

# Preventing Foodborne and Enteric Illnesses Among At-Risk Populations in the United States and Rhode Island

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## ABSTRACT

One out of every six people in the United States is estimated to become sick each year from pathogens that can cause foodborne illness. The groups at greatest risk for serious illness, hospitalization, or death include young children, older adults, people with chronic conditions, and pregnant women. Such health disparities must be considered along with those disparities that may exist among racial and ethnic groups and among groups of varying socioeconomic status. We analyzed risk profiles for enteric disease using data from Rhode Island and the nation as a whole, exploring disparities among groups defined by demographic and health characteristics. As expected, disparities in the burden of enteric illnesses are not limited to racial or ethnic differences in disease burden, or in differences otherwise attributable to socioeconomic status. Age is an especially important determinant of risk, as is residential status. Other groups found to be especially vulnerable to foodborne and enteric illnesses in Rhode Island include pregnant women and those with certain health conditions (e.g., cancer, liver disease or immunosuppression). By understanding what groups are at increased risk, providers can more effectively counsel their patients to mitigate risk and effectively treat these conditions.

**KEYWORDS:** foodborne diseases, disparities, Rhode Island

## INTRODUCTION

The Centers for Disease Control and Prevention (CDC) estimates that each year in the U.S. one in six people become sick from a foodborne pathogen, which equates to approximately 48 million illnesses, 128,000 hospitalizations, and 3,000 deaths annually.<sup>1</sup> Although everyone is susceptible to foodborne and other enteric illness, certain groups are more susceptible and are also likely to suffer more serious illnesses, hospitalizations, and death. These highest risk individuals include young children, older adults, people with weakened immune systems, and pregnant women. When considering health disparities with regard to foodborne and enteric illnesses, these at-risk groups are important to consider along with disparities that may exist due to differences in race, ethnicity, and socioeconomic status. This paper will

discuss these at-risk groups using national and Rhode Island data and provide recommendations aimed at preventing and diagnosing enteric illness among these and other groups.

## DISPARITIES DUE TO AGE AND WEAKENED IMMUNE SYSTEMS

Research suggests that the most important disparities in foodborne illness burden relate to differences in age and immune health. Young children are at risk for foodborne and enteric illnesses because of developing immune systems. Similarly, older individuals are at risk because of weakening immune systems, chronic conditions, and because bacteria remain in their gastrointestinal tracks for longer periods of time. (Many older individuals are on protein pump inhibitors that reduce stomach acid, allowing organisms to escape destruction from gastric acid, leading to bacterial overload in the lower gut.) Conversely, increased antibiotic pressure both in hospital and community environments leads to elimination of healthy enteric flora and overgrowth of deadly enteric pathogens such as *Clostridium Difficile*. Disparities in foodborne illness burden related to differences in age and immune health are revealed in both national and Rhode Island data.

The Foodborne Diseases Active Surveillance Network (FoodNet) monitors national trends in foodborne illness over time and attributes illnesses to specific foods and settings. The surveillance area covers 15% of the U.S. population (48 million people) and monitors trends in *Campylobacter*, *Cryptosporidium*, *Cyclospora*, *Listeria*, *Salmonella*, Shiga toxin-producing *Escherichia coli* (STEC), *Shigella*, *Vibrio*, and *Yersinia*.<sup>2</sup> Data from the most recently published FoodNet annual report states that the incidence of foodborne disease is highest among children under 5 years of age for all pathogens except for *Listeria*, *Vibrio*, and *Cyclospora*, where the highest incidence rates are seen among people older than 65 years of age.<sup>3</sup>

In Rhode Island, the average rate of listeriosis between 2010 and 2014 was 0.4 cases per 100,000 people, but the rate was higher among children less than 5 years of age (1.7/100,000) and highest among people who were 80 years of age or older (3.1/100,000). (See Figure 1).

Analysis of the 22 listeria cases reported in Rhode Island from 2010–2014 further illustrates these disparities. Of the 22 cases reported over this five-year time period, 5 (23%)

cases were newborns or pregnant females, 9 (41%) were cases with existing health conditions (cancer, liver disease or immunosuppression—conditions that increase the severity of listeria infection), and the remaining 8 (36%) cases were older adults ranging in age from 72 to 90 years.

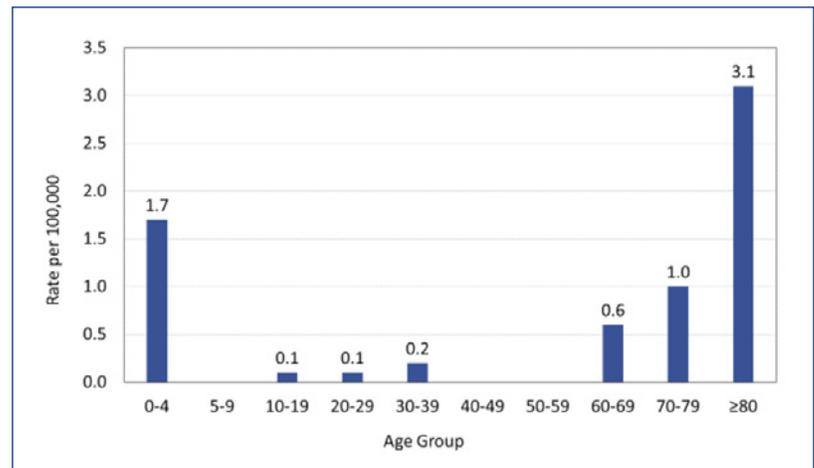
Age-specific rate disparities are also observable in 2014 Rhode Island Salmonella data. Although the overall Salmonellosis incidence rate was 13.3 cases per 100,000 people, the rate was higher among older adults and highest among children less than 5 years of age (34.8/100,000). (See Figure 2.) These disparities are consistent with disparities observable in national data. In addition to being at increased risk from foodborne infectious disease exposures because of developing immune systems, young children are *especially* vulnerable to salmonella infections from livestock or reptile exposure. The reasons for this phenomenon are multifactorial, including immature immune systems, household contamination events, overcrowded dwellings, and inadequate hygienic practices. In 2014, 27% of Rhode Island salmonellosis cases under 5 years of age were reported to have had an exposure to livestock prior to their illness onset.

The burden of norovirus on the very young, the elderly, and immunocompromised people is also higher than among other people in the general population. Norovirus is the leading cause of acute gastroenteritis and foodborne illness in the U.S., with over 14,000 estimated annual hospitalizations nationally, mostly among young children and elders.<sup>1</sup> In the U.S. from 2009 through 2012, noroviruses accounted for over 48% of foodborne outbreaks. In Rhode Island from 2010 through 2014, 39% of foodborne outbreaks were suspected or confirmed to have been caused by norovirus.

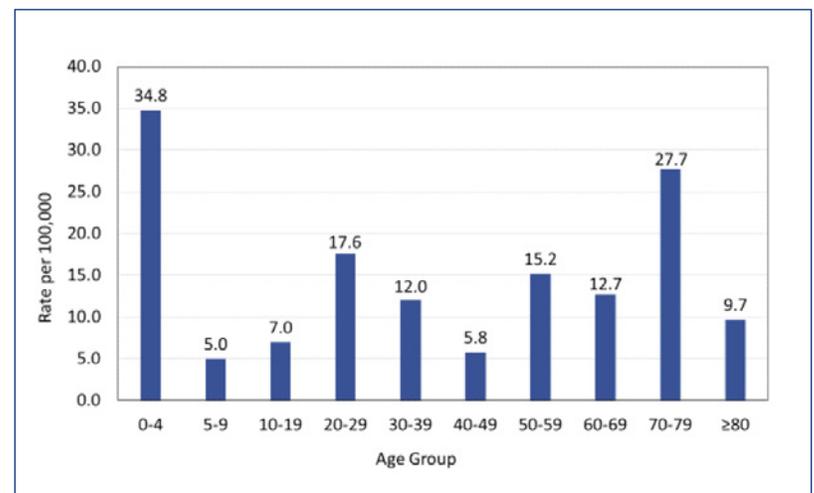
Norovirus can spread explosively from person to person in long-term care facilities, thus disproportionately affecting frail elders. In Rhode Island in 2014 for example, 45 of approximately 90 long-term care facilities reported a norovirus-like outbreak. Of these, 29 were confirmed to be caused by norovirus. The average attack rate of residents during these outbreaks was 25%.

Pregnant women and people with compromised immune systems (from conditions such as HIV, cancer, and liver disease) are also at increased risk of becoming seriously ill from foodborne pathogens. (For example, pregnant women are ten times more likely than the general population to become ill with listeriosis.<sup>5</sup>) Because of this, the Rhode Island Food Code includes special requirements for those establishments

**Figure 1.** Cumulative 5-Year Average Rate of Listeriosis Cases by Age Group, Rhode Island, 2010 – 2014. Rate is calculated per 100,000 population. The population denominator is based on the 2010 Rhode Island U.S. Census population.



**Figure 2.** Rate of Salmonellosis by Age Group, Rhode Island, 2014. Rate is calculated per 100,000 population. The population denominator is based on the 2010 Rhode Island U.S. Census population.



servicing highly susceptible populations, including hospitals, nursing homes, elder-care homes, schools, and day-care centers. Establishments serving these populations must exclude ill food employees with norovirus from working until the employees are symptom free for at least 48 hours.<sup>6</sup> Also, high risk food items that are served raw or partially cooked, such as raw shellfish and undercooked hamburgers, are not allowed to be served in these food establishments, and only fully cooked or pasteurized egg products may be used.

Individuals at greatest risk of foodborne illness can mitigate risk by avoiding certain foods and practicing food safety behaviors. High-risk groups should avoid unpasteurized dairy products, soft cheeses, sprouts, undercooked meats, raw shellfish, and deli meat that is not thoroughly reheated

prior to consumption. Proper handwashing, sanitation, and avoidance of bare hand contact with ready-to-eat foods is especially important to prevent norovirus transmission, because individuals can shed viral particles after the termination of symptoms, and the viral particles themselves can survive on typical indoor surfaces for up to 2 weeks.<sup>4</sup>

## DISPARITIES ASSOCIATED WITH DIFFERENCES IN RACE AND ETHNICITY

Race and ethnicity data have not been collected consistently in FoodNet and evidence suggests that Hispanics and low-income individuals are under-represented in the FoodNet population relative to their proportions in the U.S. as a whole.<sup>7</sup> Despite these limitations, FoodNet has constructed rates by race and ethnicity, revealing that *Campylobacter* and *Listeria* incidence rates are highest among Hispanics, that STEC rates are highest among non-Hispanics, and that *Salmonella* rates are similar for Hispanics and Non-Hispanics.<sup>2</sup>

A recent review of the public health literature suggests that minority and low-income people are at highest risk of foodborne illness.<sup>8</sup> Higher than average consumption of fresh, Mexican-style soft cheese may help explain the increased incidence of Listeriosis among Hispanics,<sup>5</sup> especially pregnant Hispanic women (whose risk of listeriosis is 24 times higher than non-pregnant, non-Hispanic women).<sup>5</sup> Several factors may explain this ethnic disparity, including unsafe food-handling practices, crowding in homes, number of young children in homes, and a lack of understanding of specific health risks. As well, access to fresh, healthy food is limited among minorities and persons of low income in the U.S. Studies have consistently demonstrated income, race, and ethnic disparities in access to fresh, healthy food at the retail level, leading to the concept of the “food deserts,” areas typified by a lack of supermarkets and an abundance of smaller ethnic markets, convenience stores, and fast food retailers. Researchers are beginning to look at specific food safety risks associated with “food deserts,” e.g., inadequate food-handling knowledge and improper food-handling practices in small independent retailers.<sup>8</sup>

In Rhode Island, activities are underway to improve our understanding of racial and ethnic disparities in the burden of foodborne illnesses. For example, an initiative begun in October 2015 aimed at improving the reporting of race and ethnicity information in foodborne case-reports received by the Rhode Island Department of Health (RIDOH) has led to more complete information. “Known” race and ethnicity in case reports of campylobacteriosis increased from 31% to 61% in the first eleven months of the initiative, and among case reports of STEC (Shiga-Toxin producing *E. coli*) from 50% to 83%. Such improvements will enable RIDOH to perform detailed analyses of racial and ethnic disparities, enabling the improved targeting of prevention measures. As well, the Rhode Island Center for Food Protection focuses attention on high-risk food establishments, including those smaller

independent food stores located in “food deserts,” to improve compliance with safe food-handling and storage practices.

## RECOMMENDATIONS

Understanding foodborne illness disparities can help providers diagnose, treat, and report infections from foodborne pathogens. Although elimination of these disparities will undoubtedly require societal change, patient-by-patient guidance and education is also of great value to individuals and their families. Individuals at especially high risk of severe foodborne infections should be counseled to avoid certain foods, e.g., undercooked animal products, raw shellfish, sprouts, deli meat that is not thoroughly re-heated, soft cheeses, and unpasteurized milk and juice products. Non-food related factors, such as contact with pets, reptiles, livestock, exotic animals, and unsanitary environments are also important to address, particularly where young children are involved. Immediate and thorough handwashing after contact is recommended. As well, *no* reptiles should be allowed in a home with an infant. Children should receive rotavirus and hepatitis A vaccines according to the prescribed schedule. At-risk persons can also protect themselves from disease *carriers* (known and unknown) by several means:

- Regular and thorough hand-washing
- Regular and thorough sanitizing of residential and work environments
- Use of “cyst filtration devices” for the extreme immunosuppressed
- Caution around domestic and wild animals
- Avoidance of untreated drinking water
- Proper food-handling and storage methods (Hot foods should be kept hot and cold foods cold.)

Many useful resources are available online to help educate those at increased risk.<sup>9,10</sup>

Testing for foodborne and enteric illnesses and the reporting of confirmed cases are *critical* elements in disease prevention, including the prevention of widespread food-borne illness outbreaks. It is important to recognize the symptoms of foodborne and enteric illnesses and to obtain a stool culture when bloody diarrhea or severe gastrointestinal symptoms are observed. Guidance on managing these conditions are available.<sup>11</sup> Data reported in the literature suggest that culture-independent diagnostic tests (CIDTs)—rapid tests that do not require the isolation of living organisms—are now commonly used to test for bacteria, aiding timely clinical management.<sup>2</sup> However, the isolation of organisms is still required for genetic testing. The latter permits public health officials to work with state partners and federal agencies to identify and to eliminate ongoing sources of food contamination. Therefore, sending specimens to the State Public Health Laboratory is critical following a positive CIDT. RIDOH has worked closely with hospital laboratories to

facilitate this process. Collecting and reporting information on race and ethnicity is also helpful in identifying the sources of foodborne illnesses and to reduce disparities in the burden of foodborne illnesses.

In conclusion, illnesses caused by enteric pathogens are preventable and can impact certain groups more severely than others. Continued research and outreach is needed at the national and state level to understanding *what* groups are at increased risk and *why*. Patient education, laboratory culture testing, and the collection and reporting of race and ethnicity to public health will facilitate the assessment of risk factors and the targeting of scarce public health resources.

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