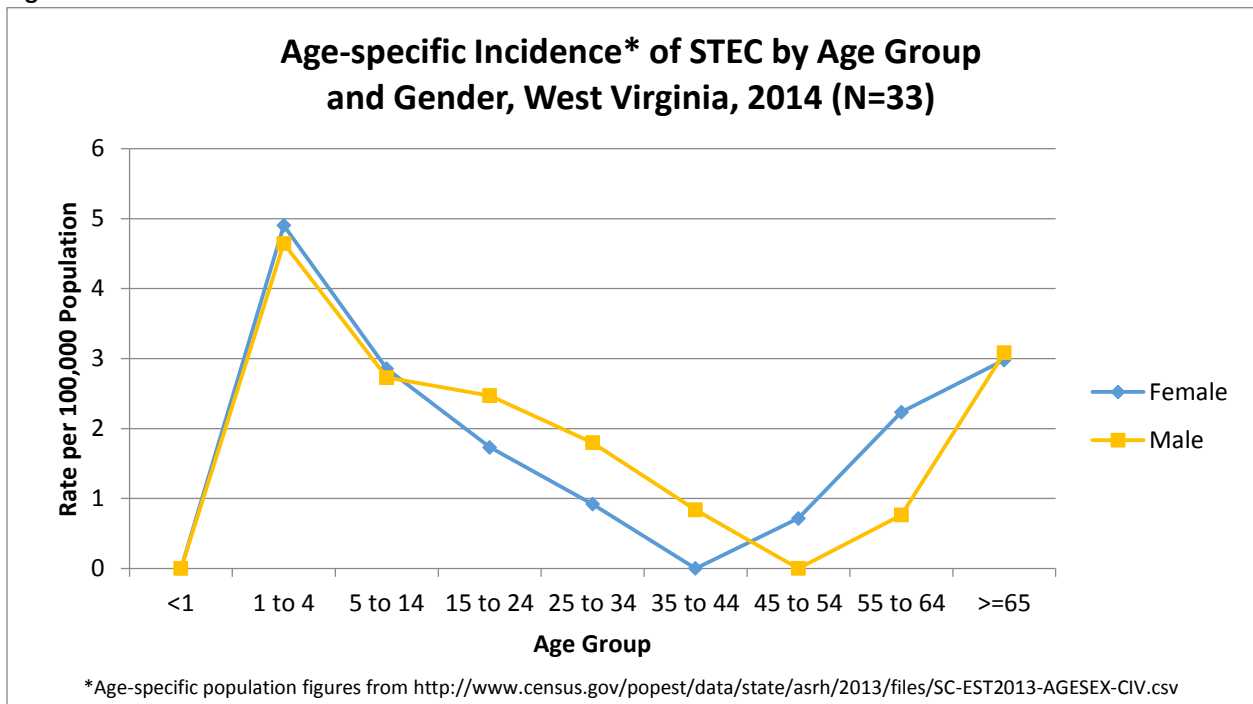
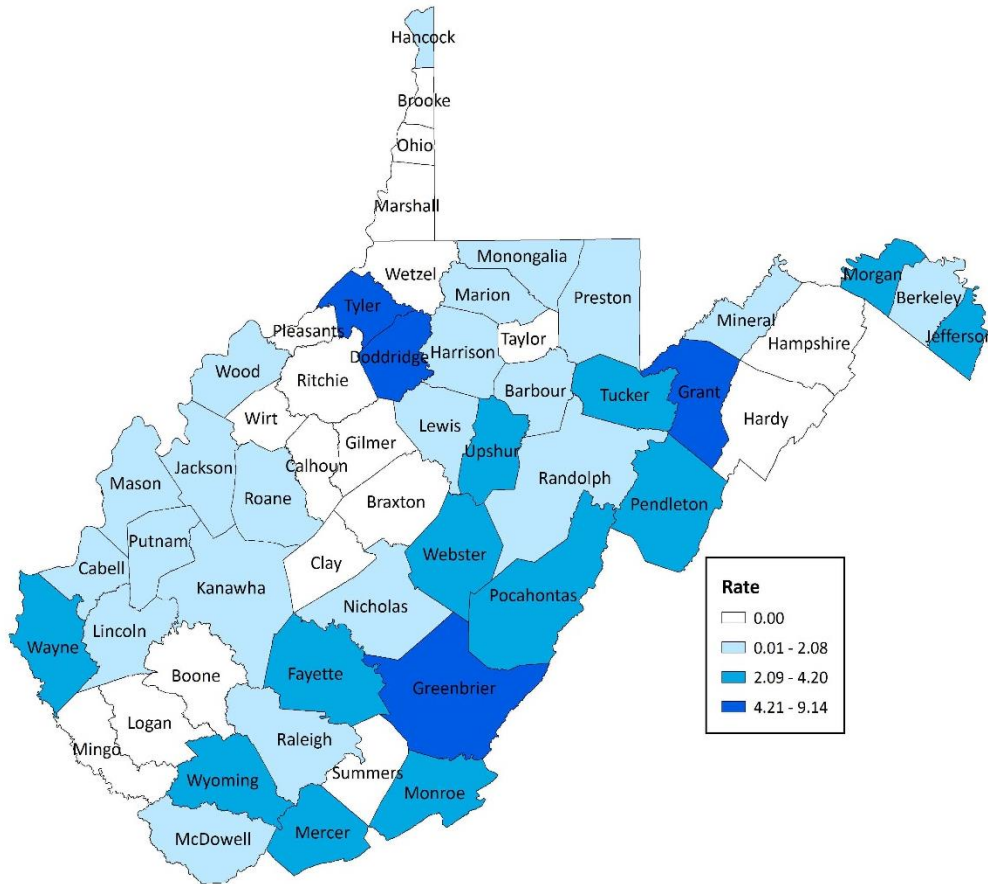


Figure 19



**Figure 20**

Average Annual County Specific Incidence\* of STEC per 100,000 population, West Virginia, Reported 2011-2014



\*Age-specific population figures from <http://www.census.gov/popest/data/state/asrh/2013/files/SC-EST2013-AGESEX-CIV.csv>

**Table 4**

Exposure/Risk Factor	Number of Cases	Percentage of Cases
Consuming Raw Fruits/Vegetables	16	47%
Contact with Manure	7	21%
Visited a Zoo or Petting Zoo	4	12%
Consuming Untreated Water	3	9%
Works with Animals	2	6%
Consuming Raw Milk*	0	0%

\*The sale or distribution of raw milk is currently prohibited in West Virginia.

### STEC Prevention

- Wash hands with soap carefully and frequently, especially before preparing food and after going to the bathroom, after changing diapers, or after touching livestock. Supervise hand washing of toddlers and small children after they use the toilet.
- Do not work or attend daycare, serve or prepare food, or work in healthcare while ill with diarrhea.
- Cook all products of animal origin, especially ground beef products thoroughly and prevent cross contamination in the kitchen.
- Do not drink raw milk and do not eat foods that have unpasteurized milk in them