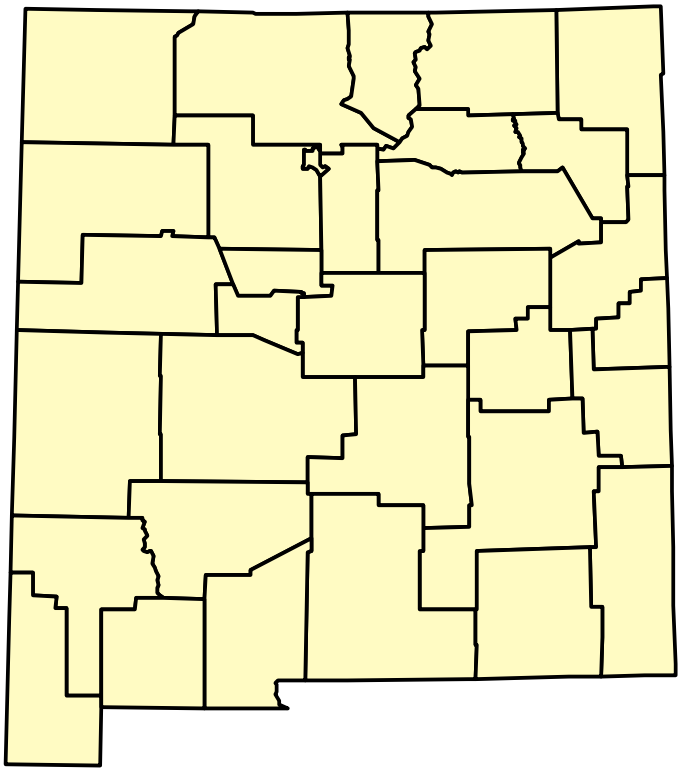
New Mexico
Waterborne Disease Surveillance Project
Annual Report
2002



Prepared by Karen Johnson
Environmental Health Epidemiology Unit
JPA # 00/667/JPA/012
July 2003

NEW MEXICO WATERBORNE DISEASE SURVEILLANCE PROJECT ANNUAL REPORT, 2002

INTRODUCTION

Purpose

In April 2000, the New Mexico Environment Department (NMED) funded the New Mexico Department of Health (NMDOH), Office of Epidemiology to develop a waterborne disease surveillance system in an effort to evaluate NMED efforts towards ensuring safe drinking water in New Mexico. The purpose of the waterborne disease surveillance project (WDSP) was to develop a system for identifying incidents and outbreaks of waterborne disease in New Mexico and to maintain a database of waterborne disease events. Based on an extensive literature review, seven disease-causing infectious agents were included in the initial surveillance efforts. The organisms include three parasitic agents (*Entamoeba histolytica, Cryptosporidium sp., Giardia sp.*), three bacterial agents (*Campylobacter sp.,* enterohemorrhagic *Escherichia coli, and Shigella sp.*), and one viral agent (Hepatitis A). All of the identified diseases are "notifiable conditions"; reportable by law to NMDOH.

This report encompasses year two of the WDSP (2002). Year 2002 program changes reflected recommendations noted in the Year 2001 annual report. Weekly monitoring of reported cases of each disease was deemed a priority. The Environmental Health Epidemiology Unit (EHEU) worked closely with the Infectious Disease Unit to follow up cases. In addition, the EHEU took on the responsibility of systematically taking public calls for environmental health issues. Systematic collaboration continued with NMED's Drinking Water Bureau (DWB).

METHODS

Information to track the burden of waterborne disease was collected through a number of different sources. Call tracking, communication between agencies, test results from the state scientific laboratory and NMED, and the infectious disease database (National Electronic Telecommunications System for Surveillance - NETSS) were all mechanisms used to track potential and actual exposures and disease in New Mexico. Water quality data were compared with disease reports and calls to identify any suspected waterborne disease cases.

A contact database was developed early in the project to track calls received by the Environmental Health Epidemiology Unit (EHEU). Caller type, location, major/minor call topics, and other specific information are some variables collected in the database. During October 2002, the decision was made to assign one member of the EHEU to take all environmental health calls on a given day. A calendar was produced and provided to the administrative staff who initially receive the calls and to the infectious disease epidemiology staff who systematically take call. In this manner, calls which in the past would have been responded to by the infectious disease epidemiology staff could be referred to a single point of contact in the EHEU.

The communication protocol developed during the initial stages of the JPA between NMED Drinking Water Bureau and the EHEU identifying a single point of contact (with a designated back-up) in each agency was reviewed and updated as needed (see Appendix 2). Via this process, NMED relays information regarding water system violations or refers concerned members of the public to EHEU.

Types of Public Water Systems:
Community water system: serves at least 15 service connections used by year-round residents or regularly serves at least 25 year-round residents.
Non-transient non-community water system: serves at least 25 persons for more than 6 months per year, including but not limited to schools and factories.
Non-community water system: serves 25 or more persons who are not residents year-round (e.g. restaurants, rest areas, gas stations) or seasonal facilities (e.g. children's camps or recreational camping facilities).
Definitions: 20 NMAC 7.1.

New Mexico public water systems are required by law to monitor for sixteen inorganic chemicals (non-transient, non-community systems monitor fourteen), thirty synthetic organic contaminants and twenty-one volatile organic contaminants. Radionuclide levels (alpha, beta, radium-226 and radium–228) are also monitored; another radionuclide, Uranium, will be monitored beginning in December 2003. In addition, community water systems that serve a population of 10,000 or more individuals and add a disinfectant to any part of the water system must monitor for trihalomethanes (20 NMAC 7.1). Results of these analyses are reported the NMED's DWB. NMDOH and NMED are working on ways to collaborate to provide public education and information on any of these chemicals that consistently exceed the MCL in New Mexico.

Surveillance for reportable diseases is ongoing in the state of New Mexico. Diseases are reported to the Office of Epidemiology by laboratories or health care providers. State surveillance staff inform the local public health office when they are alerted to a reportable disease case; local public health nurses use a standard enteric disease report form to document the investigation of enteric disease cases. Surveillance data collected by the local health office are submitted to the Office of Epidemiology and reported through the National Electronic Telecommunications System for Surveillance (NETSS) to the Centers for Disease Control and Prevention (CDC). When necessary, the EHEU is called upon by the Infectious Disease Epidemiology Unit for assistance with possible waterborne disease-related illness reports. Assistance takes the form of follow-up telephone calls, information gathering, and relaying information to and from NMED.

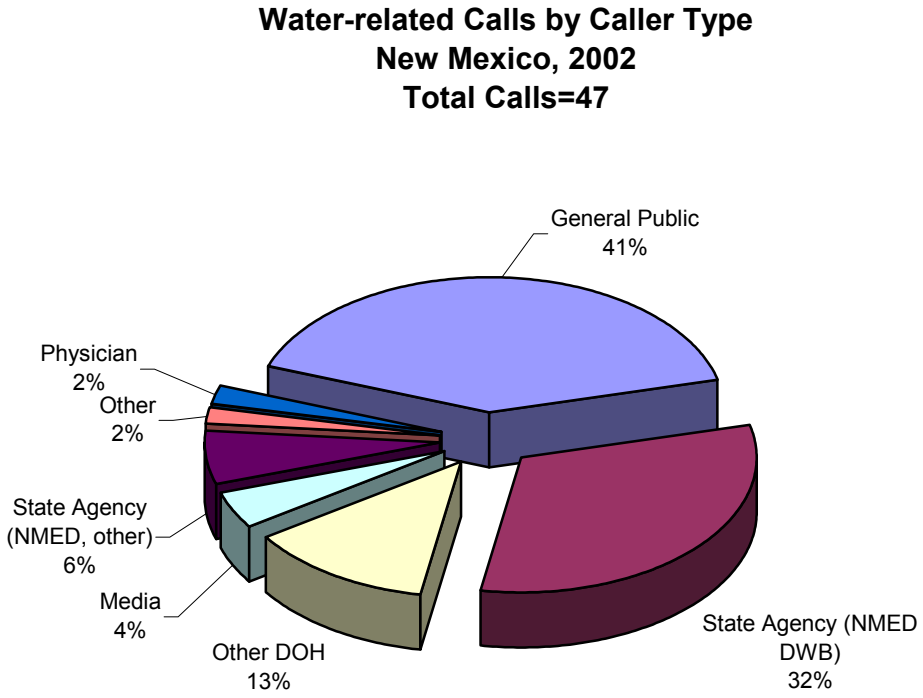
RESULTS

Calls

The EHEU received 47 water-related calls in 2002 that were recorded in the "Incident Database"; a 52% increase in the number of water-related calls recorded in 2001. Part of this increase may be due to the system developed by EHEU in October 2002 to take environmental health-related calls. Prior to this, the infectious disease epidemiologist on call handled many environmental health-related calls. The

majority of the calls in 2002 (41%) were from the general public, followed by referrals from the DWB (32%). The remaining calls were from other NMED bureaus, district public health staff, the media, physicians, and a school principal. Figure one shows calls by caller type during 2002.

Figure 1. Water-related Calls by Type, New Mexico, 2002



Chemical Maximum Contaminant Level (MCL) Violations

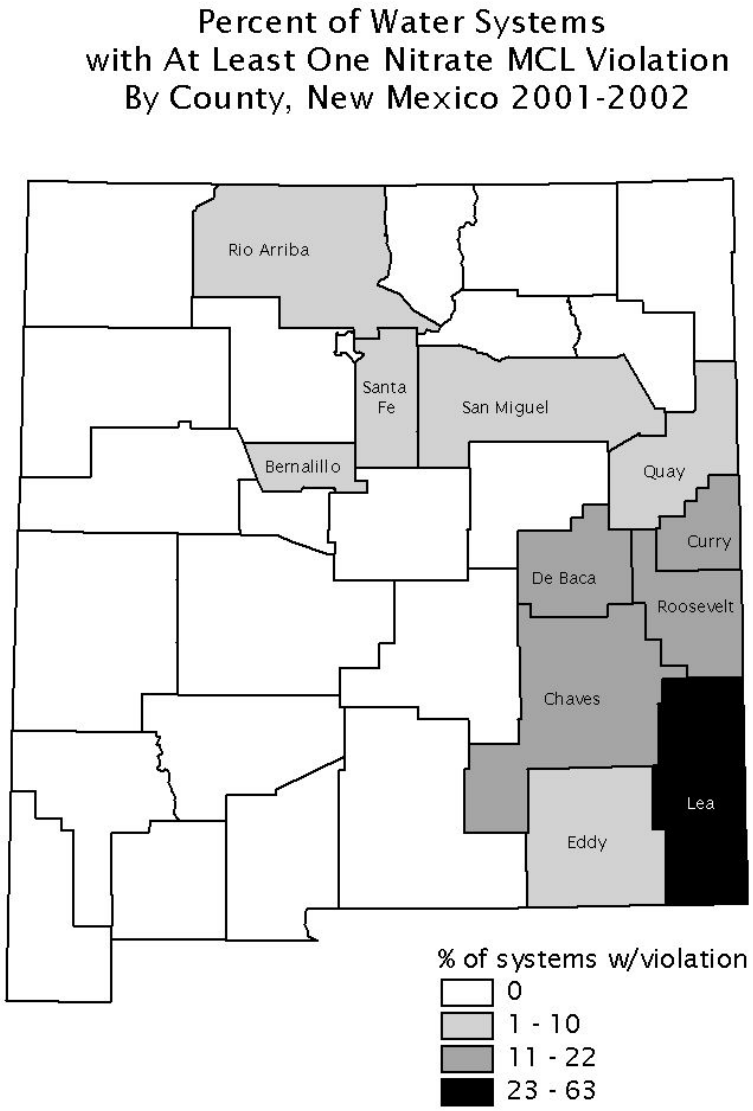
Nitrate is an inorganic chemical that can have some serious health effects in certain populations. This chemical was chosen for analysis because many of New Mexico's water systems have a history of violating the Nitrate MCL, suggesting the potential for adverse health effects. A syndrome called methemoglobinemia occurs when the ingested nitrate interferes with the ability for blood to carry oxygen to the body tissues, which need a constant supply of oxygen to survive. This is a particular problem in infants, pregnant women, or the elderly, because of body chemistry.

An analysis of the NMED DWB's database indicated that during 2001 to 2002, 11 of the 33 counties had one or more public water systems that violated the MCL for nitrate. Figure 2 illustrates which counties have the highest percentage of water systems with nitrate violations during the 2-year period. The county with the highest percentage of water systems violating the MCL was Lea County in southeastern New Mexico. The southeastern portion of the state in general was most affected by

nitrate contamination, possibly due to dairy farming or other agricultural activities. Strategies for providing public information to affected counties will continue into 2003 and will be reported in the next annual report. There were, however, no reported cases of methemoglobinemia in 2002.

During the next year, NMDOH will work with NMED to identify other chemical contaminants in public water systems that may result in adverse health effects in New Mexico.

Figure 2. Percent of Water Systems with a Nitrate Violation (by County), New Mexico, 2001 - 2002



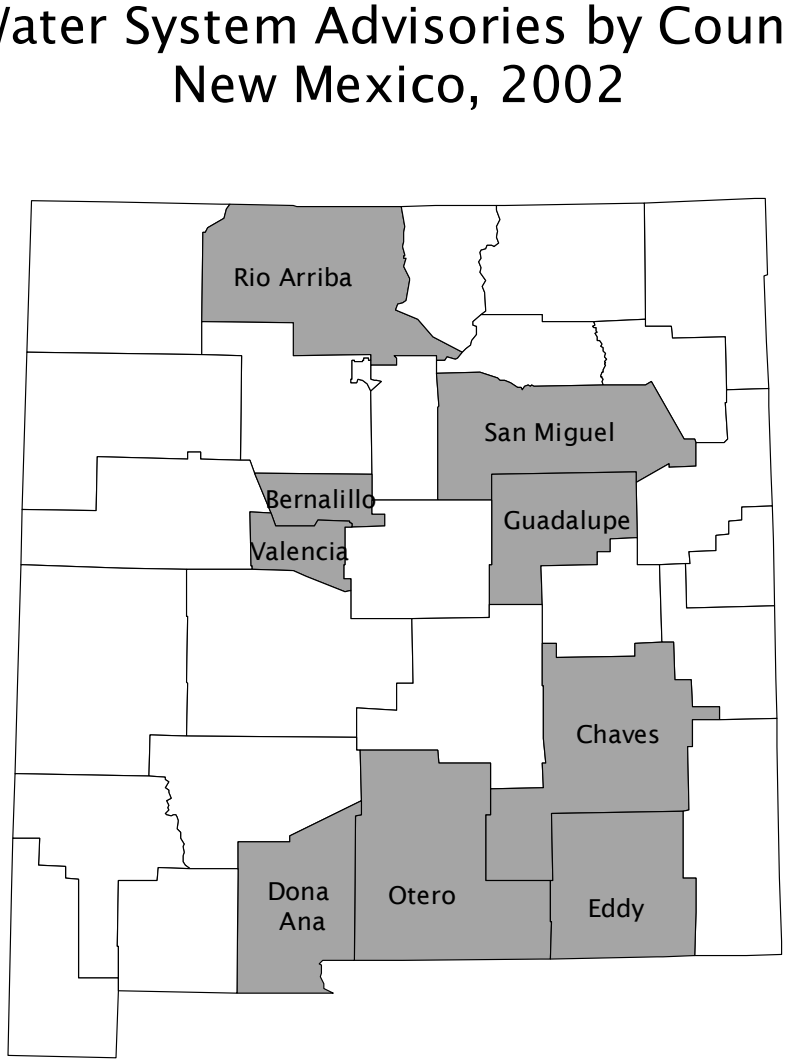
Biological Contamination of Water Systems

Drinking water systems are sampled on a routine basis for total coliforms (TCs) to assure compliance with federal drinking water standards. Total coliforms are a group of bacterial organisms that are present in the natural environment. If a water system tests positive for TC, further testing is done for fecal coliform (FC) or for *E. coli*, one of the fecal coliform organisms. FCs are organisms that are present in intestinal systems of all warm-blooded animals; most are not dangerous to humans, however, some may cause adverse health effects. Fecal coliforms are also used as an indicator organism. Because fecal coliforms occur naturally in animal intestines, contamination may indicate that other disease-causing organisms spread through feces (bacteria, parasites, and viruses) could be present in the water.

When fecal contamination is identified in a system, confirmatory samples are taken immediately to rule out sampling or other errors. If the confirmatory samples show fecal contamination, NMED issues an acute violation and confers with NMDOH to decide whether to issue a “Boil Water Advisory”. A situation in which an advisory might not be issued is when the water source is not being used as drinking water. Upon issuance, NMDOH notifies district public health offices to be on alert for cases of gastrointestinal illness. Water system consumers are notified by the water system through an interagency press release or individual notification.

There were 10 Boil Water Advisories in 2002. Figure 4 shows the distribution of advisories throughout the state. One advisory, issued in February 2001, was still in effect as of December 2002.

Figure 3. Map of Water Advisories by County, New Mexico, 2002



Cases of potential waterborne disease

There were no confirmed disease incidents related to public water systems in 2002; however, data were collected on potential waterborne disease events to ensure that no waterborne outbreaks were missed. Absolute confirmation of disease etiology is difficult, as it involves a timely stool sample and water sample, and a laboratory comparison of organisms identified in each. Often, diseases are not reported to the Office of Epidemiology until many days or weeks after symptom onset, which makes sample collection problematic. There were 815 reported cases of the selected potential waterborne diseases, approximately 100 more than in 2001. Based on estimates by the US Centers for Disease Control & Prevention, nearly half of those

are probably foodborne (Mead et al, 2000). Table 1 indicates the counts of each disease that are likely to be foodborne. Because the actual foodborne cases could not be separated from the others, all reported cases of the selected diseases were used in the analysis.

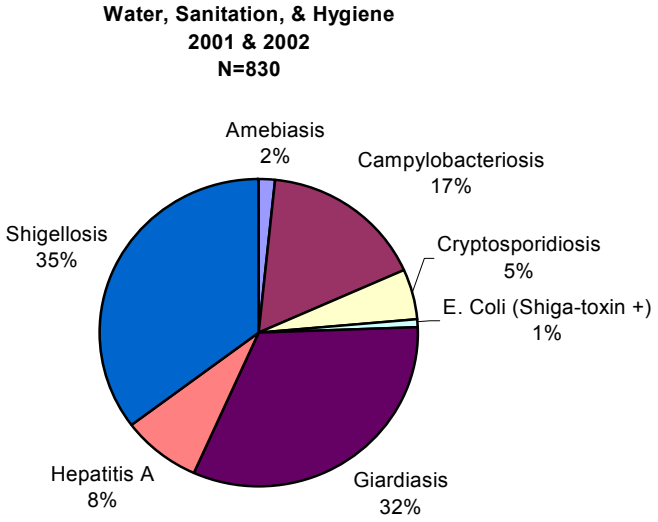
Table 1. Percentage of Selected Diseases Estimated to be Foodborne, New Mexico, 2002

Disease	2002 Reported NM Cases	% Estimated to be waterborne or other**	% Estimated to be Foodborne*	Estimated # waterborne or other etiology**
Amebiasis	**8**	**Unknown**	**Unknown**	**8**
Campylobacteriosis	**347**	**20**	**80**	**69**
Cryptosporidiosis	**20**	**90**	**10**	**18**
***E. coli* (O157:H7 & STX+)**	**17**	**15**	**85**	**2**
Giardiasis	**148**	**90**	**10**	**133**
Hepatitis A	**32**	**95ǂ**	**5**	**30ǂ**
Shigellosis	**243**	**80ǂ**	**20**	**196ǂ**
Total	**815**			**456**

***Estimated percents from Mead, et al, (2000). Food-related illness and death in the United States, Emerging Infectious Diseases, 5 (5).**
****Other etiology could include person-to-person or animal-to-person**
ǂHepatitis A and Shigella organisms are more often spread from person-to-person than through water.

Figure 4 shows a chart of illnesses reported in years 2001 and 2002 that are estimated to be related to water, sanitation and hygiene. Shigellosis represents the highest percentage, however that disease is more frequently associated with person-to-person contact than water contamination. Giardiasis, which is more commonly related to contaminated water ingestion, makes up 32% of the two-year sample.

Figure 4. Percentage of reported illnesses estimated to be due to water, sanitation, and hygiene, NM, 2001-2002



Analysis of infectious disease NETSS data was performed for each of the selected potential waterborne diseases on a weekly basis. The weekly data were compared with an 11-year average rate. Each time the weekly rate exceeded one standard deviation above the average rate, a line listing which includes the case's city of residence and street address was run for that week and surrounding two weeks to determine if there was any unrecognized spatial clustering of disease. Enteric disease report forms were reviewed to see if there was any evidence of waterborne transmission. The surveillance charts for each disease are included in Appendix 1.

Maps were produced to analyze the spatial distribution of potential water-related disease cases throughout New Mexico. See Appendix 1 for disease-specific maps.

Table 2 compares 2002 New Mexico data with 2001 US rates (the most recent data available) for the selected diseases.

Table 2. Selected Disease Rates* in New Mexico (2002) and the US (2001)

Disease	NM Rate per 100,000 Persons	US Rate per 100,000 Persons**
Amebiasis	**0.4**	**NA**
Campylobacteriosis	**18.7**	**NA**
Cryptosporidiosis	**1.1**	**1.3**
***E. coli* (O157:H7 & STX+)**	**0.9**	**1.2**
Giardiasis	**8.0**	**NA**
Hepatitis A	**1.7**	**3.8**
Shigellosis	**13.1**	**7.2**

***Rates were calculated using US Census 2001 population estimates.**
****2001 US data from Summary of Notifiable Diseases – United States, 2001 MMWR Volume 50/No. 53; amebiasis and campylobacteriosis are not nationally reportable diseases. Giardiasis became nationally reportable in 2002.**

Trends in selected enteric diseases. Seven enteric diseases were selected for surveillance of waterborne illness. There were 815 reported cases of the selected potential waterborne diseases, however, there is no evidence that any of the cases was related to a public water system. Initial information such as gender, age, onset date, and address was collected for most cases. In addition, supplemental information was collected via the "Enteric Disease Report Form" for approximately 60% of the cases. This form included information on water supply, recreational water exposure, sewage exposure, various types of high-risk food exposure, travel history, and daycare exposure.

The reported cases for all the diseases combined were distributed statewide, with the highest frequency of elevated disease rates in McKinley and Luna Counties (see map, Appendix 1). As is often the case with enteric disease, rates were highest for children under 5 years of age. Most symptom onset occurred during fall months (September, October, November) followed closely by summer (June, July, and August). Appendix 1 contains charts and maps that graphically represent case

characteristics and potential risk factors. Of the 443 individuals from whom additional information was collected, 63% reported eating in a restaurant in the two weeks prior to onset of symptoms. It is unknown the percentage of the general public who eat in restaurants. Travel history (previous 2 weeks) was collected for 460 of the 815 cases (60%). Of the 460 cases, 25% reported some travel. Analyses of the combined diseases are driven mainly by those diseases with the highest frequency of reporting (shigellosis and campylobacteriosis); analyses were performed for each individual disease due to the varying frequency and different risk factors for each disease.

Amebiasis. *Entamoeba histolytica* is a parasite that causes intestinal and other symptoms. Upon infection, humans can shed the cyst form in their feces. The disease caused by infection with *Entamoeba histolytica* is referred to as amebiasis. Cysts can survive outside the host in water and soils. While ingestion of only one viable cyst can cause infection, not all infections are symptomatic. The incubation period for this organism is usually between two and four weeks, but can be from a few days to years. Unlike most enteric illnesses, amebiasis is rare in children under five years. Worldwide, infection rates are higher in those areas with poor sanitation (Chin, 2000). When untreated, infections may last for years.

During 2002, there were only eight amebiasis cases reported in New Mexico. It is unknown how many of those were in individuals who lived in or visited a foreign country. Thirty-eight percent of cases were in children under five. Exposure information was collected on three of the eight cases.

Campylobacteriosis. This bacterial disease is one of the most frequently reported causes of gastroenteritis in the US and in the world. The organism is often found in the gastrointestinal tracts of a wide range of birds (especially poultry) and animals, and can frequently be isolated from surface water (Hunter, 1997). Eating undercooked chicken or contact with farm animals are important risk factors for *campylobacter* infection. The incubation period (the amount of time from ingestion of the organism to symptom onset) is approximately two to five days.

Campylobacter enteritis was the most frequently reported of the seven selected potential waterborne diseases in 2002. In New Mexico, there were 347 reported cases of campylobacteriosis in 2002; this is strikingly consistent with the 346 cases reported in 2001. Thirty-eight percent of cases reported onset during summer months (mostly in July and August), 29% reported onset during the fall. While this disease had a statewide distribution, disease rates were highest in De Baca, McKinley, Socorro, and Roosevelt Counties; Bernalillo (22%), McKinley (15%), and Dona Ana (10%) had the highest numbers of cases. During October 2002, 46 individual cases were reported in New Mexico; 57% of these cases were in McKinley County. On further investigation, however, actual disease onset in that county was similar to surrounding months. The elevated “cluster” was due to reporting of many older cases at the same time. Children aged 0 to 4 had the highest disease rates. Of

the 347 cases, additional risk factor information from the enteric report form was available on nearly half (188 cases – 54%).

Cryptosporidiosis. The organism responsible for this disease is a parasite. This organism is especially resistant to chlorine disinfection, and thus is a potential problem in both surface and recreational waters and in groundwater systems that may have experienced sewage contamination or infiltration of surface water. Cryptosporidium has a variable incubation period, ranging from two to twenty-eight days, but typically it takes about a week between infection and illness.

There were 20 reported cases of cryptosporidiosis in New Mexico during 2002. Unlike 2001, the case count was slightly higher for females than males (60% vs. 40%); children under one year of age had the highest rates. Fifty-five percent of the individuals experienced onset of symptoms during the summer months (June, July, August); 25% reported onset in the spring (March, April, May). Of the 20 cases, additional information was available for 15 individuals. Of those, 20% had contact with recreational water. Unlike last year, only one individual reported camping in the weeks preceding symptom onset; in 2001, 18% reported camping. Forty percent reported travel (an increase from 10% in 2001). Approximately 73% of those with additional risk factor information reported eating in a restaurant in the previous two weeks. Twenty-seven percent reported some underlying illness, possibly reflecting testing bias: providers may be more likely to test those patients who are most adversely affected by an illness, for example those with HIV/AIDS or some other disease that may suppress the immune system. Spatially, some of the highest rates were reported in Guadalupe County. As expected, the highest disease counts were in the Albuquerque metropolitan area. Long incubation periods for this organism can lead to difficulties in pinpointing risk factors.

Enterohemorrhagic *Escherichia coli* infection. Enterohemorrhagic *E. coli* was first identified in 1982 and became a nationally reportable disease in 1993; the most commonly reported serotype is E. coli O157:H7. This type of *E. coli* produces a Shiga toxin that can cause severe damage to the lining of the intestine, and complications can result in serious kidney damage (Hemolytic Uremic Syndrome – HUS). Infection with this organism is most commonly associated with the ingestion of undercooked beef and other foods contaminated by cattle feces. However, waterborne transmission has also been documented. Contamination of a municipal water system in Walkerton, Ontario, Canada resulted in several deaths and significant illness in a small community. A report by the US Food and Drug Administration indicated that in the Pacific Northwest, *E. coli* O157:H7 was suspected to be second only to Salmonella as a cause of bacterial diarrhea, and mild infection was thought to be vastly under-reported (FDA, 2001). The incubation period ranges from two to eight days.

There were 17 reported cases of enterohemorrhagic E. coli infection in New Mexico in 2002, 14 of which were attributable to *E.coli* O157:H7. Seventy-one percent were in males. Season of onset was typically fall (47%); 18% of reported cases noted

onset of symptoms in each of the other seasons. Highest rates were reported in the over 85-age group and the 1 to 4 year olds. Risk factor information was collected for 59% (10 cases). While this family of organisms is frequently associated with undercooked food, none of the high-risk food variables (e.g., eating undercooked meat) seemed to play a role in the New Mexico cases. In fact, only one person reported eating jerky, two individuals reported eating rare beef, two individuals reported contact with a sick animal, and two reported visiting a farm. None of the 10 cases reported drinking unpasteurized milk or cider, or eating unpasteurized cheese.

Giardiasis. *Giardia lamblia* is a protozoa that is the most frequently identified cause of non-bacterial diarrhea in North America. It survives in the environment as a cyst, and is more resistant than most other waterborne pathogens (except Cryptosporidium) to chemical disinfection. *Giardia lamblia* infects a wide range of birds, amphibians, and other animals in nature, and is frequently found in surface water as a result of animal fecal contamination (especially beavers). The incubation period can be lengthy, ranging from three to twenty-five days.

There were 148 reported cases of giardiasis in New Mexico in 2002. Further analysis of the 2002 giardiasis cases in New Mexico indicated that onset of most reported cases of disease occurred during the summer months, followed closely by spring. Children aged 0 to four had the highest reported rates. Fifty-three percent of the cases were female. Risk factor information was available on 93 of the 148 cases (59%). Thirteen percent of those reported swimming in some type of recreational water (i.e., swimming pool, reservoir, lake, river). Nearly 40% reported travel in the weeks preceding illness. Notably, 16% reported an underlying illness, once again suggesting testing bias for those with suppressed immune systems.

Hepatitis A. Hepatitis A is a viral organism that can result in the following symptoms: fever, malaise, nausea, anorexia, and abdominal discomfort, followed by jaundice. Hepatitis A has a long incubation period (between 10-50 days, with an average of 30 days), making it difficult to determine water or foodborne etiology. The FDA estimated that in 1988, 7.3% of cases (nationally) were foodborne or waterborne, however direct contact (fecal-oral) was the most common route of infection. A targeted immunization program begun in 1996 has been instrumental in reducing morbidity due to Hepatitis A in New Mexico.

Because of the long incubation period, additional food-related risk factor information was not analyzed for the 32 reported cases. Additional information, including travel and daycare contact was collected on 18 of the 32 cases. Nine of the 18 had traveled internationally; three had contact with children in daycare, however none of the cases was determined to be daycare associated.

Shigellosis. *Shigella sp.* is a bacterium that almost exclusively infects humans (other primates may be infected), and some species can result in death. The species endemic in developed countries (*S. sonnei* and *S. flexneri*) typically produce milder symptoms (in those with adequate immune response) than *Shigella dysenariae*, the

species more common in developing countries. Shigellosis (bacillary dysentery) is mainly spread from person to person by direct contact (fecal-oral), but can occur through direct fecal contamination of water and food sources. The infectious dose is small, between 10 and 100 organisms, and the incubation period is relatively short (12 to 26 hours). Because this organism frequently causes bloody diarrhea, Mead et al. (1999) estimate that treatment is more often sought for shigellosis than other diarrheal illnesses, and is therefore more likely to be reported to health authorities.

There were 243 reported cases of shigellosis in New Mexico in 2002, a nearly 100% increase from 2001. One to four year olds had the highest rates, followed by 5 to 14 year olds; fifty-four percent of the cases were in females. Spatially, the highest disease rates were in McKinley and Luna counties. During April 2002, there were 28 reported cases in McKinley County. However, further inspection of the data indicated that only 17 of those cases actually experienced onset of symptoms during April, while there were 10 cases that experienced symptom onset in March which were not reported in March. The infectious disease epidemiology unit followed up with area health offices in many of these cases.

Of the 77 cases for whom additional information was available, 29% reported having a potential sewage contact, including direct contact with sewage, or a septic tank or cesspool at their residence. Daycare history was collected on 143 of the 243 cases. Of the 143 cases, 10% were determined to be daycare associated (5% of the total reported cases).

Case Study: A potential waterborne disease cluster in a small subdivision

In April 2002, an emergency room nurse noticed that several people from the same subdivision arrived for treatment of dehydration caused by diarrheal disease. At the same time, work was being done on the water system distribution lines in the subdivision (with a population of about 1,000 people), causing frequent water outages and dirt in the water supply lines. The Office of Epidemiology was notified by the hospital of this situation further information was sought to determine if there could be a relationship between the water system work and disease events. Contact with the water system operator revealed that there were two accidental water distribution line breaks during the construction process.

Methods: The initial case definition was symptoms of diarrhea or vomiting between April 9th and 22nd. The infectious disease epidemiology unit surveillance nurse collected contact information for those appearing at the emergency room and followed up to collect names and addresses of other individuals experiencing symptoms. Symptomatic individuals (13 of the approximately 1,000 subdivision residents) were encouraged to produce a stool sample for analysis. Two stool samples were obtained and sent to the NM Scientific Laboratory Division for biological testing. Preliminary information was collected from a limited number of individuals.

Staff from the NMDOH and NMED met with the water system manager to determine actual distribution line break dates and locations, water sampling dates, and to identify procedures which took place to disinfect the water after the line breaks.

NMED field staff inspected the water system and pulled special samples from homes of people experiencing gastrointestinal symptoms. Water was checked not only for microbiological contamination but also for adequate chlorine residual.

Results: The water system was tested for fecal indicator organisms on March 20, April 3, April 17, and April 22. Results of the water system testing by the water system operator and NMED indicated that there were no indicator bacteria in the system on any of the four sampling dates, and that the water contained a sufficient residual amount of chlorine to ensure adequate disinfection. Special samples taken at the home of some of the symptomatic residents showed no indicator bacteria.

Spatially, the symptomatic individuals resided at or visited homes at the far end of the subdivision. Anecdotally, many of the symptomatic individuals had had contact with each other previous to becoming ill. The actual water line break locations were a substantial distance from the homes of the symptomatic individuals, and many homes with no reported symptomatic individuals lay between the line breaks and those residents. Additionally, NMED field staff reported an extremely poor hygiene situation in the home of the one of the affected families, including toddlers accessing the dirty diaper pail and poor kitchen hygiene.

Bacteriological tests of the stool samples did not identify any bacterial disease-causing agents, however, virus testing showed that one of the samples was positive for viruses that cause gastrointestinal symptoms such as those described by the ill residents. Unfortunately, the other stool sample was of poor quantity and quality and could not be tested.

Conclusions: Based on the preliminary information, it was determined that the gastrointestinal symptoms experienced by the residents were most likely the result of norovirus infection passed by direct contact from person-to-person. A full investigation was not initiated because there appeared to be no evidence of water-related disease transmission and no new cases were reported in the area. NMDOH obtained an information sheet from the US Centers for Disease Control and Prevention on preventing infectious disease, including information on handwashing, disinfection, food safety and other issues that the water system operator agreed to include in the next water bill. NMDOH worked with NMED to prepare a joint press release to alert the public that no connection was found between the water system and disease.

Although this event was determined not to be an actual waterborne disease outbreak, the scenario allowed NMED and NMDOH to work together to test the system for investigating potential waterborne disease.

Other WDSP Outcomes

The waterborne disease surveillance project had outcomes beyond simple disease and contaminant tracking. During 2002, a strong relationship was built between the NMED's Drinking Water Bureau and NMDOH's Office of Epidemiology. As a result of this strengthening relationship, several collaborative efforts were completed, including:

- **Fact sheet development:** A fact sheet on the health effects of Uranium was developed in collaboration with NMED's DWB and the NMED Ground Water Quality Bureau (see Appendix 2).
- **Presentations:** New Mexico Environmental Health Conference, October, 2002: Waterborne Disease Surveillance in New Mexico (see Appendix 2).
- **Training initiatives:** NMDOH provided a training session in disease outbreak investigation (foodborne/waterborne) for sanitarians at the Bernalillo County Environmental Health Department (September, 2002). A copy of presentation handouts is included in Appendix 2.
- **Collaboration on a potential waterborne disease cluster**

These initiatives are ongoing and are expected to continue.

DISCUSSION

Because of the sporadic nature and different risk factors for each of the seven selected diseases, it is difficult to draw broad conclusions regarding waterborne disease in New Mexico. There were no situations in which drinking water was definitively identified as the source of infection. Relative numbers of cases remained the similar to 2001 cases with the exception of shigellosis, which increased by about 99%. Several small, localized shigellosis clusters were identified and followed up by the Infectious Disease Epidemiology Unit; however, further examination revealed that different serotypes were involved, dispelling the notion that the increase represented a statewide outbreak. None of the clusters appeared to be water-related.

2002 was the second complete year of the waterborne disease surveillance project. The weekly surveillance system was operationalized mid-year, and led to identification of gaps in data collection. Some additional databases were developed to help track water quality and potential waterborne disease in the state. Currently, this system is a tracking system for enteric disease, of multiple and frequently unknown etiology. Utilization and fine-tuning of the databases and protocols will allow the implementation of a surveillance system that has the potential to differentiate waterborne disease from diseases of other etiology.

Limitations. There are some major limitations to using reported enteric disease as a surveillance system for waterborne disease, including source determination, timeliness of reporting, recall bias, and reporting bias. Primarily, it is difficult to determine specific etiology for many diseases, especially those with relatively long incubation periods. To be confirmed, the potential source must be identified in time

to test it for the organism in question. Most of the selected enteric illnesses can be transmitted person-to-person, through food, or by animals in addition to waterborne transmission. Often, disease reports are not brought to public health practitioners' attention until after many days or weeks of symptoms. It is difficult for most people to recall food and activity histories for events that happened many weeks in the past. Frequently, no follow-up risk factor information is collected. Reporting bias is also an issue. Certain infections may be more likely to be reported than others; also, specific populations may be more likely to be tested, for example those with HIV/AIDs, or other immune-suppressing disorders. An otherwise healthy person may be diagnosed based on clinical symptoms rather than a confirmatory test, and therefore, never reported. In addition, most people don't seek medical care for diarrheal illness, preferring to self-medicate with over-the-counter medicines. Lastly, basing the surveillance system on reportable diseases may miss waterborne outbreaks of diseases that are not reportable. For example, some viruses, such as noroviruses, can be transmitted through water but are not reportable to the state.

CONCLUSION

2002 was a year of operationalizing the waterborne disease surveillance project. Weekly analysis of data was initiated for two of the diseases, giardiasis and cryptosporidiosis in the first part of the year. The remaining 5 diseases were added by mid-year.

Recommendations

1. **Identify and monitor "susceptible systems":** With the help of NMED, criteria will be identified to determine whether a system is susceptible to contamination. These systems will be monitored carefully and may provide a location for secondary surveillance methods (see recommendation 2).
2. **Investigate secondary surveillance systems:** During 2003, two secondary surveillance methods will be investigated: Over-the-counter antidiarrheal sales monitoring and sentinel clinic surveillance. It is anticipated that one or both of these methods will be continued if they add valuable information on the burden of diarrheal disease in New Mexico.
3. **Provide training for district NMED and NMDOH personnel:** New Mexico is a large, rural state. Because it is not always possible for state personnel from Santa Fe to be on scene immediately during a disease outbreak, it is essential that staff from local district offices be trained in appropriate disease investigation protocol. NMDOH and NMED will continue to work together to provide statewide training opportunities.
4. **Provide information for the general public, healthcare providers, and water system operators**
5. **Collaborate with DWB to perform an analysis of the DWB database to help prioritize development of health information (eg, radionuclides, volatile organic compounds [VOCs], synthetic organic compounds [SOCs], disinfection by products).**

REFERENCES

Chin, J (Ed.). (2000) Control of Communicable Diseases Manual (17th Edition) American Public Health Association.

Food and Drug Administration (2001) Foodborne Pathogenic Microorganisms and Natural Toxins Handbook. Center for Food Safety and Applied Nutrition. [Online: http://www.cfsan.fda.gov/~mow].

Hunter, P. R. (1997) Waterborne Disease: Epidemiology and Ecology. Chichester, England: John Wiley & Sons, Ltd.

New Mexico Administrative Code (NMAC) Title 20, Chapter 7, Part 1.

Mead, P. S., Slutsker, L., Dietz, V., McCaig, L. F., Bresee, J., Shapiro, C., Griffin, P. M., and Tauxe, R. V. (2000). Food-related illness and death in the United States. Emerging Infectious Diseases, 5 (5).

Appendices

Appendix 1. Disease Specific Charts and Maps
Appendix 2. Fact Sheets & Presentations

APPENDIX 1, DISEASE SPECIFIC CHARTS AND MAPS

Definition of Terms:

Rates: Rates were calculated as number of cases per 100,000 people using the 2000 US Census population, increased by the overall estimated 2001 New Mexico population increase (1.6%).

Seasons: (Season of symptom onset)
- Winter: January, February, and December
- Spring: February, March, and April
- Summer: May, June, July, and August
- Fall: September, October, and November

Residential water source: source of drinking water at home

Recreational water exposure: exposure to lake, pond, swimming pool, river, or other source of water for recreational purposes.

Potential sewage exposure: Combined variable includes any case that reported exposure to raw sewage, or have a home septic system or cesspool.

Case contact: Case reported contact with someone with diarrhea within two weeks before or after onset of illness.

Restaurant: Case reported eating at a restaurant within one week for a bacterial infection, two weeks for parasitic infections.

Underlying illness: Case reported some sort of underlying illness. Those with underlying illnesses may have a higher likelihood of being tested than the general population.

Travel: Case reported travel (any, outside New Mexico, or outside the US) within two weeks of symptom onset.

Farm: Recent visit to a farm reported

Sick animal: Contact with sick animals, including reptiles, poultry, cattle, or any other (e.g. sick pet).

Food exposures: Nine different questions are asked regarding various food exposures, including raw meats (beef, chicken, eggs, shellfish, jerky), unpasteurized dairy products or cider, and unwashed fruits/vegetables. Different foods may be associated with each illness; for example, E. coli infection is often associated with undercooked beef, while campylobacter infection is more likely to be associated with undercooked chicken.

Contaminated drinking water: Drinking water with documented microbial contamination at the time the illness occurred. This variable is unknown in all cases.

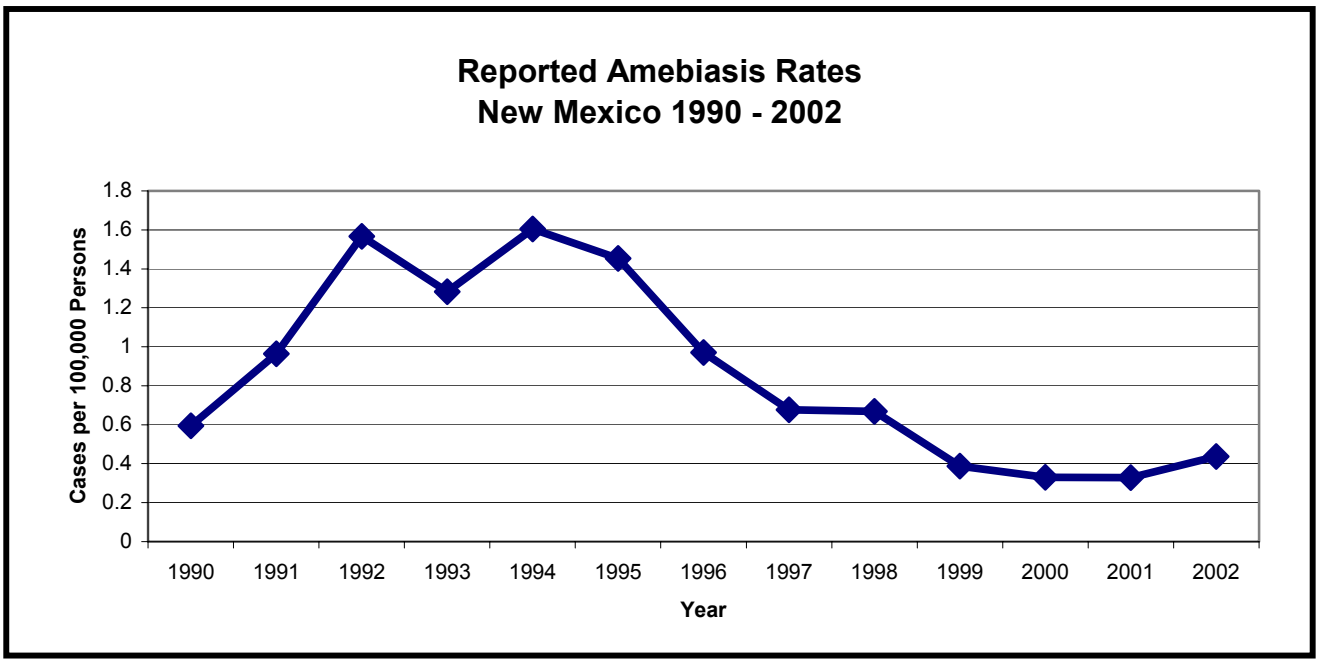
Note: Reporting a positive risk factor does not necessarily indicate source of illness, for example, if a case reports swimming in a lake then reports illness, the illness may not necessarily be related to the lake water exposure.

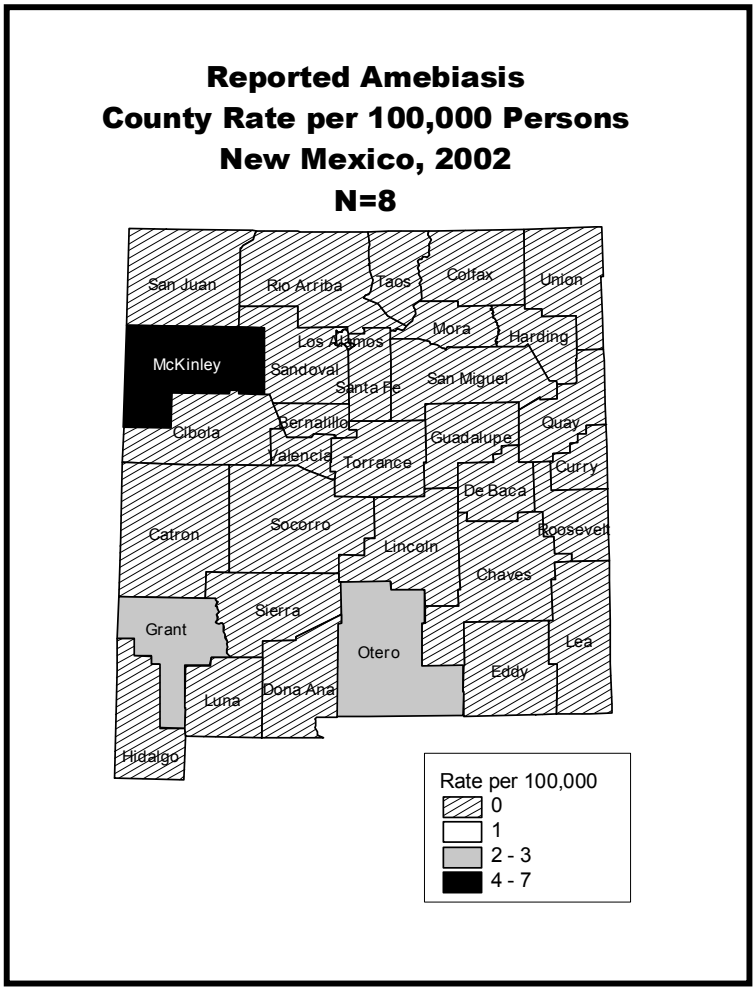
None of the variables is mutually exclusive; a single individual can be positive for more than one risk factor.

A risk factor graph was not produced for amebiasis due to lack of data. A limited graph was produced for Hepatitis A, which generally has a long incubation period.

Reported Amebiasis in New Mexico, 2002

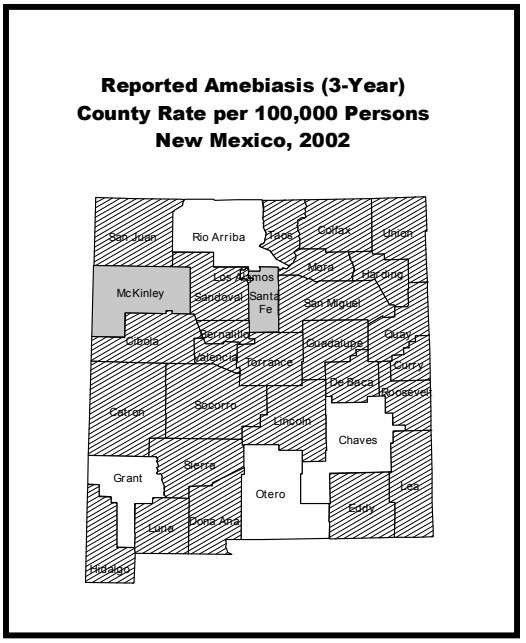
Total reported cases: 8





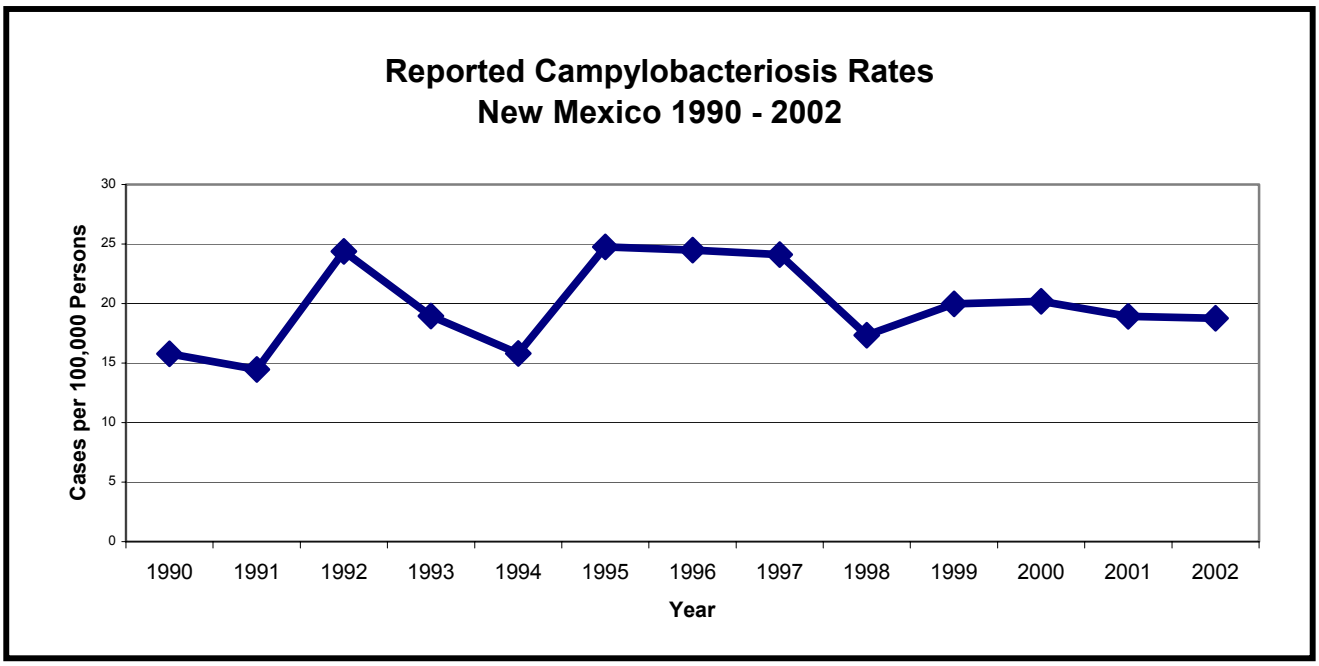
Special points of interest:

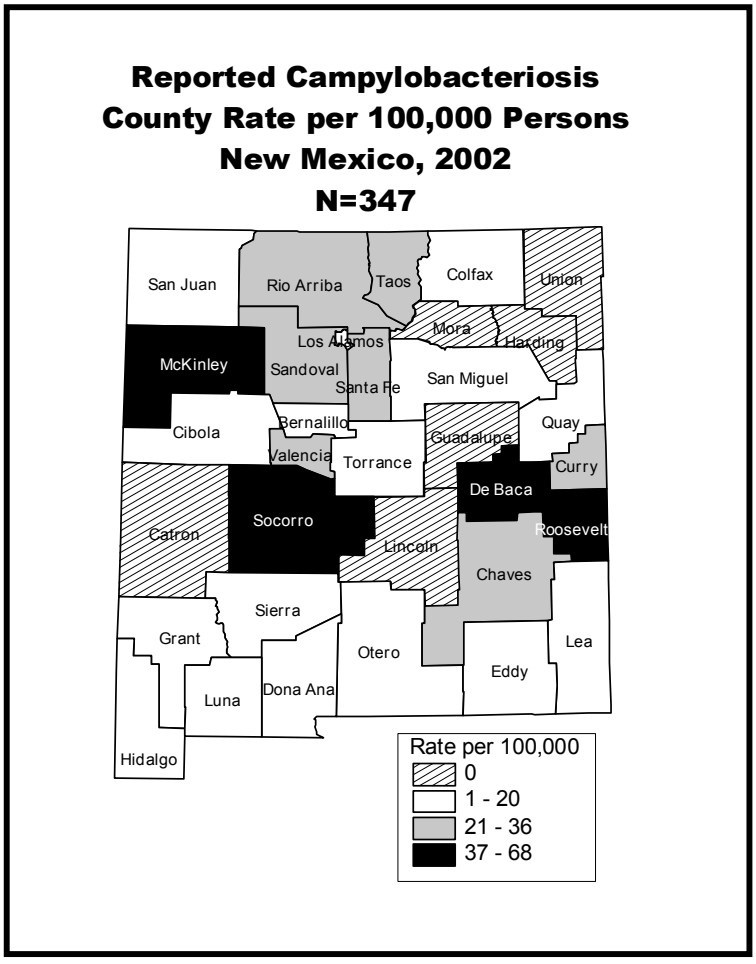
- Reported amebiasis has decreased since the first half of the 1990s
- McKinley County reported the highest rate in 2002
- This disease appears to be uncommon in New Mexico



Reported Campylobacteriosis in New Mexico, 2002

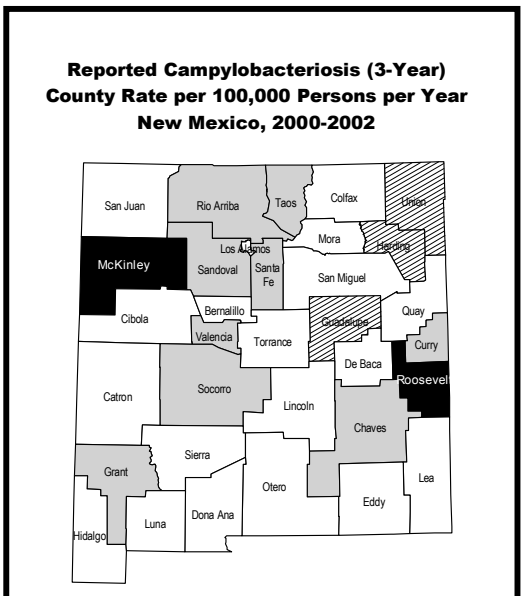
Total reported cases: 347





Special points of interest:

- Reported campylobacteriosis has remained relatively stable since the early 1990s
- Summer was the most frequent season of onset for this disease
- McKinley & Roosevelt Counties had the highest rates during 2000-2002

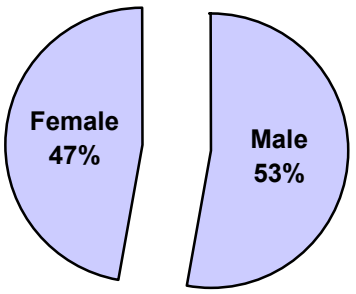


REPORTED CAMPYLOBACTERIOSIS, NEW MEXICO, 2002

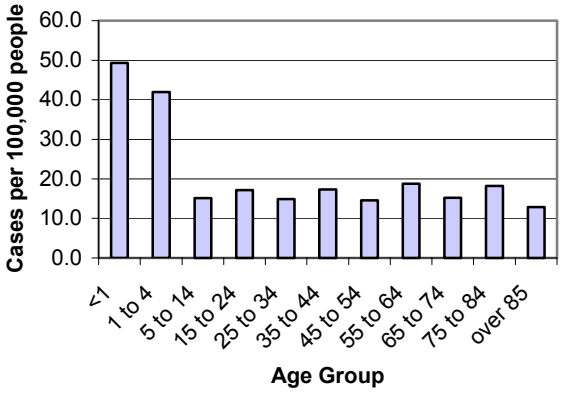
General Case Characteristics & Possible Water Exposures

Total reported cases: 347

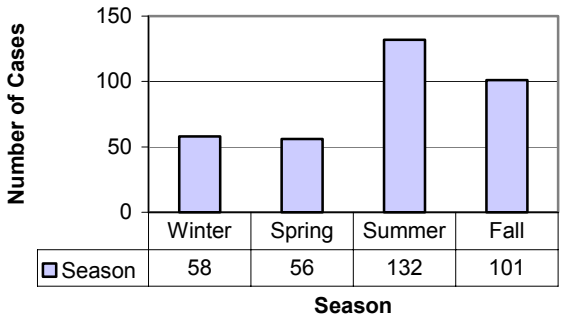
Reported Cases by Gender



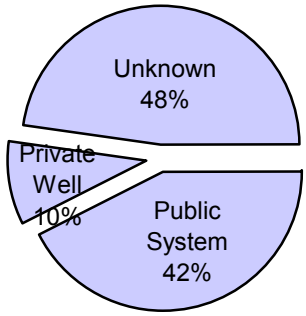
Reported Rates by Agegroup



Season of Onset

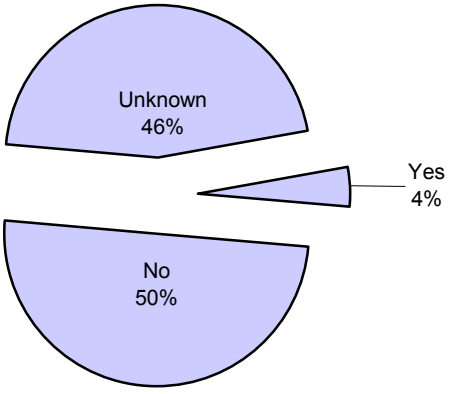


Residential Water Source



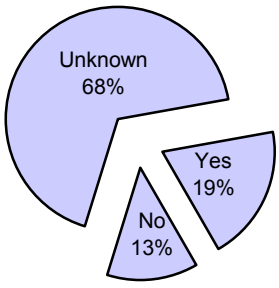
No infections have been causally linked to this risk factor

Recreational Water Exposure



No infections have been causally linked to this risk factor

Potential Sewage Exposure*



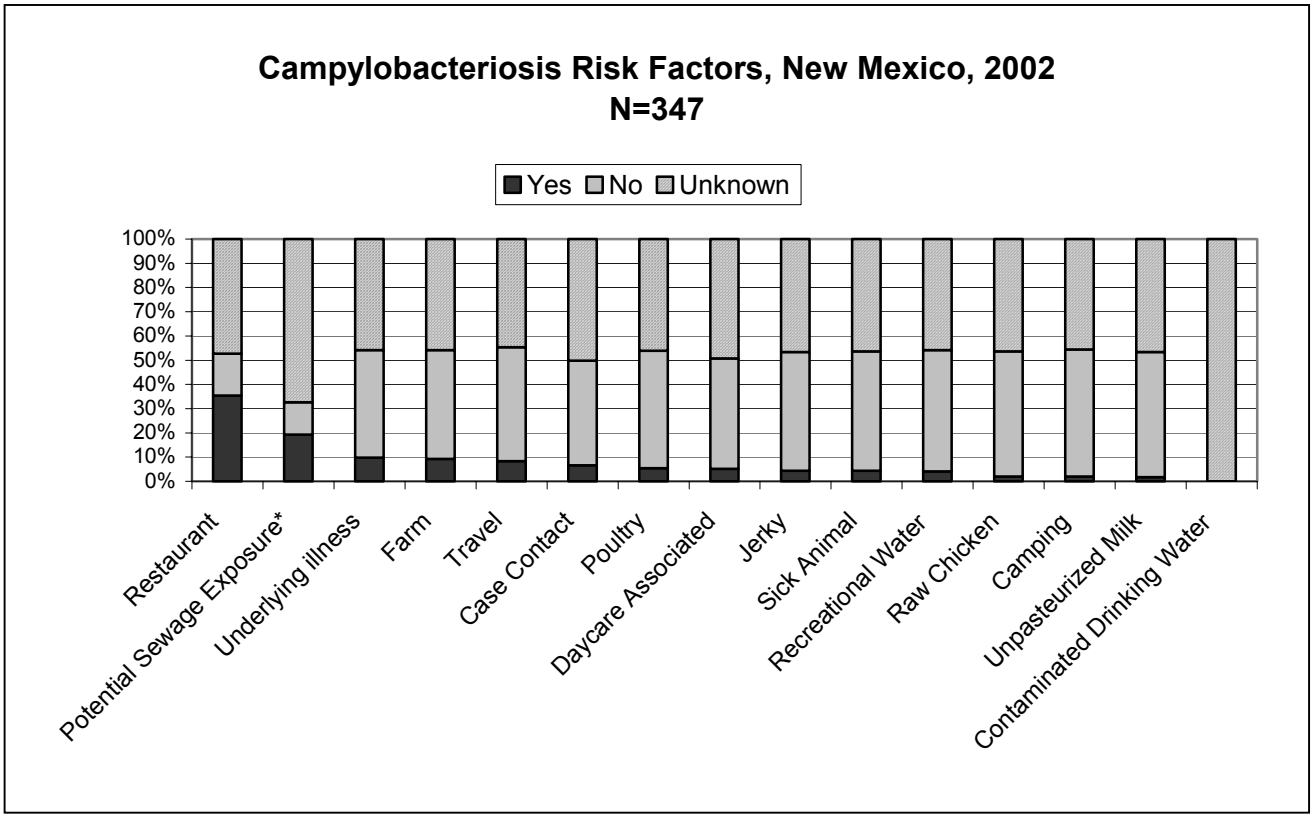
*includes those who report exposure to raw sewage, or have a home septic system or cesspool.

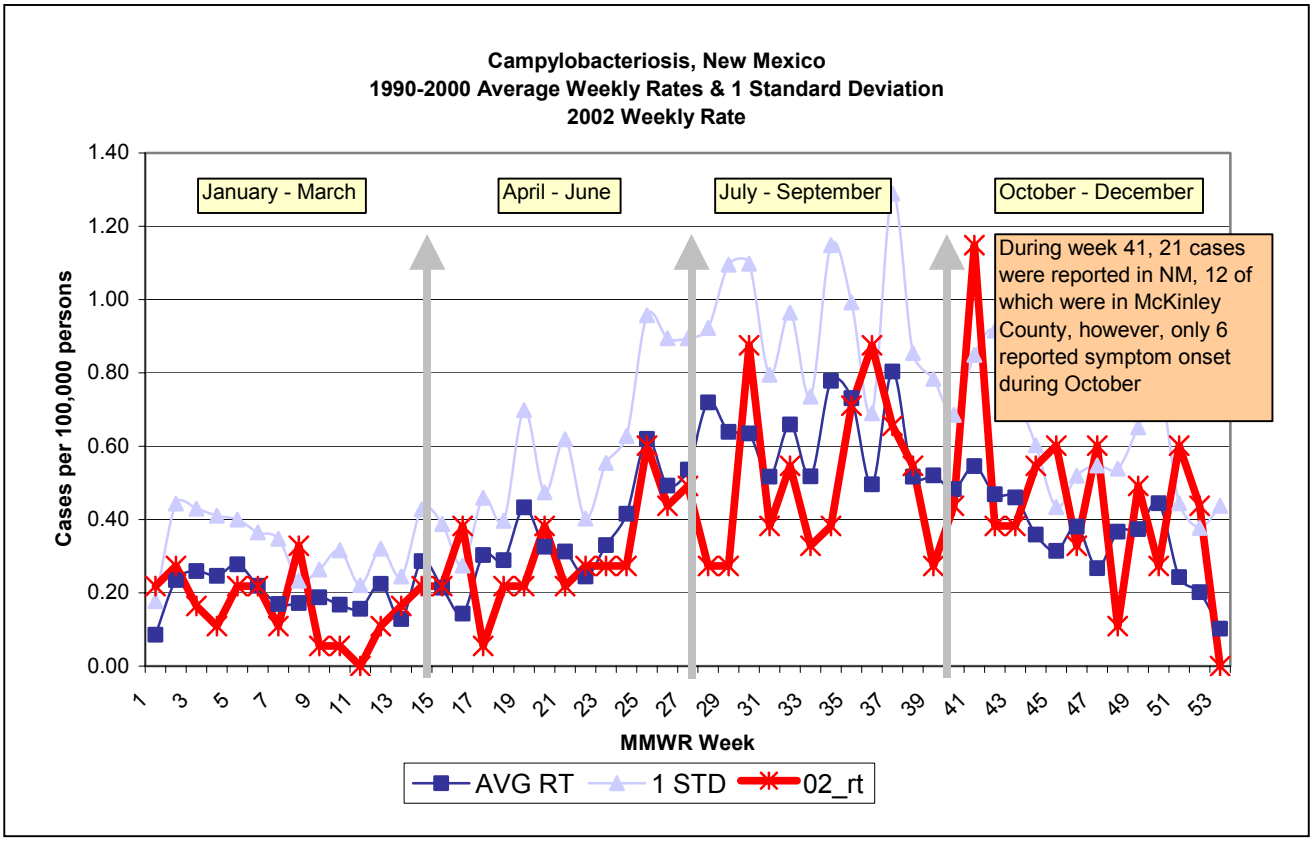
No infections have been causally linked to this risk factor

REPORTED CAMPYLOBACTERIOSIS, NEW MEXICO, 2002

Weekly Surveillance and Risk Factor Information

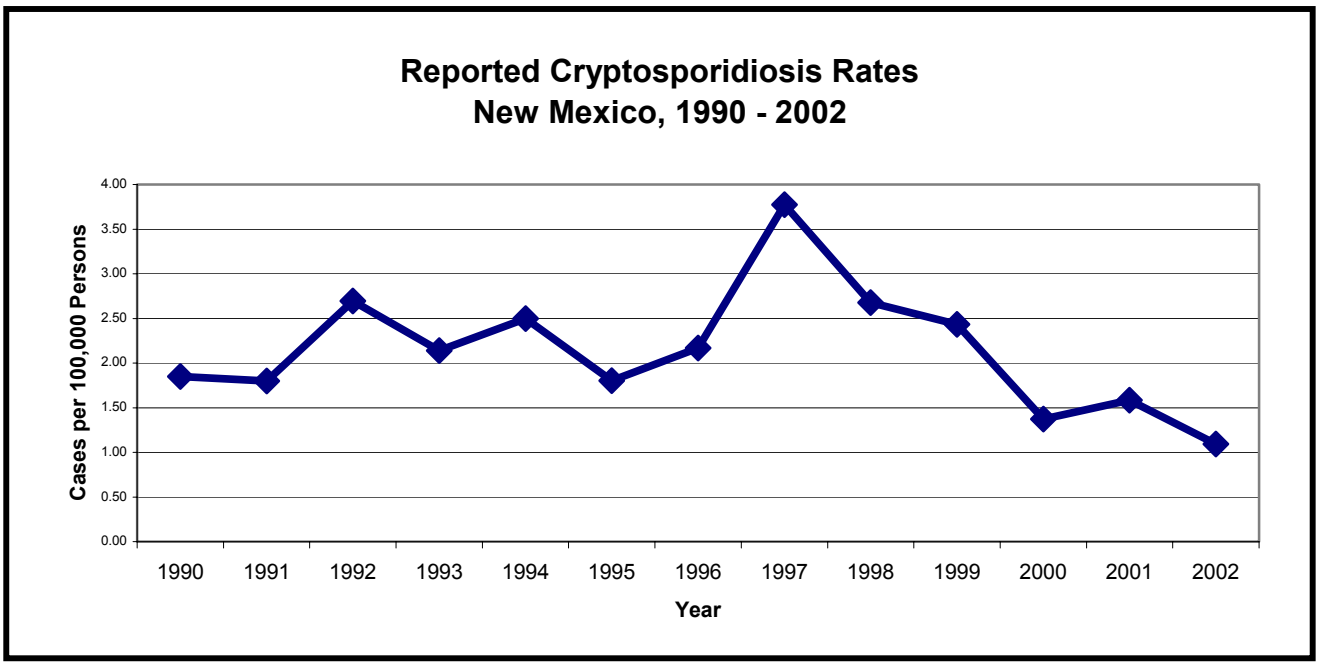
Total reported cases: 347

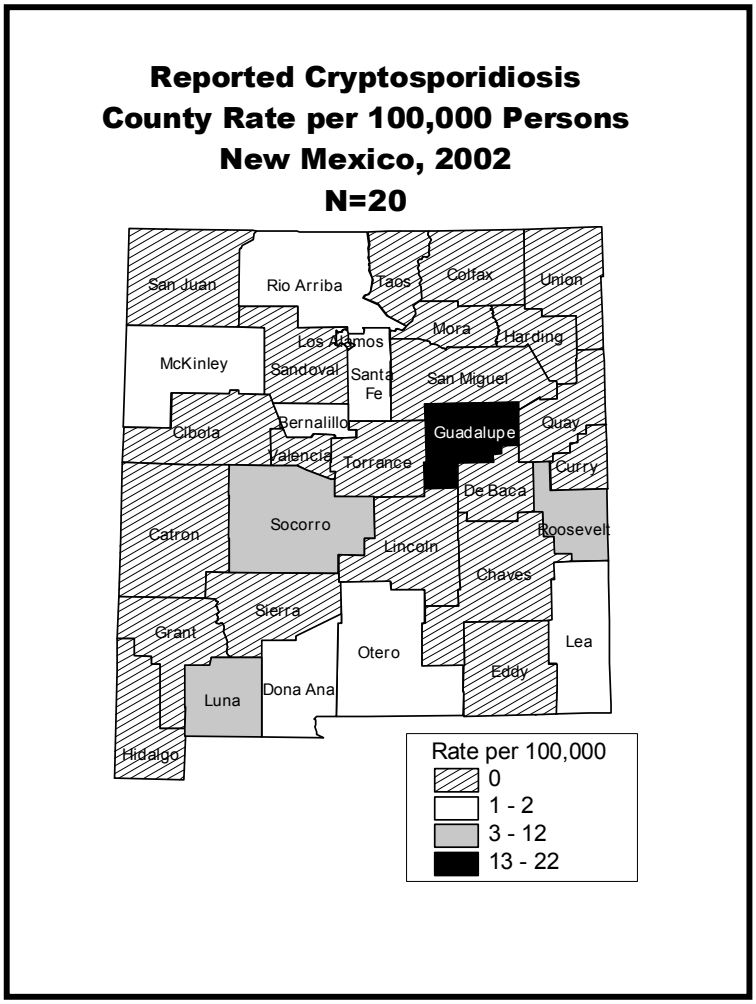




Reported Cryptosporidiosis in New Mexico, 2002

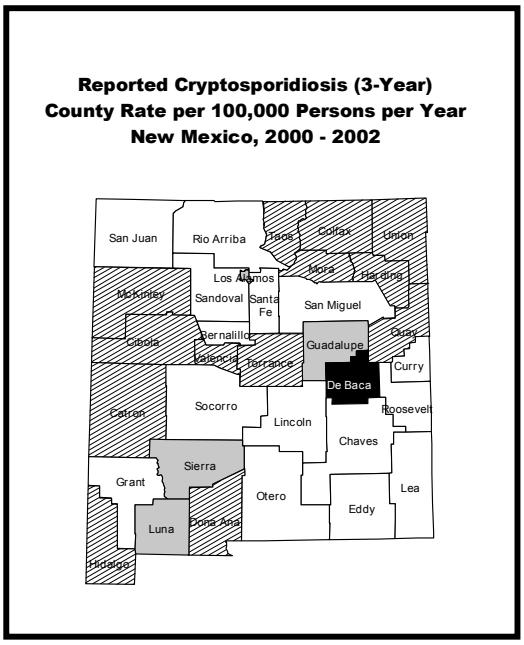
Total reported cases: 20





Special points of interest:

- Cryptosporidiosis has shown a slight decreasing trend, with the exception of a large increase in 1997
- Guadalupe County had the highest rate in 2002
- Cryptosporidiosis is a low incidence disease in NM; most counties reported no cases in 2002

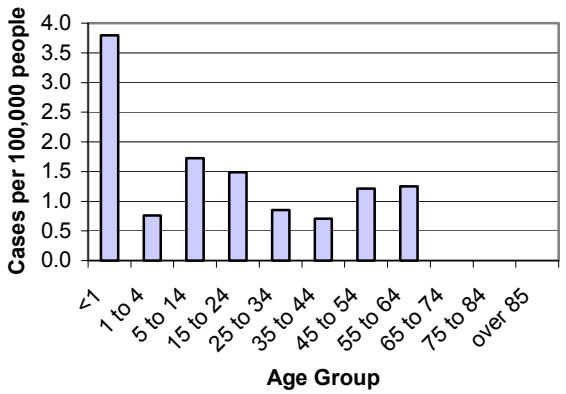


REPORTED CRYPTOSPORIDIOSIS, NEW MEXICO, 2002

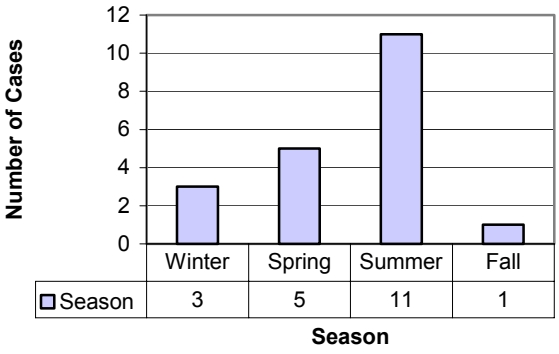
General Case Characteristics & Possible Water Exposures

Total reported cases: 20

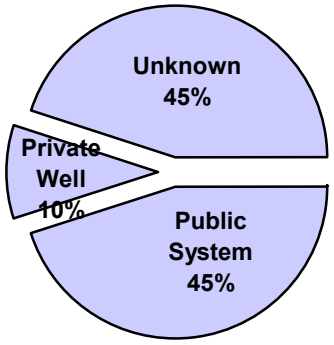
Reported Rates by Agegroup



Season of Onset

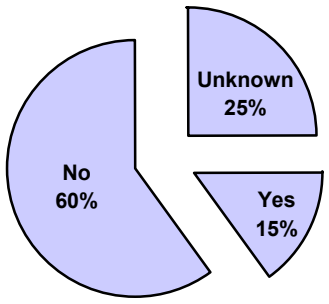


Residential Water Source



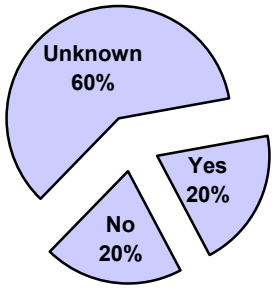
No infections have been causally linked to this risk factor

Recreational Water Exposure



No infections have been causally linked to this risk factor

Potential Sewage Exposure*



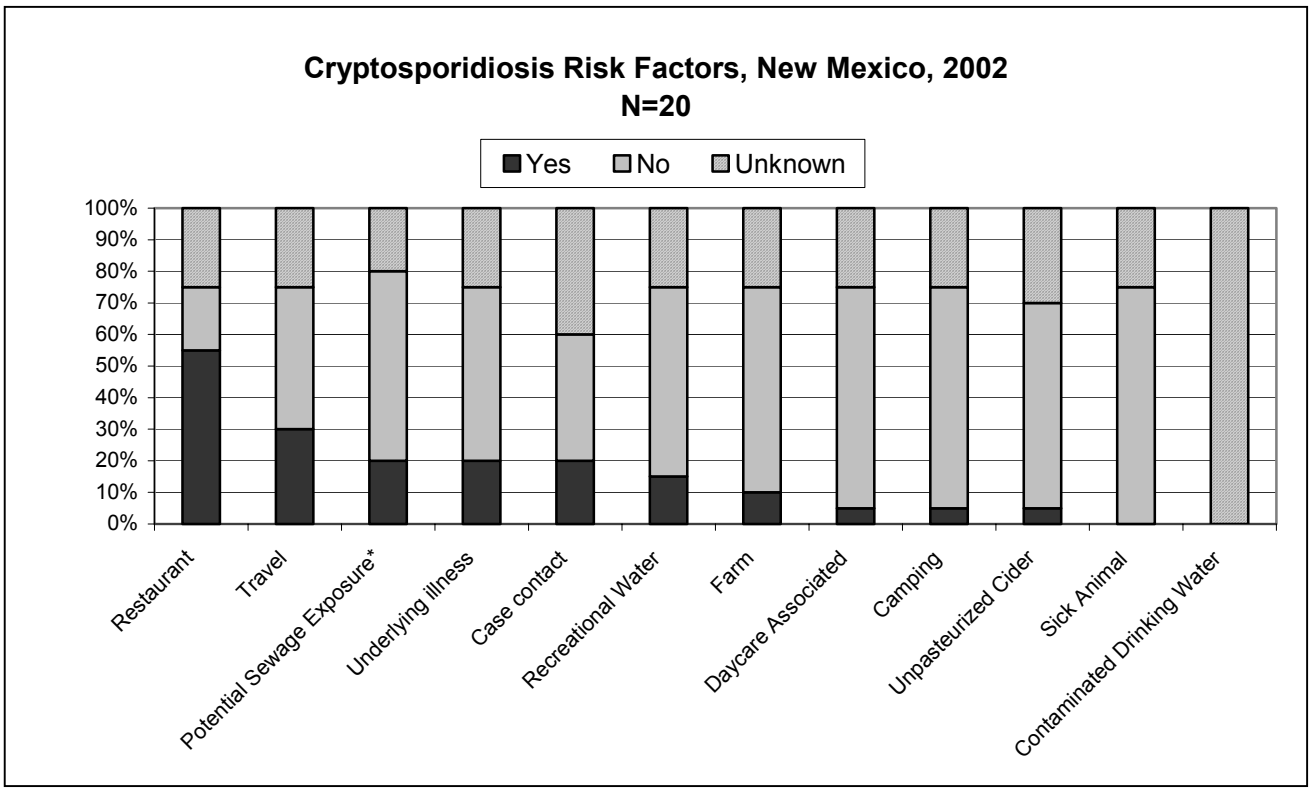
*includes those who report exposure to raw sewage, or have a home septic system or cesspool.

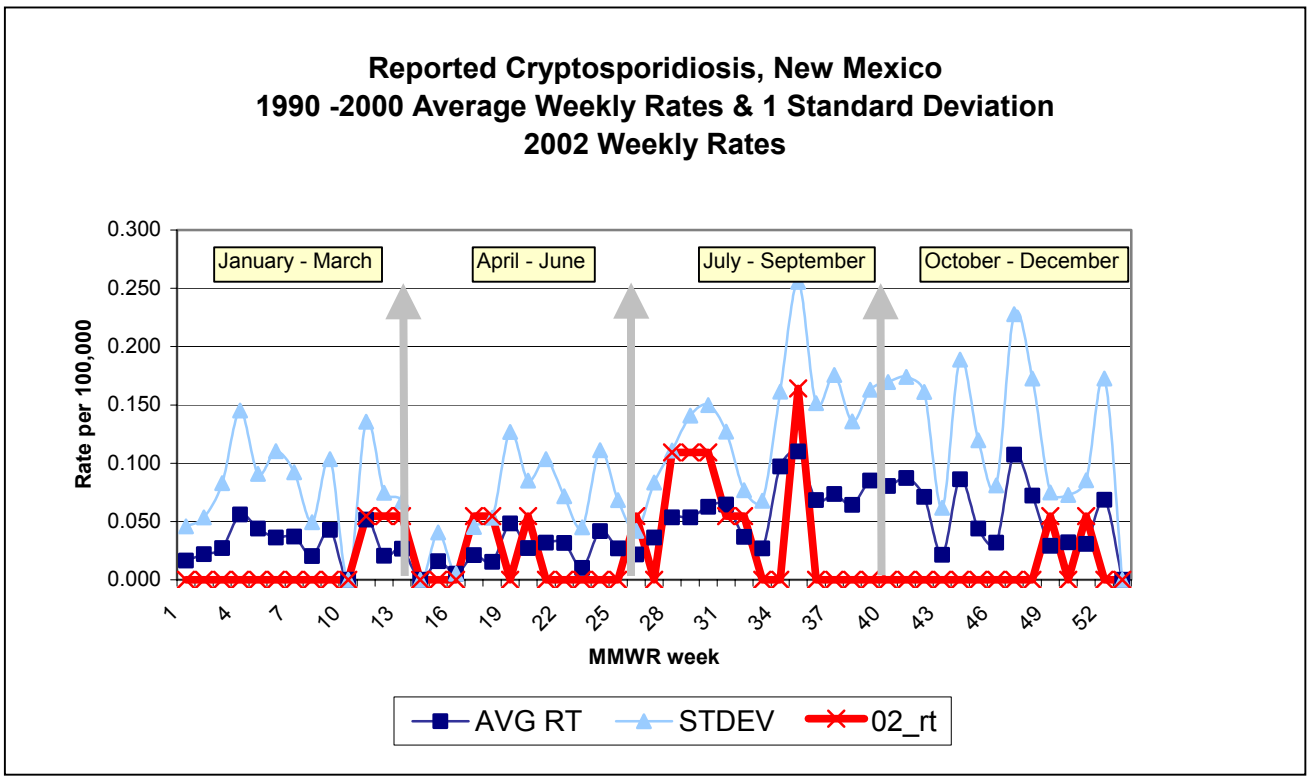
No infections have been causally linked to this risk factor

REPORTED CRYPTOSPORIDIOSIS, NEW MEXICO, 2002

Weekly Surveillance and Risk Factor Information

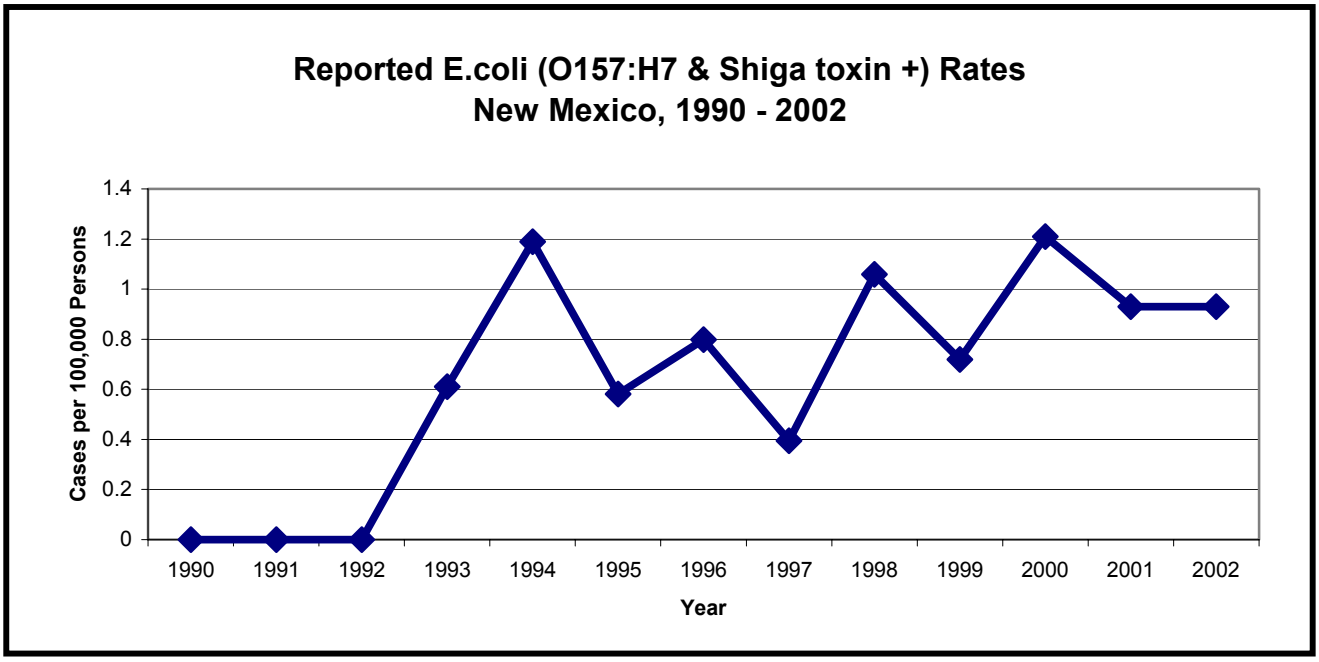
Total reported cases: 20

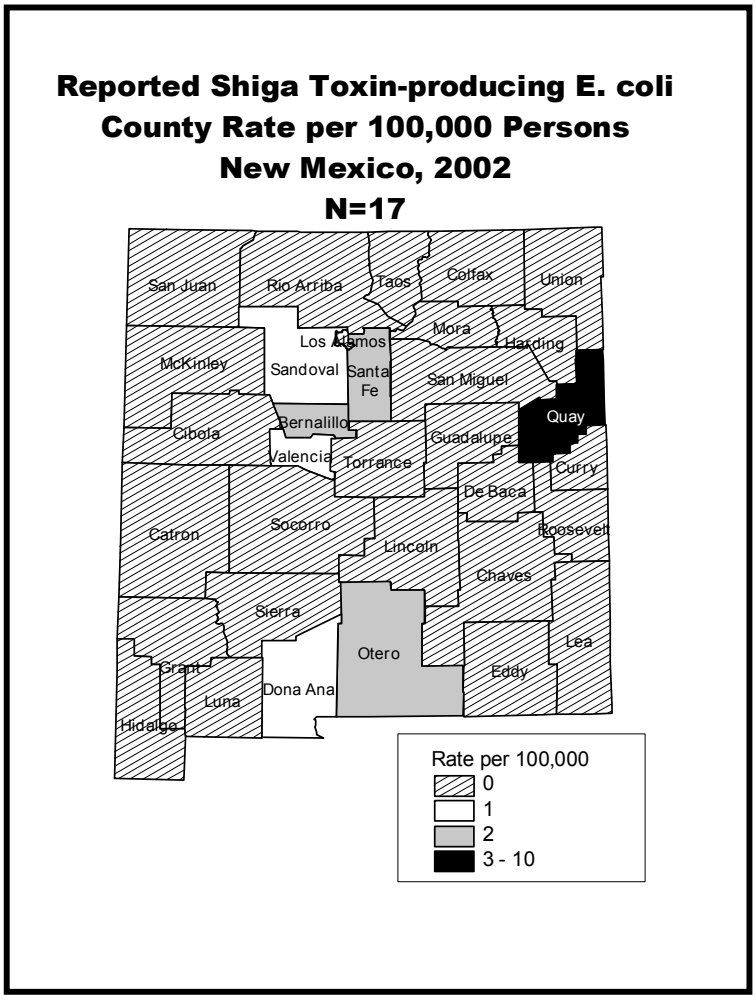




Reported Enterohemorrhagic E. coli (EHEC) in New Mexico, 2002

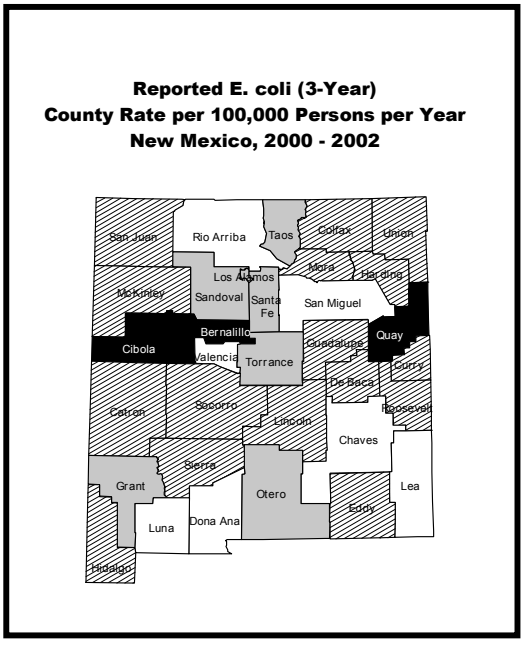
Total reported cases: 17





Special points of interest:

- This disease became reportable in 1993.
- Undercooked meat did not seem to be an important risk factor in 2002.
- Bernalillo, Cibola, and Quay Counties had the highest rates during 2000-2002.

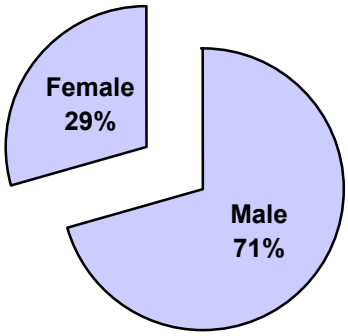


REPORTED ENTEROHEMORRHAGIC E. COLI INFECTION, NM, 2002

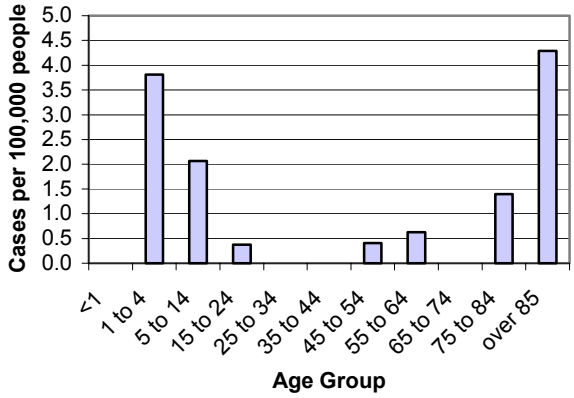
General Case Characteristics & Possible Water Exposures

Total reported cases: 17

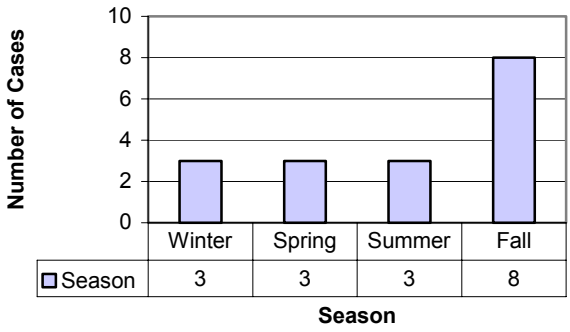
Reported Cases by Gender



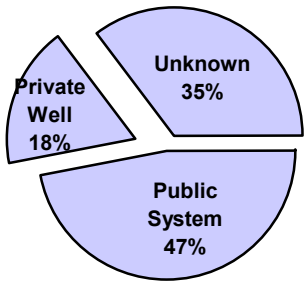
Reported Rates by Agegroup



Season of Onset

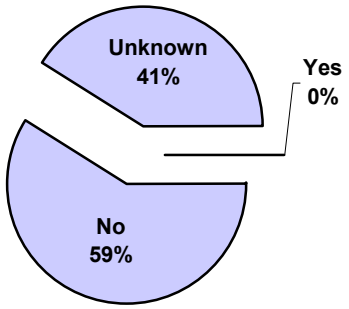


Residential Water Source



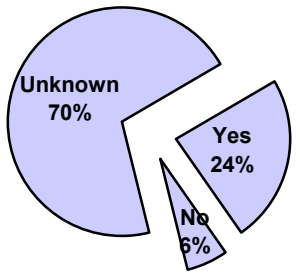
No infections have been causally linked to this risk factor

Recreational Water Exposure



No infections have been causally linked to this risk factor

Potential Sewage Exposure*



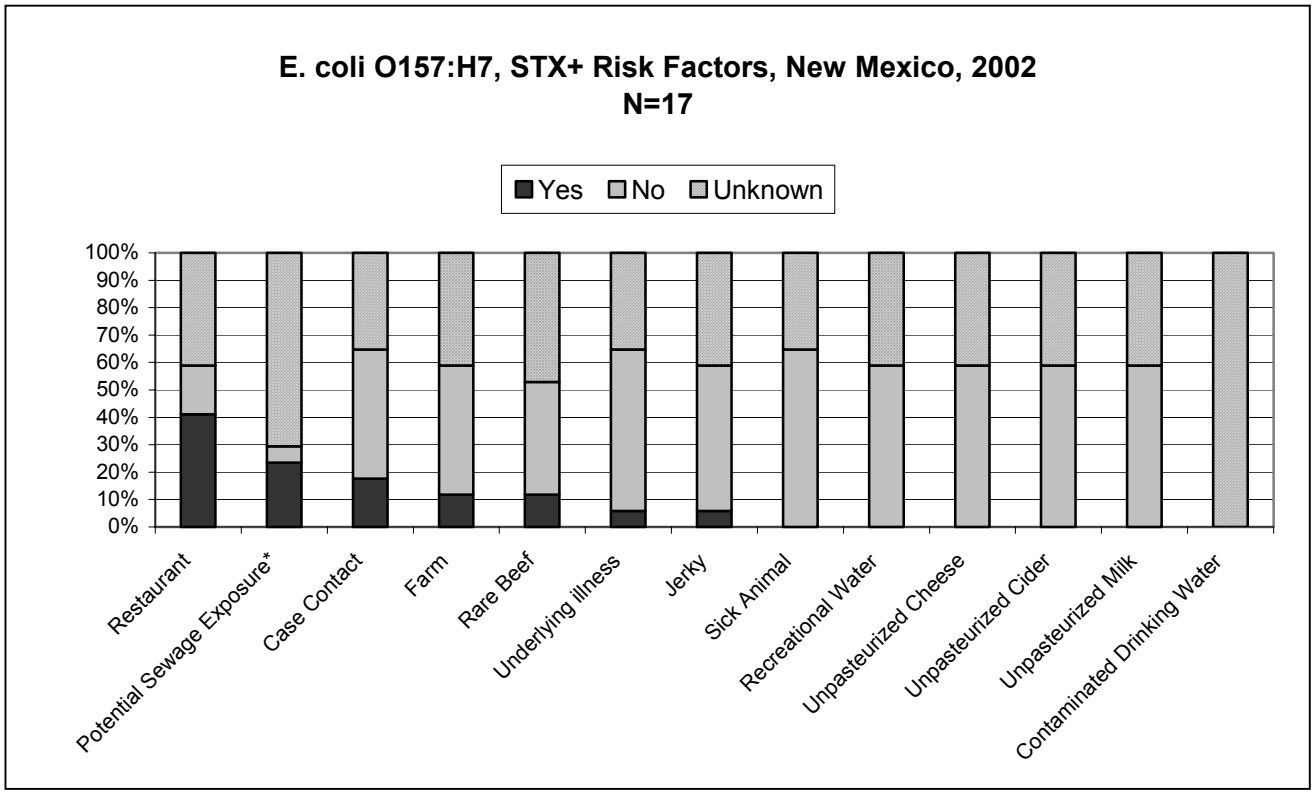
*includes those who report exposure to raw sewage, or have a home septic system or cesspool.

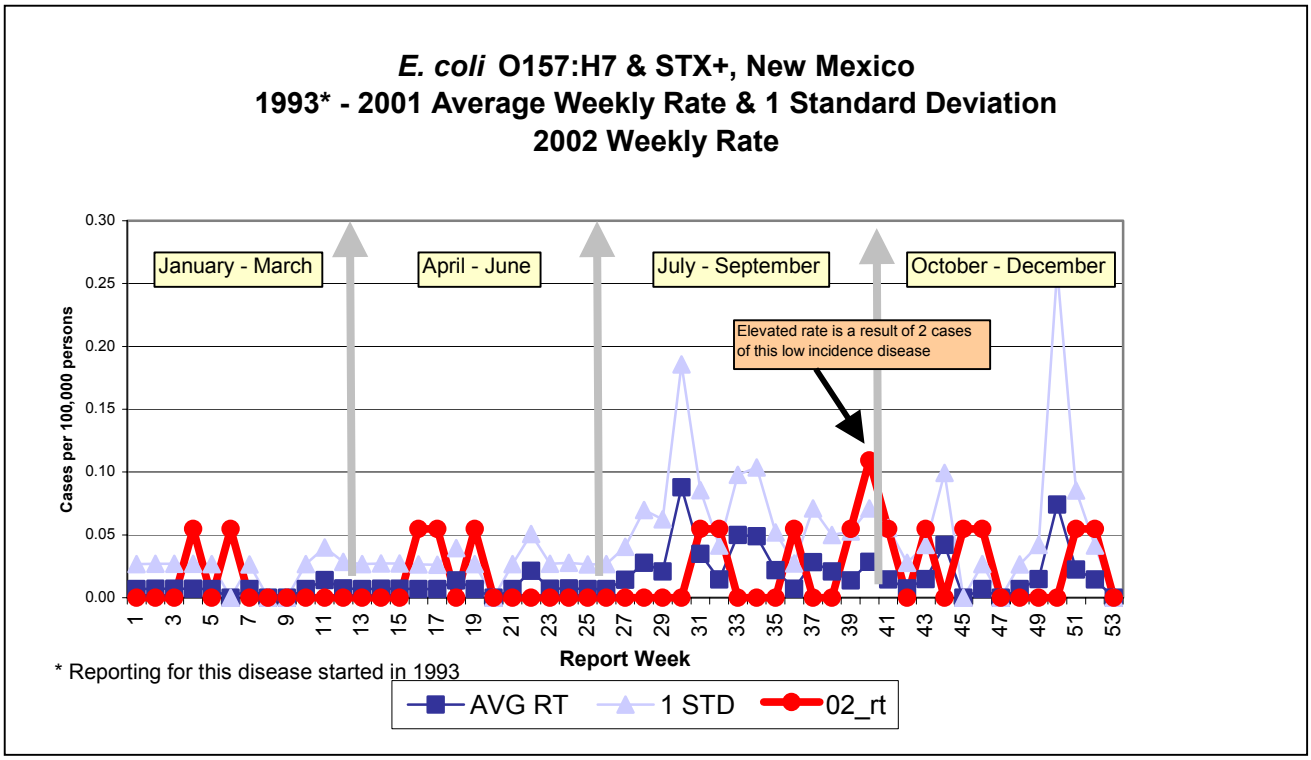
No infections have been causally linked to this risk factor

REPORTED ENTEROHEMORRHAGIC E. COLI, NEW MEXICO, 2002

Weekly Surveillance and Risk Factor Information

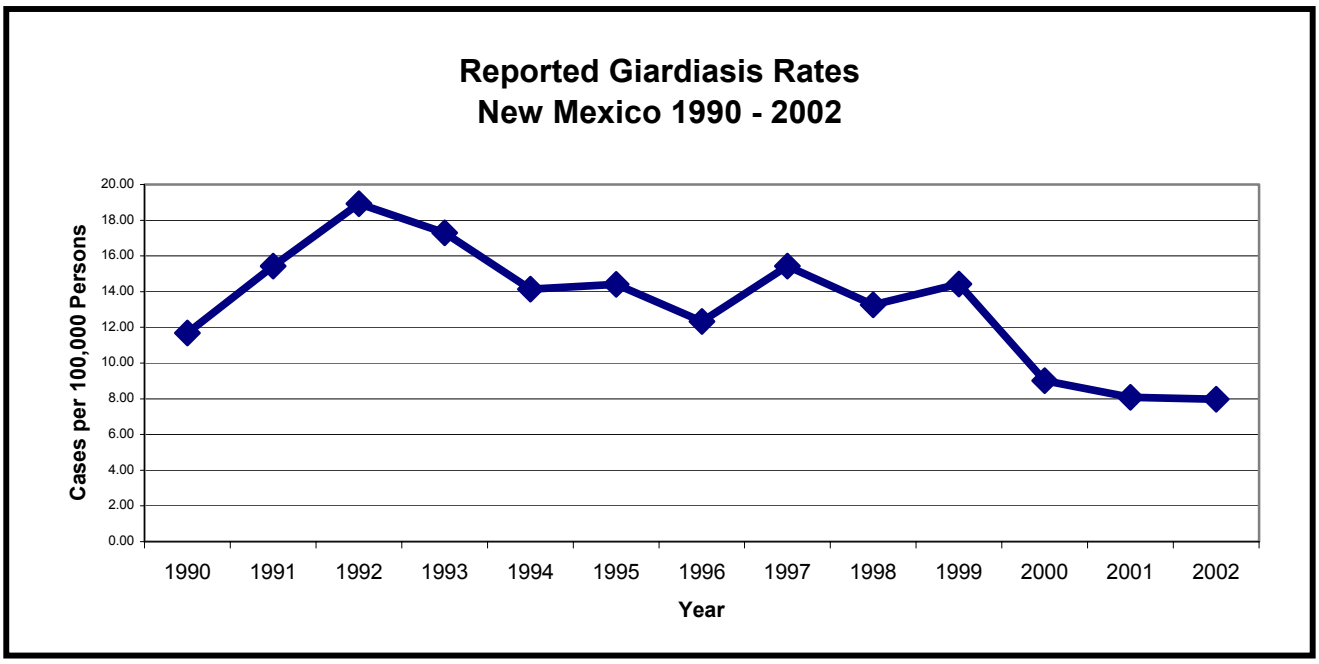
Total reported cases: 17

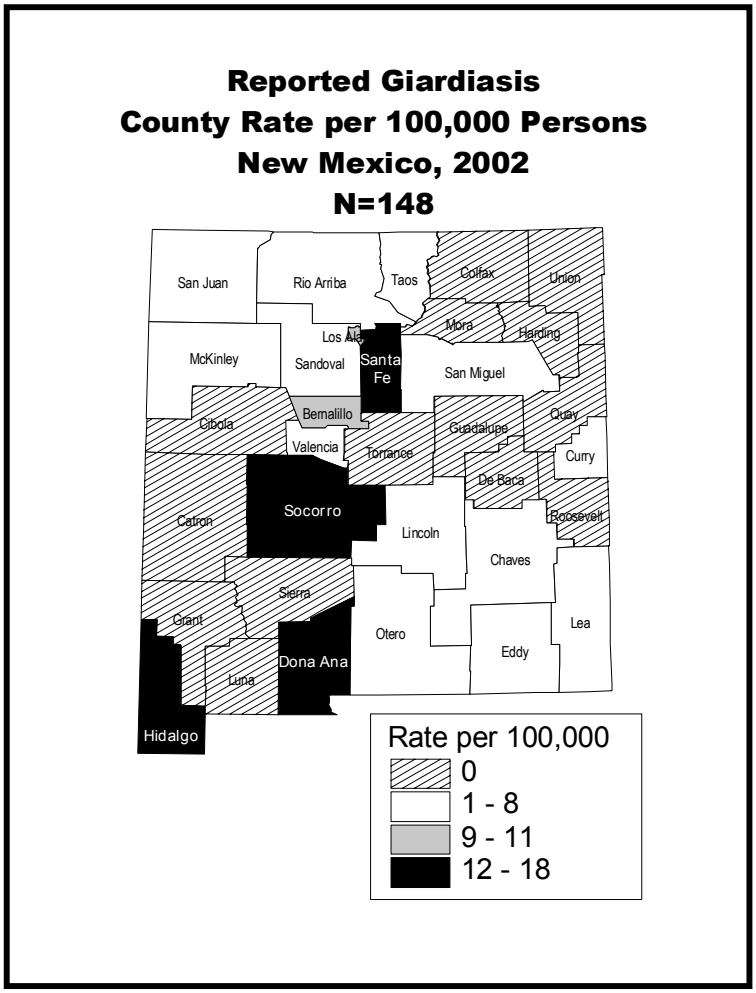




Reported Giardiasis in New Mexico, 2002

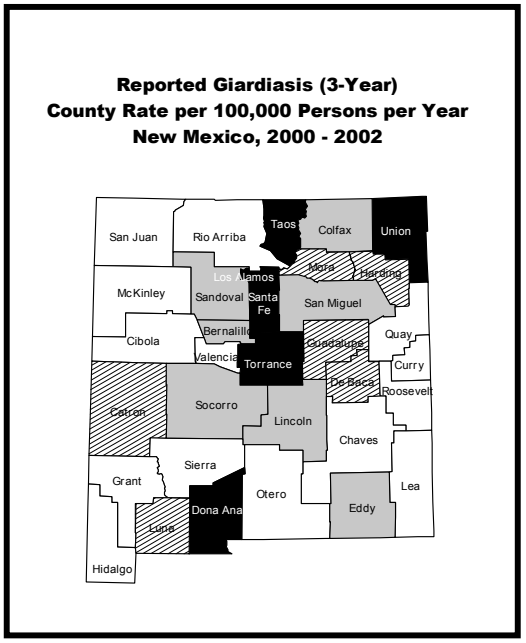
Total reported cases: 148





Special points of interest:

- Reported giardiasis has decreased slightly since 1990
- Four counties had the highest rates in 2002: Santa Fe, Socorro, Dona Ana, & Hidalgo
- Spring & summer were the highest reported onset seasons

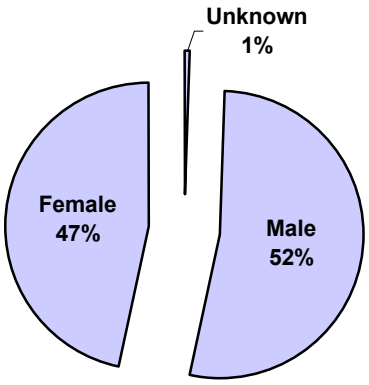


REPORTED GIARDIASIS, NEW MEXICO, 2002

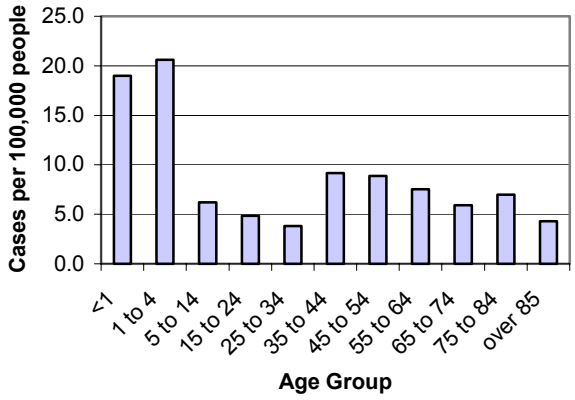
General Case Characteristics & Possible Water Exposures

Total reported cases: 148

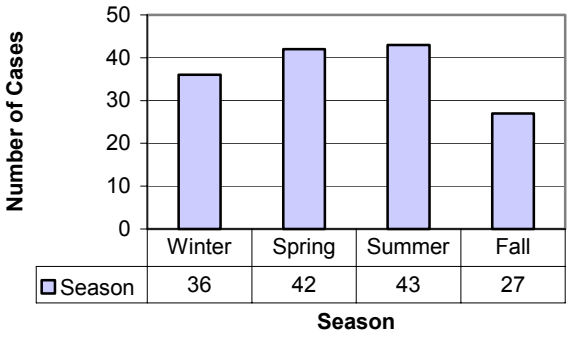
Reported Cases by Gender



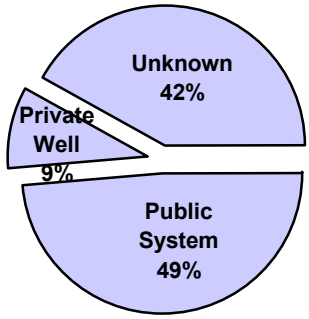
Reported Rates by Agegroup



Season of Onset

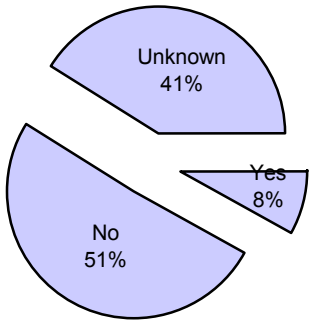


Residential Water Source



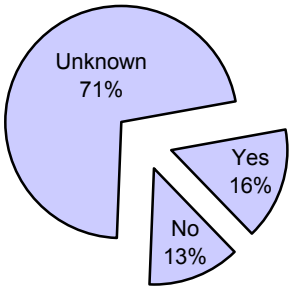
No infections have been causally linked to this risk factor

Recreational Water Exposure



No infections have been causally linked to this risk factor

Potential Sewage Exposure*



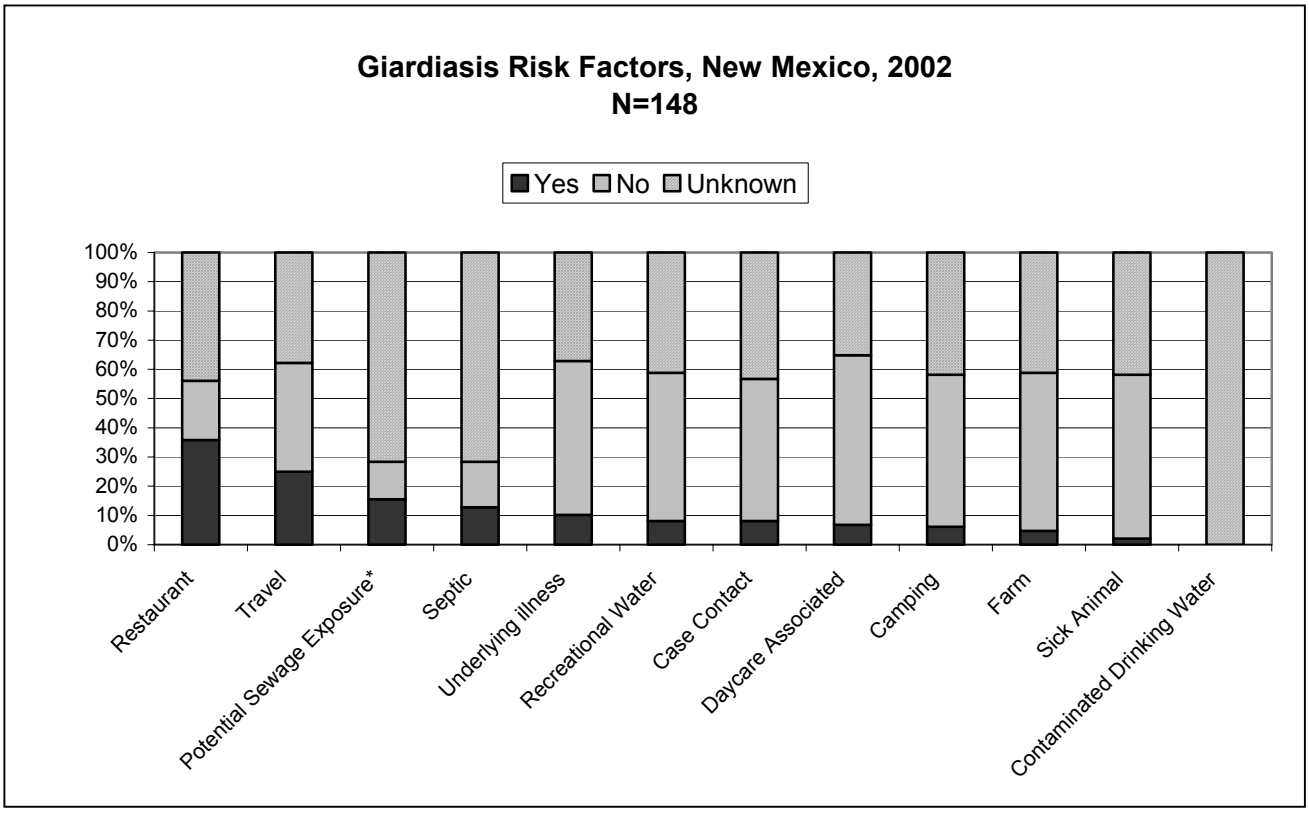
*includes those who report exposure to raw sewage, or have a home septic system or cesspool.

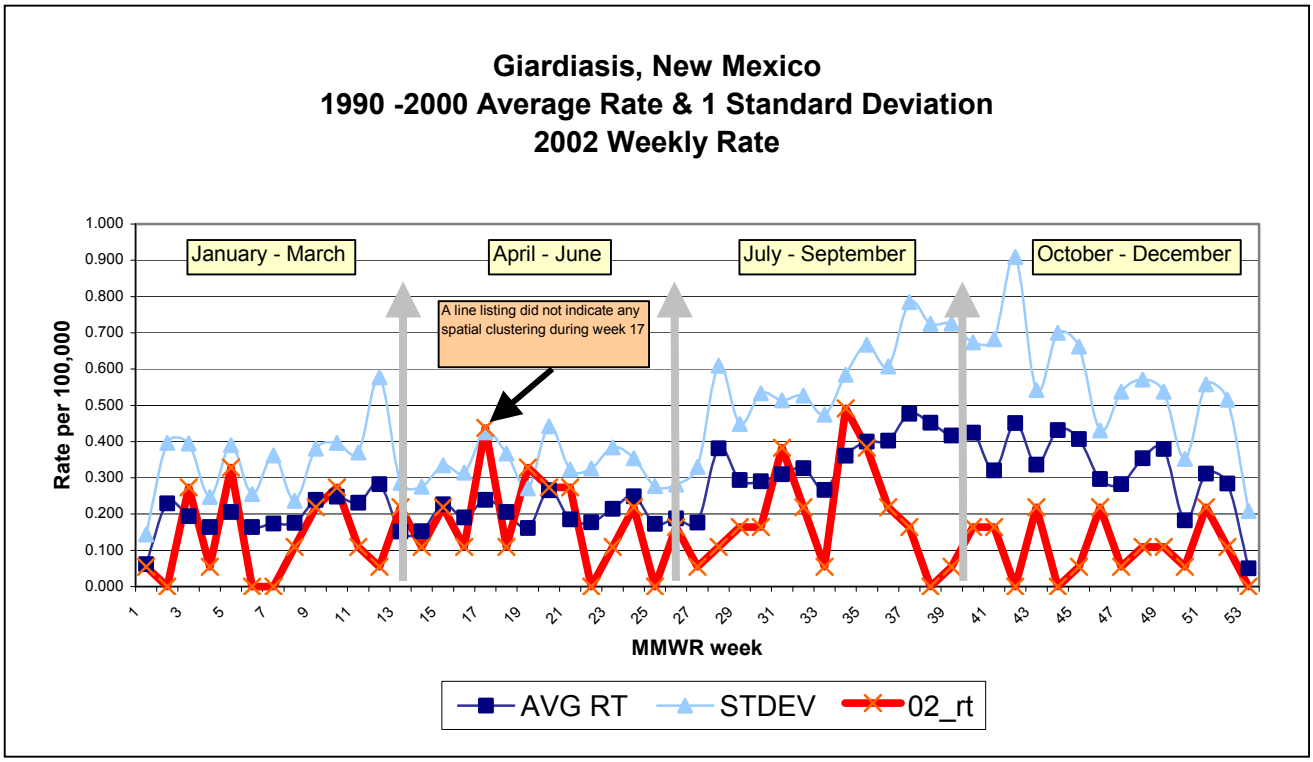
No infections have been causally linked to this risk factor

REPORTED GIARDIASIS, NEW MEXICO, 2002

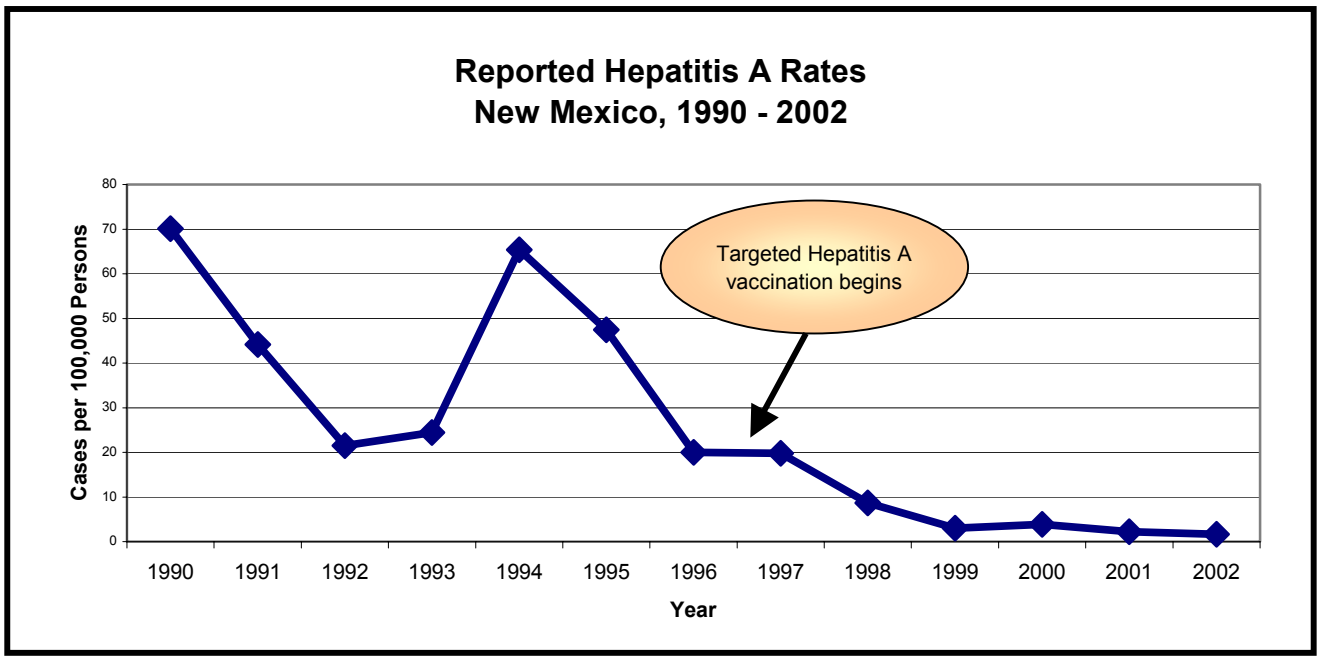
Weekly Surveillance and Risk Factor Information

Total reported cases: 148

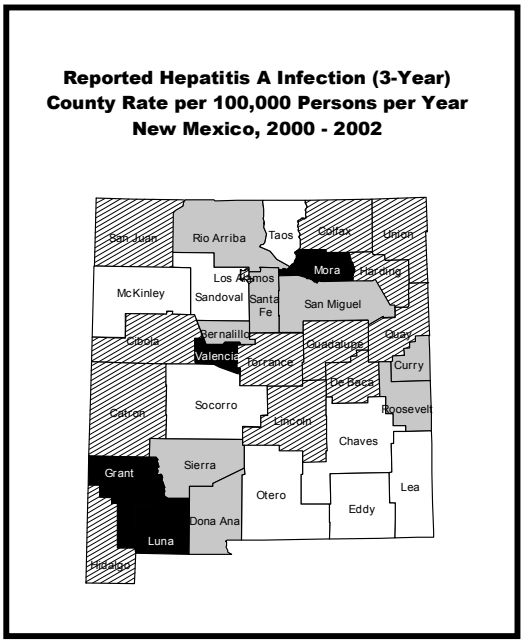




Reported Hepatitis A infection in New Mexico, 2002
Total reported cases: 32



- The NM rate was well above the national rate until 1996, when targeted immunization strategies decreased rates statewide
- Most counties reported no cases in 2002
- Approximately 30% reported international travel

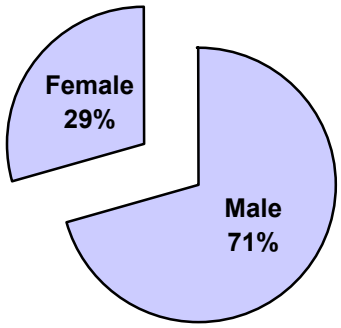


REPORTED HEPATITIS A INFECTION, NEW MEXICO, 2002

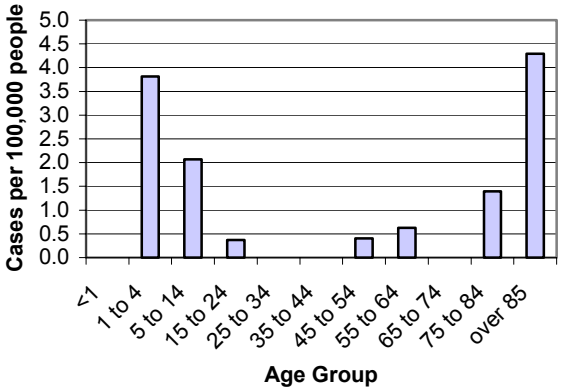
General Case Characteristics & Possible Water Exposures

Total reported cases: 32

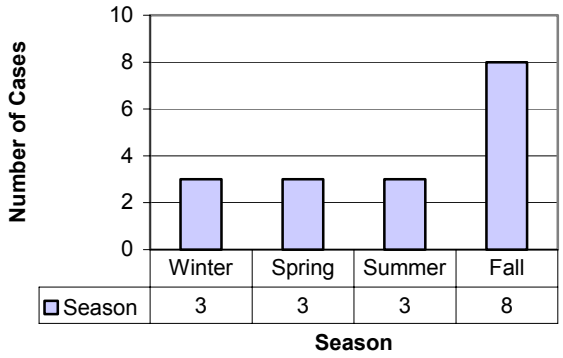
Reported Cases by Gender



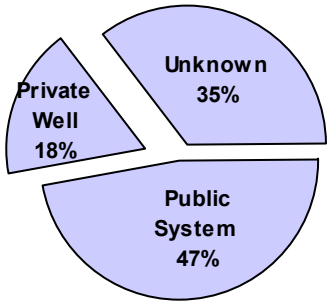
Reported Rates by Agegroup



Season of Onset

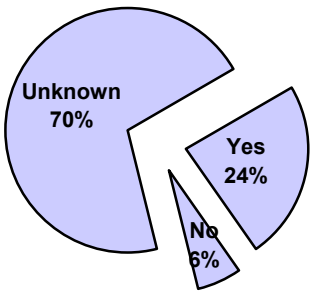


Residential Water Source



No infections have been causally linked to this risk factor

Potential Sewage Exposure*



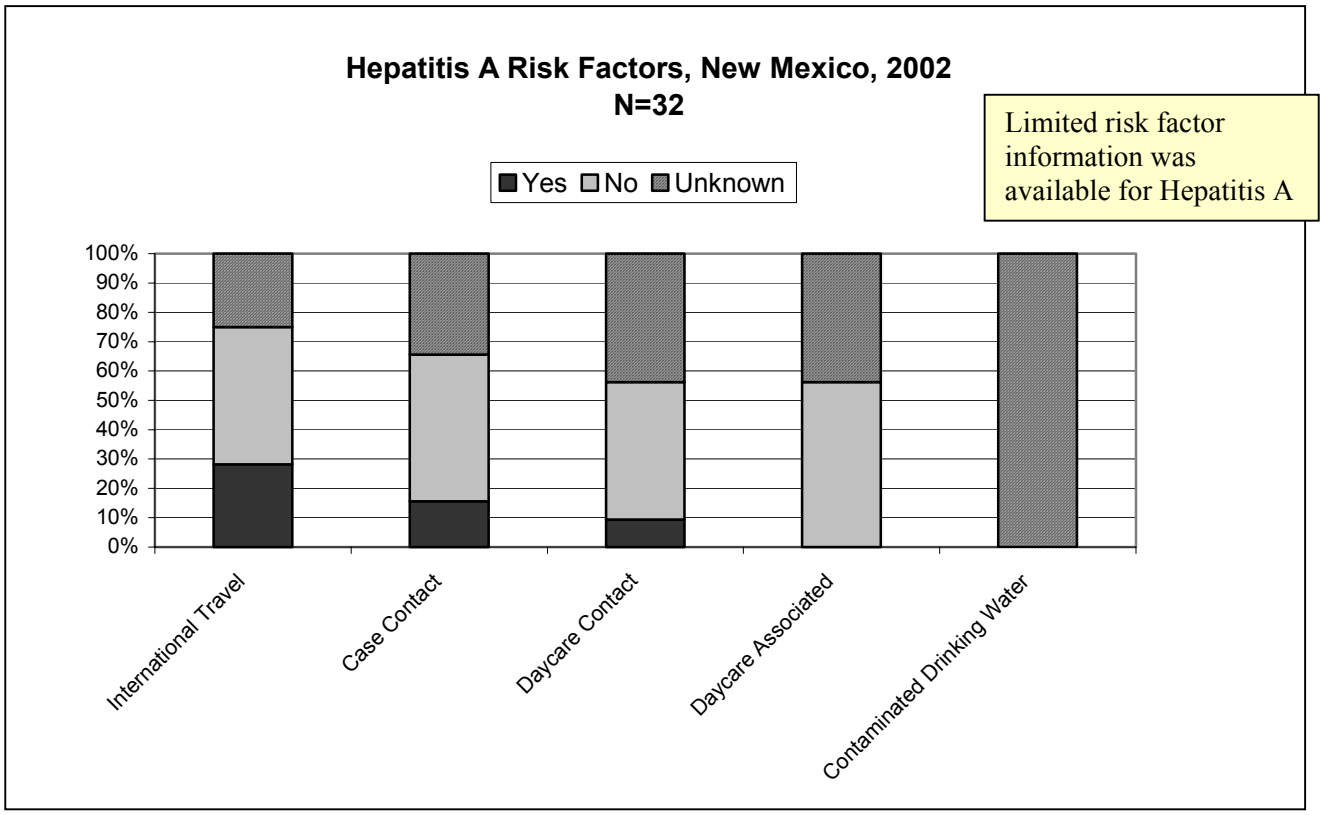
*includes those who report exposure to raw sewage, or have a home septic system or cesspool.

No infections have been causally linked to this risk factor

REPORTED HEPATITIS A INFECTION, NEW MEXICO, 2002

Weekly Surveillance and Risk Factor Information

Total reported cases: 32

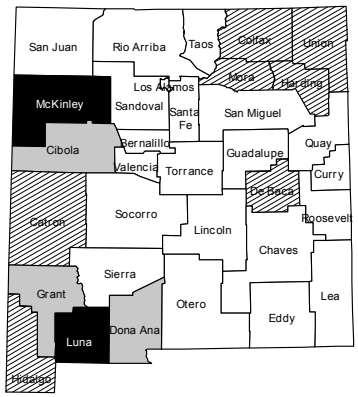


Limited risk factor information was available for Hepatitis A

Reported Shigellosis in New Mexico, 2002

Total reported cases: 243

- The reported Shigellosis trend is relatively stable with the exception of an extreme rate in 1995
- McKinley County seems to be disproportionately affected by shigellosis
- Most infections occurred in fall months

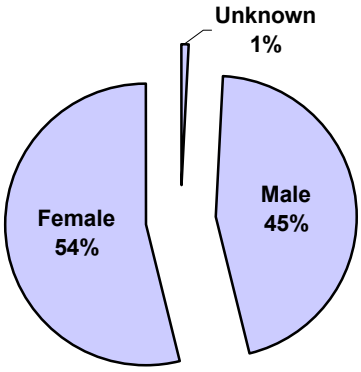


REPORTED SHIGELLOSIS, NEW MEXICO, 2002

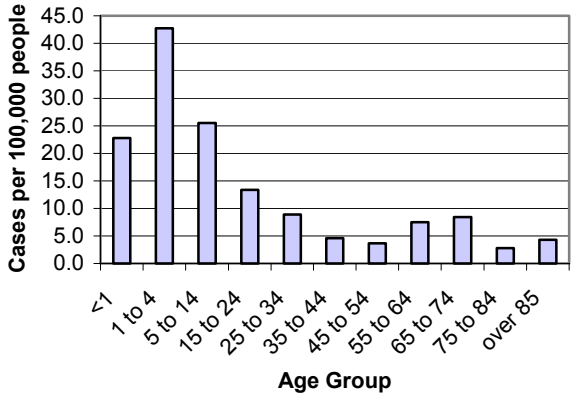
General Case Characteristics & Possible Water Exposures

Total reported cases: 243

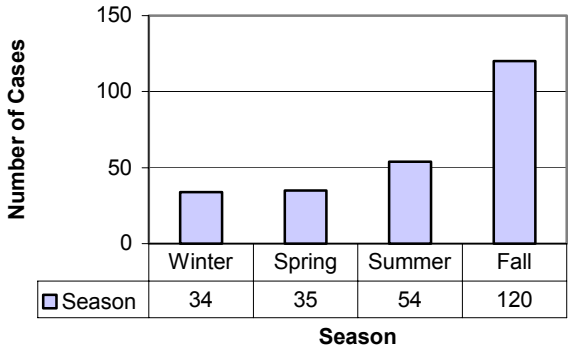
Reported Cases by Gender



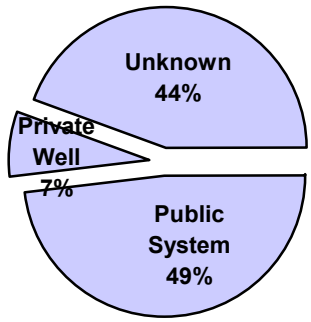
Reported Rates by Agegroup



Season of Onset

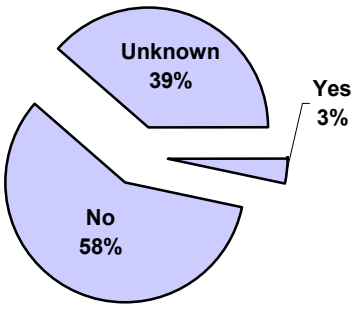


Residential Water Source



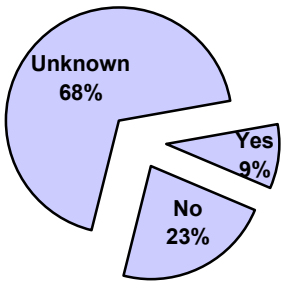
No infections have been causally linked to this risk factor

Recreational Water Exposure



No infections have been causally linked to this risk factor

Potential Sewage Exposure*



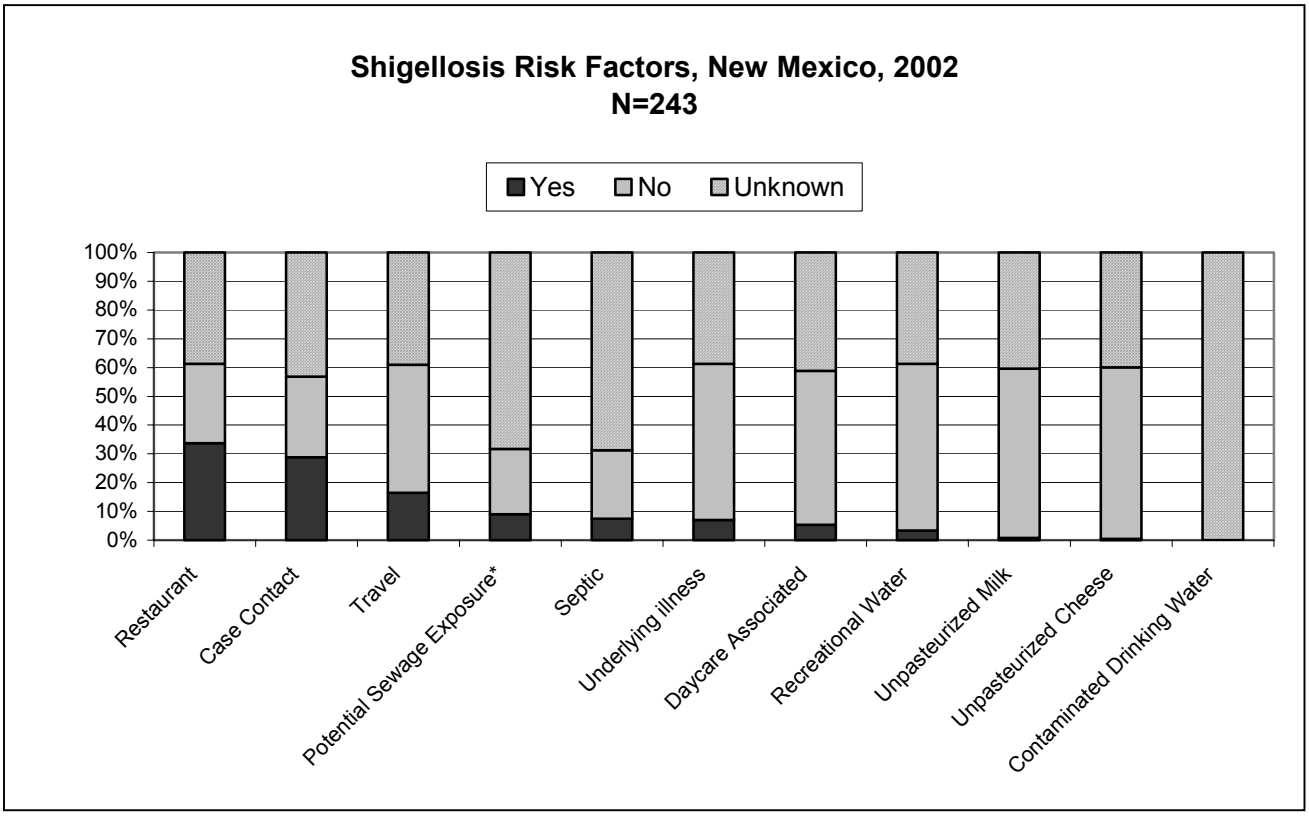
*includes those who report exposure to raw sewage, or have a home septic system or cesspool.

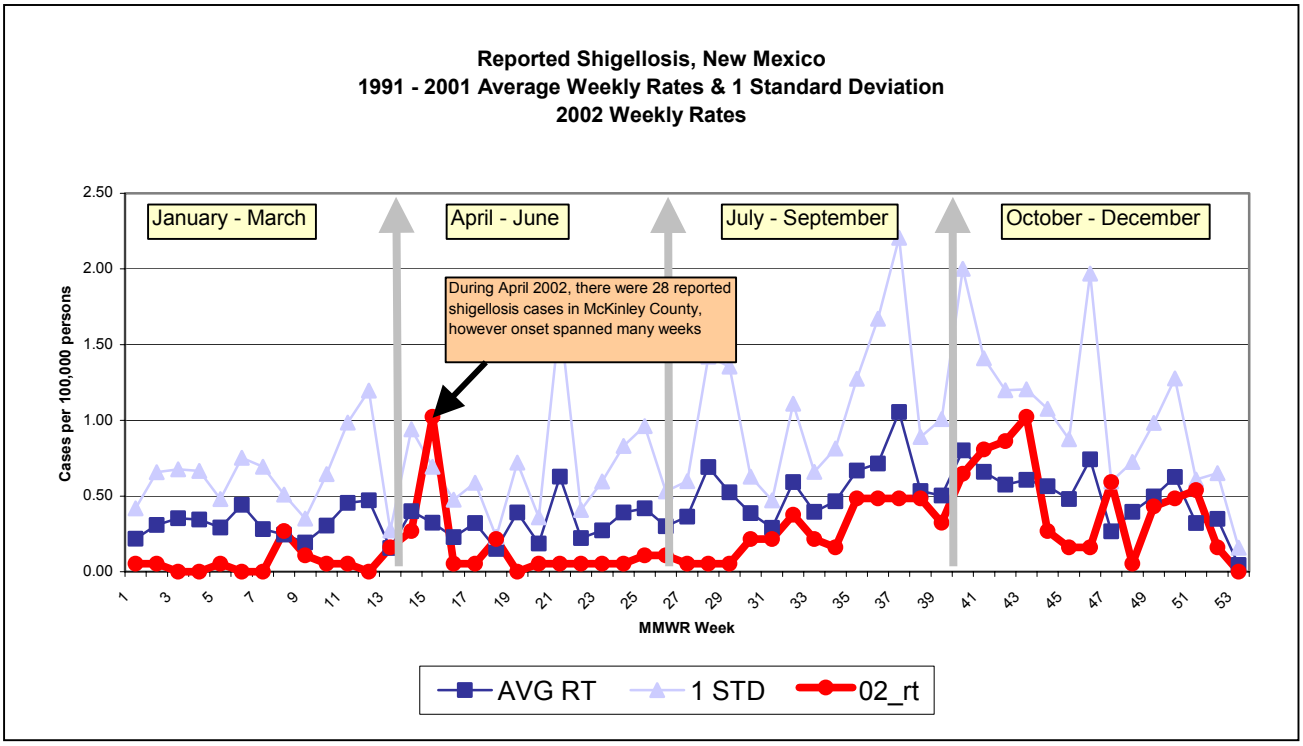
No infections have been causally linked to this risk factor

REPORTED SHIGELLOSIS, NEW MEXICO, 2002

Weekly Surveillance and Risk Factor Information

Total reported cases: 243





APPENDIX 2, FACT SHEETS & PRESENTATIONS