1. Name of the Organism:
Shigella spp. (Shigella sonnei, S. boydii, S. flexneri, and S. dysenteriae)

Shigella are Gram-negative, nonmotile, nonsporeforming rod-shaped bacteria. The illness caused by Shigella (shigellosis) accounts for less than 10% of the reported outbreaks of foodborne illness in this country. Shigella rarely occurs in animals; principally a disease of humans except other primates such as monkeys and chimpanzees. The organism is frequently found in water polluted with human feces.

2. Nature of Acute Disease:
Shigelliosis (bacillary dysentery).

3. Nature of Disease:
CDC Case Definition

Symptoms -- Abdominal pain; cramps; diarrhea; fever; vomiting; blood, pus, or mucus in stools; tenesmus.

Onset time -- 12 to 50 hours.

Infective dose -- As few as 10 cells depending on age and condition of host. The Shigella spp. are highly infectious agents that are transmitted by the fecal-oral route.

The disease is caused when virulent Shigella organisms attach to, and penetrate, epithelial cells of the intestinal mucosa. After invasion, they multiply intracellularly, and spread to contiguous epitheleal cells resulting in tissue destruction. Some strains produce enterotoxin and Shiga toxin (very much like the verotoxin of E. coli O157:H7).

4. Diagnosis of Human Illness:
Serological identification of culture isolated from stool.
5. Associated Foods: Salads (potato, tuna, shrimp, macaroni, and chicken), raw vegetables, milk and dairy products, and poultry. Contamination of these foods is usually through the fecal-oral route. Fecally contaminated water and unsanitary handling by food handlers are the most common causes of contamination.

6. Relative Frequency of Disease: An estimated 300,000 cases of shigellosis occur annually in the U.S. The number attributable to food is unknown, but given the low infectious dose, it is probably substantial.

7. Course of Disease and Complications: Infections are associated with mucosal ulceration, rectal bleeding, drastic dehydration; fatality may be as high as 10-15% with some strains. Reiter's disease, reactive arthritis, and hemolytic uremic syndrome are possible sequelae that have been reported in the aftermath of shigellosis.
8. **Target Populations:**

Infants, the elderly, and the infirm are susceptible to the severest symptoms of disease, but all humans are susceptible to some degree. Shigellosis is a very common malady suffered by individuals with acquired immune deficiency syndrome (AIDS) and AIDS-related complex, as well as non-AIDS homosexual men.

9. **Food Analysis:**

Organisms are difficult to demonstrate in foods because methods are not developed or are insensitive. A genetic probe to the virulence plasmid has been developed by FDA and is currently under field test. However, the isolation procedures are still poor.

10. **Selected Outbreaks:**

*Literature references can be found at the links below.*

**MMWR 48(14):1999**

In August 1998, the Minnesota Department of Health reported to CDC two restaurant-associated outbreaks of *Shigella sonnei* infections. Isolates from both outbreaks had two closely related pulsed-field gel electrophoresis (PFGE) patterns that differed only by a single band. Epidemiologic investigations implicated chopped, uncooked, curly parsley as the common vehicle for these outbreaks.

**MMWR 45(11):1996**

On August 20, 1995, the District 7 Health Department requested the Idaho Department of Health to assist in investigating reports of diarrheal illness among visitors to a resort in Island Park in eastern Idaho; *Shigella sonnei* had been isolated from stool cultures of some cases. This report summarizes the findings of the investigation, which implicated contaminated drinking water as the cause of the outbreak.

**MMWR 43(35):1994**

During August 29-September 1, 1994, an outbreak of gastrointestinal illness occurred on the cruise ship Viking Serenade (Royal Caribbean Cruises, Ltd.) during its roundtrip voyage from San Pedro, California, to Ensenada, Mexico. A total of 37% of passengers and 4% of the crew who completed a survey questionnaire reported having diarrhea or vomiting during the cruise. One death occurred. Investigation of the mode of transmission is under way.

**MMWR 41(25):1992**

In January 1991, the Lexington-Fayette County (Kentucky) Health Department (LFCHD) received three reports of *Shigella sonnei* infections from the University of Kentucky microbiology laboratory. The infections occurred in children.
aged 2-3 years, each of whom attended a different child day
care center in Lexington-Fayette County (population:200,000).

**MMWR 40(25):1991**

On March 14, 1991, physicians at a hospital in Guatemala City reported to the Institute of Nutrition of Central America and Panama (INCAP) that a 2-year-old boy living in an orphanage in Guatemala City had been hospitalized with dysentery. Another child from the orphanage had recently died from dysentery. During March 18-21, two other young children from the orphanage were diagnosed with *Shigella dysenteriae* type 1. On March 21, health officials in Rabinal, in the department of Baja Verapaz, reported more than 100 cases of dysentery to the Division of Epidemiology and Disease Control of the Ministry of Health (MOH).

**MMWR 39(30):1990**

From 1986 to 1988*, the reported isolation rate of *Shigella* in the United States increased from 5.4 to 10.1 isolates per 100,000 persons. In addition to the increase in *Shigella* isolation rates, many communitywide shigellosis outbreaks that have been difficult to control have been reported. This report describes four community outbreaks of shigellosis during 1986-1989 in which innovative public health control measures were used.

**MMWR 37(31):1988**

From January 1 to August 1, 1988, 17 cases of diarrheal disease caused by *Shigella dysenteriae* type 1 (*Shiga bacillus*) were reported to CDC. Three cases were reported to CDC during the same period in 1987. Fifteen of the patients with shigellosis had visited Cancun, Mexico, and two had visited other areas in Mexico in the weeks before or during onset of their illness. The patients had no common exposures in hotels or restaurants. An epidemiologic and laboratory investigation is under way in Mexico.

In 1988, numerous individuals contracted shigellosis from food consumed aboard Northwest Airlines flights; food on these flights had been prepared in one central commissary. No specific food item was implicated, but various sandwiches were suspected.

**MMWR 36(38):1987**

In early July 1987, an outbreak of multiply resistant *Shigella sonnei* gastroenteritis occurred among persons who attended the annual Rainbow Family gathering in North Carolina. Since that time, four clusters of gastroenteritis due to multiply resistant *S. sonnei* have been reported among persons who had no apparent contact with gathering attendees. Basic hygiene and sanitary precautions remain the cornerstones of control measures for shigellosis outbreaks, including those due to multiply resistant strains. Vigorous emphasis on handwashing
with soap after defecation and before eating has been shown to reduce secondary transmission of shigellosis.

**MMWR 36(27):1987**

CDC has received reports that shigellosis outbreaks have occurred in several states, affecting related religious communities. Dates of onset range from November 1986 through June 1987. The largest outbreak was in New York City, and outbreaks in other states began soon after the Passover holiday in April, when many persons visited relatives in New York. Epidemiologic data are incomplete, but in some of these outbreaks new cases continue to occur.

**MMWR 35(48):1986**

Between October 10 and November 6, 1985, 15 children at a day-care center in Diboll, Texas, developed a diarrheal illness. *Shigella sonnei* was isolated from 10 ill children and from two of 19 asymptomatic children who were cultured on November 7. All isolates were colicin type 9, resistant to ampicillin, carbenicillin, streptomycin, cephalothin, and trimethoprim/sulfamethoxazole (TMP/SMX), and sensitive to tetracycline, nalidixic acid, chloramphenicol, and gentamicin. The attack rate was highest among the 12- to 22-month-old group. Family members of this group had the highest secondary attack rate. No cases occurred among the 22 staff members.

In 1985-1986, several outbreaks of shigellosis occurred on college campuses, usually associated with fresh vegetables from the salad bar. Usually an ill food service worker was shown to be the cause.

In 1985, a huge outbreak of foodborne shigellosis occurred in Midland-Odessa, Texas, involving perhaps as many as 5,000 persons. The implicated food was chopped, bagged lettuce, prepared in a central location for a Mexican restaurant chain. FDA research subsequently showed that *S. sonnei*, the isolate from the lettuce, could survive in chopped lettuce under refrigeration, and the lettuce remained fresh and appeared to be quite edible.

**MMWR 34(39):1985**

In 1984, 12,790 Shigella isolates from humans were reported to CDC. This is a 14.4% decrease from the 14,946 isolates reported in 1983. The number of isolates continues to be less than the 15,334 reported during the peak year, 1978.

**MMWR 33(43):1984**

In 1983, 14,946 Shigella isolates from humans were reported to CDC. This is a 10.5% increase from the 13,523 isolates reported in 1982. The number of isolates is still less than the 15,334 reported during the peak year, 1978.
**NOTE** - Although all Shigella spp. have been implicated in foodborne outbreaks at some time, *S. sonnei* is clearly the leading cause of shigellosis from food. The other species are more closely associated with contaminated water. One in particular, *S. flexneri*, is now thought to be in large part sexually transmitted.

For more information on recent outbreaks see the CDC.

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| MMWR 32(34):1983 | In 1982, 13,523 Shigella isolations from humans were reported to CDC. This represents a 9.9% decrease from the 15,006 isolations reported in 1981. The number of isolations has continued to decline from the 15,334 reported during the peak year, 1978. |
| MMWR 32(19):1983 | An outbreak of severe dysentery caused by *Shigella dysenteriae* type 2 recently occurred at the U.S. Naval Hospital, Bethesda, Maryland. Epidemiologic investigation implicated the salad bar in the active-duty staff cafeteria as the source of infection. |
| MMWR 31(50):1982 | In 1981, 15,006 Shigella isolations from humans were reported to CDC. While this represented a 6% increase over the 14,168 isolates reported in 1980, it remained 2% below the 15,334 reported during the peak year, 1978. |

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### 11. Education and Background Resources:

- **Loci index for genome** *Shigella spp.*
- **Shigelllosis FAQ's from the CDC.**

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**Literature references can be found at the links below.**

**CDC/MMWR**

The CDC/MMWR link will provide a list of Morbidity and Mortality Weekly Reports at CDC relating to this organism or toxin. The date shown is the date the item was posted on the Web, not the date of the MMWR. The summary statement shown are the initial words of the overall document. The specific article of interest may be just one article or item within the overall report.

**NIH/PubMed**
The NIH/PubMed button at the top of the page will provide a list of research abstracts contained in the National Library of Medicine's MEDLINE database for this organism or toxin.

**AGRICOLA**
The AGRICOLA button will provide a list of research abstracts contained in the National Agricultural Library database for this organism or toxin.

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January 1992 with periodic updates