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Disparities in Incidence and Severity of *Shigella* Infections Among Children—Foodborne Diseases Active Surveillance Network (FoodNet), 2009–2018

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Abstract

Background.—*Shigella* infections are an important cause of diarrhea in young children and can result in severe complications. Disparities in *Shigella* infections are well documented among US adults. Our objective was to characterize disparities in incidence and severity of *Shigella* infections among US children.

Methods.—We analyzed laboratory-diagnosed *Shigella* infections reported to FoodNet, an active, population-based surveillance system in 10 US sites, among children during 2009–2018. We calculated the incidence rate stratified by sex, age, race/ethnicity, *Shigella* species, and disease severity. Criteria for severe classification were hospitalization, bacteremia, or death. The odds of severe infection were calculated using logistic regression.

Results.—During 2009–2018, 10 537 *Shigella* infections were reported in children and 1472 (14.0%) were severe. The incidence rate was 9.5 infections per 100 000 child-years and the incidence rate of severe infections was 1.3 per 100 000 child-years. Incidence was highest among children aged 1–4 years (19.5) and lowest among children aged 13–17 years (2.3); however, children aged 13–17 years had the greatest proportion of severe infections (21.2%). Incidence was highest among Black (16.2 total; 2.3 severe), Hispanic (13.1 total; 2.3 severe), and American Indian/Alaska Native (15.2 total; 2.5 severe) children. Infections caused by non-*sonnei* species had higher odds of severity than infections caused by *Shigella sonnei* (adjusted odds ratio 2.58; 95% confidence interval 2.12–3.14).

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Supplementary Data

Supplementary materials are available at the *Journal of the Pediatric Infectious Diseases Society* online.

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Conclusions.—The incidence and severity of *Shigella* infections among US children vary by age, race/ethnicity, and *Shigella* species, warranting investigation of unique risk factors among pediatric subpopulations.

Keywords

gastrointestinal infections; health disparities; pediatric; *Shigella* ; shigellosis

Shigella infections are a major cause of diarrhea in young children [1]. Although *Shigella* infections are usually self-limited, they can result in severe complications including dehydration, sepsis, and invasive extraintestinal infections [2]. Complications also include seizures, which are reported most often in young children with fever or metabolic alterations [3]. In the United States, an estimated 500 000 *Shigella* infections occur each year and children under the age of 5 years represent an estimated 13% of infections, 22% of hospitalizations, and 24% of deaths [1]. *Shigella sonnei* is the predominant *Shigella* species in the United States; in 2016, *S. sonnei* represented approximately 80% of laboratory-confirmed *Shigella* infections, followed by *S. flexneri* at approximately 13% [4]. Infections caused by *S. dysenteriae* and *S. boydii* are rare in the United States [4]. Although *S. dysenteriae* type 1 is known to cause severe epidemic dysentery, any *Shigella* species can cause severe illness, particularly in individuals with immunocompromising conditions [5].

Shigella outbreaks in the United States are primarily associated with person-to-person contact in childcare settings [6]. Documented risk factors for sporadic (non-outbreak-associated) infections include age (1–4 years), ethnicity (Hispanic), international travel, contact with an ill person, and attending or working in childcare [7]. Racial and ethnic disparities in shigellosis incidence appear to be influenced by poverty and crowding, particularly among children [8]. Analysis of pediatric cases in California identified disparities by race/ethnicity and poverty level; incidence was highest in children under the age of 5 years and those of Hispanic ethnicity, and incidence increased with census tract poverty [9]. Risk factors for severe *Shigella* infection among children have not been well characterized in the US context; however, among US adults, prior analyses of surveillance data indicated that severe infections were associated with men 18–49 years old, *S. flexneri* species, and Black race [10]. To expand on these findings, we sought to characterize disparities in the incidence and severity of *Shigella* infections among a larger pediatric sample in the United States.

METHODS

We analyzed sporadic *Shigella* infections reported to the Foodborne Diseases Active Surveillance Network (FoodNet) during 2009–2018 in children (defined as persons <18 years old); cases reported to be associated with an outbreak were excluded from the analysis. FoodNet is a collaboration between the US Centers for Disease Control and Prevention, 10 state health departments, the US Department of Agriculture's Food Safety and Inspection Service, and the US Food and Drug Administration. FoodNet conducts active, population-based surveillance for laboratory-diagnosed infections caused by pathogens, including *Shigella*, in 10 sites covering 15% of the US population. FoodNet collects demographic,

clinical, and epidemiologic data, including the specimen source, hospitalization, and death [11]. Hospitalizations occurring within 7 days before or after specimen collection are attributed to the infection, as is the patient's vital status at hospital discharge or 7 days after specimen collection if the patient was not hospitalized. Since 2011, FoodNet has included infections diagnosed by culture-independent diagnostic tests (CIDTs) in addition to culture-confirmed infections.

To account for missingness in race and ethnicity data, we used a composite race/ethnicity variable: cases with Hispanic ethnicity were classified in the race/ethnicity category "Hispanic" regardless of reported race, and cases with non-Hispanic or unknown ethnicity were classified in race/ethnicity categories of non-Hispanic White ("White"), non-Hispanic Black ("Black"), non-Hispanic Asian or Pacific Islander ("Asian/Pacific Islander"), non-Hispanic American Indian or Alaska Native ("American Indian/Alaska Native"), and non-Hispanic multiple/other race ("multiple/other race") corresponding to their reported race. Sensitivity analyses, in which cases with unknown ethnicity were excluded from White, Black, Asian/Pacific Islander, and American Indian/Alaska Native race/ethnicity categories, were conducted to assess possible misclassification in the composite variable.

Criteria for severe classification were hospitalization, bacteremia (defined as blood being the source of the *Shigella* isolate), or death. We calculated the 10-year (2009–2018) incidence rate per 100 000 child-years stratified by sex, age, race/ethnicity, *Shigella* species (*S. sonnei* vs non-*sonnei* species, including *S. flexneri*, *S. boydii*, and *S. dysenteriae*), FoodNet site, and disease severity. We used 2018 US Census Bureau estimates (released June 20, 2019) for children in the 10 FoodNet site catchment areas. Cases with multiple/other race were excluded from analyses of incidence by race/ethnicity due to lack of population denominator estimates.

Simple logistic regression was used to estimate the odds of developing severe infection (as a binary outcome) by sex, age, race/ethnicity, and *Shigella* species (*S. sonnei* vs non-*sonnei*), as well as the odds of developing a non-*sonnei* species infection. Additionally, adjusted odds ratios (aOR) were calculated using a multivariable logistic regression model including sex, age, race/ethnicity, *Shigella* species, and FoodNet surveillance site. Cases with missing data for these variables were excluded from logistic regression, as were cases with multiple/other race. All analyses were performed using SAS (version 9.4; SAS Institute, Inc, Cary, NC).

RESULTS

During 2009–2018, 11 391 *Shigella* infections in children were reported to FoodNet, of which 10 537 (92.5%) sporadic (non-outbreak-associated) infections were included in this analysis. Of these, 1472 (14.0%) were classified as severe; 1446 patients (98.2%) were hospitalized, 43 (2.9%) were bacteremic, and 4 (0.3%) died. Patient demographics and *Shigella* species distributions are summarized in Table 1.

The incidence rate of *Shigella* infections during 2009–2018 was 9.5 per 100 000 child-years, and the incidence rate of severe infections was 1.3 per 100 000 child-years (Table 2). Incidence rates were similar by sex. The highest incidence of total and severe *Shigella*

infections occurred in children aged 1–4 years, with 19.5 total infections per 100 000 child-years and 2.3 severe infections per 100 000 child-years. Incidence rates were lowest in children aged 13–17 years (2.3 total; 0.5 severe); however, this age group had the greatest proportion of severe infections (21.2%).

Shigella incidence was highest in Black children (16.2 total infections per 100 000 child-years and 2.3 severe infections per 100 000 child-years), followed by American Indian/Alaska Native children (15.2 total; 2.5 severe) and Hispanic children (13.1 total; 2.3 severe) (Table 2). Hispanic children had a higher proportion of severe infections (17.6%) than American Indian/Alaska Native (16.5%), White (14.1%), Black (14.0%), and Asian/Pacific Islander (10.5%) children. Incidence and severity also varied by site, with highest incidence of both total and severe infections in Georgia (19.3 total; 2.5 severe) and Tennessee (16.4 total; 2.1 severe). The incidence rate of *S. sonnei* species infections (7.1 infections per 100 000 child-years) was 10 times higher than that of non-*sonnei* species (0.7); however, a higher proportion of non-*sonnei* species infections were severe (30.2% for non-*sonnei* vs 13.6% for *S. sonnei*).

The incidence rate of *S. sonnei* infections was higher than that of non-*sonnei* infections across all race/ethnicity groups (Figure 1); however, the distribution of *S. sonnei* and non-*sonnei* infections differed by race/ethnicity. American Indian/Alaska Native children had the highest incidence rate of *S. sonnei* infections, with 14.1 infections per 100 000 child-years, followed by Black (13.0), Hispanic (8.9), White (3.8), and Asian/Pacific Islander (2.4) children. Non-*sonnei* species infections were most common among Hispanic and Asian/Pacific Islander children (1.8 and 1.2 infections per 100 000 child-years, respectively) compared with Black (0.7), American Indian/Alaska Native (0.4), and White (0.1) children. Incidence of *S. sonnei* and non-*sonnei* species infections varied by FoodNet site (Supplementary Figure 1); however, the odds of non-*sonnei* species vs *S. sonnei* infection were higher among Asian/Pacific Islander, Hispanic, and Black children compared with White children even after adjusting for sex, age, and FoodNet site (Supplementary Table 1).

The odds of severe infection varied by age, race/ethnicity, and *Shigella* species (Table 3). Independently, the unadjusted odds of developing severe infection were higher among children aged 13–17 years compared with those <1 year old (OR 1.89; 95% confidence interval [CI] 1.32–2.72), Hispanic children compared with White children (OR 1.30; 95% CI 1.12–1.50), and infections caused by non-*sonnei* species compared with *S. sonnei* (OR 2.72; 95% CI 2.29–3.22). After adjusting for all other variables, the odds of developing severe infection were lower for Asian/Pacific Islander children than White children (aOR 0.57; 95% CI 0.36–0.90). *Shigella* species had the strongest effect on developing severe infection even after adjusting for other variables; the odds of developing severe infection were more than doubled if the infection was caused by non-*sonnei* species compared with *S. sonnei* (aOR 2.58; 95% CI 2.12–3.14).

Sensitivity analyses, in which 725 cases with unknown ethnicity were excluded from White (n = 342), Black (n = 316), American Indian/Alaska Native (n = 51), and Asian/Pacific

Islander (n = 16) race/ethnicity categories, indicated no alteration of these findings (data not shown). Excluded cases represented 6.9% of total infections and 7.8% of severe infections.

DISCUSSION

FoodNet surveillance data from 2009 to 2018 demonstrated disparities in the incidence and severity of *Shigella* infections among children by age and race/ethnicity. Incidence was highest among children aged 1–4 years, consistent with previously described risk factors for sporadic shigellosis.[7] High incidence of *Shigella* infections in this age group might be driven by transmission in childcare settings and due to limited handwashing and toileting skills [12]. Adolescents aged 13–17 years had the lowest incidence of *Shigella* infections, likely due to less frequent exposure to childcare settings; however, adolescents had the highest proportion of severe infections among all age groups. Adolescents might have less frequent preventive health care visits than younger children (eg, for routine childhood immunizations), and may face gaps in care [13], fragmented health care services, and missed opportunities for health promotion [14], such as discussion of prevention messages for *Shigella*. Thus, adolescents with shigellosis might be less likely to report and seek health care for mild diarrheal symptoms than younger children, unless illness becomes severe. Underlying health conditions among this age group may further contribute to the increased severity of disease [15]. Additional formative research is needed to understand risk factors for *Shigella* transmission and severity among adolescents and to develop tailored prevention messaging strategies for this age group.

The incidence of *Shigella* infections was highest in Black, American Indian/Alaska Native, and Hispanic children; this was consistent with previous surveillance data for *Shigella* infection in US children and adults [7–10, 12]. In 2018, the proportion of children <18 years in the United States living in families with incomes below the federal poverty level, as defined by the US Office of Management and Budget, was greater for Black (32%), American Indian/Alaska Native (31%), and Hispanic (26%) children than White (11%) and Asian/Pacific Islander (11%) children. Poverty has been described as a risk factor for shigellosis [8, 9, 16], and factors contributing to increased risk could include greater household crowding, allowing for person-to-person spread of *Shigella* [8]. Poverty might also affect access to health insurance [17], influence medical care-seeking for diarrheal illness and submission of stool cultures [18], and pose economic barriers to hygiene such as lack of access to diapers for young children [19].

Racial/ethnic disparities might also be shaped by additional factors at the individual and community levels, such as access to clean water and adequate sanitation, health literacy, and childcare utilization. Race/ethnicity is a strong predictor of access to clean water and adequate sanitation (eg, complete plumbing) in the United States; American Indian/Alaska Native populations are more likely to face clean water and sanitation access issues than any other racial/ethnic group, and Black and Hispanic populations are also disproportionately affected [20]. Measures to prevent *Shigella* transmission, such as frequent hand hygiene, might be impaired by unsafe or inadequate water and sanitation. Furthermore, health literacy, defined as “the degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health

decisions" [21], is a known driver of health disparities and poorer health outcomes for infectious and noninfectious conditions [22]. A recent study of US parents revealed that Black and Hispanic race/ethnicity, low income, and birth outside of the United States were significantly associated with low health literacy [23], and thus lesser reach of *Shigella* prevention messaging to these populations and barriers to medical care-seeking might contribute to greater incidence of infections and severe outcomes. Finally, use of childcare facilities [24, 25] and access to paid family and medical leave [26] might vary by race/ethnicity, and thus variability in *Shigella* transmission exposures from childcare settings might also contribute to the racial/ethnic disparities we identified.

Non-*sonnei* species had higher odds of causing severe infection among children than did *S. sonnei*. This was consistent with prior all-age analyses from the Georgia FoodNet site indicating that the proportion of isolates cultured from blood vs feces was greater for *S. flexneri* than *S. sonnei* [27], as well as international studies identifying *S. flexneri* more commonly than *S. sonnei* in bacteremic patients [28–30]. In the United States, the incidence of both *S. sonnei* and *S. flexneri* is highest in children aged 1–4 years [12]; however, as *S. sonnei* is commonly transmitted in childcare settings, risk for *S. sonnei* infection among children may be more widely recognized by clinicians than risk for *S. flexneri*, which is often described among adult men [12].

Targeted outreach to pediatric clinicians regarding differences in severity by *Shigella* species may inform decisions regarding monitoring, supportive care, and treatment for *Shigella* infections. The use of CIDTs by clinical laboratories to diagnose *Shigella* infections has increased in recent years [31, 32]; while these tests offer advantages in ease and speed compared to traditional culture methods, CIDTs do not yield isolates that can be speciated. In fact, many infections (18.2% total; 12.0% severe) included in this analysis were caused by an unknown *Shigella* species, of which 68.1% were diagnosed using CIDTs alone. Cultures of specimens from children with *Shigella* infections identified by CIDTs (called reflex cultures) are needed to identify species, which can provide important information for clinical decision making. Additional benefits of reflex culture and sequencing of isolates include determination of antibiotic resistance and detection of outbreaks.

Non-*sonnei* species infections were more commonly observed in Hispanic and Asian/Pacific Islander children than in other racial/ethnic groups; this may be explained in part by international travel. Prior analysis of infections reported to FoodNet demonstrated that infections with *S. dysenteriae* (56.3%), *S. boydii* (44.3%), and *S. flexneri* (24.4%) were more often travel-associated than infections with *S. sonnei* (11.7%), and travel-associated infections occurred more commonly in individuals of Asian race or Hispanic ethnicity [33]. Outreach efforts to understand pediatric risk factors for *Shigella* transmission in populations with high incidence of non-*sonnei* species infections may facilitate the development of targeted interventions and prevention messages.

The unadjusted odds of developing a severe infection were higher in Hispanic children than in other racial/ethnic groups; this may have been driven in part by the higher incidence of non-*sonnei* species infections in this subpopulation. However, though Asian/Pacific Islander children also had a high incidence of non-*sonnei* infections, their odds of developing severe

shigellosis were low. Reasons for this difference are unknown, and additional formative work is needed to understand possible contributing factors such as socioeconomic status, access to affordable health care, and cultural/behavioral norms. More granular data on the Hispanic population captured in FoodNet data, such as primary language, country of origin, and country of birth, could better elucidate risk factors for severe *Shigella* infection among children in Hispanic subpopulations, as they likely vary across this diverse ethnic group [34].

This analysis is subject to several limitations. Findings from the 10 FoodNet sites may not be widely generalizable, though estimates may mirror national trends. Census data from 2019 were used to estimate the population denominators for FoodNet sites and did not account for possible changes in population size during 2009–2018. Prior comparison of FoodNet demographics with US population demographics has indicated that while age and race correlate well, Hispanic ethnicity might be underrepresented in FoodNet surveillance [35]. Similarly, efforts to increase representation of American Indian/Alaska Native persons in surveillance data may assist in understanding disparities in this population [36]; small numbers limited interpretation of findings among American Indian/Alaska Native children in this analysis. Many cases had unknown race/ethnicity (10.8% total; 5.0% severe) and additional cases had unknown ethnicity despite reporting race (6.9% total; 7.8% severe). Use of a composite race/ethnicity variable allowed for inclusion of cases with unknown ethnicity if race was reported; this could have resulted in misclassification bias. However, exclusion of these cases in the sensitivity analysis did not alter results. Regardless, improving data collection for race and ethnicity can improve the quality, representativeness, and usefulness of public health surveillance for evaluation of health disparities [37].

Additionally, exclusion of infections with an unknown species may have biased results if data were not missing at random; it is plausible that differences in health care-seeking behaviors and consequent use of CIDTs could differ between racial/ethnic and age groups. Furthermore, including hospitalization to define severe infection might have included patients hospitalized for monitoring, but who never developed advanced clinical signs. Similarly, although hospitalizations within 7 days before or after specimen collection and deaths within 7 days after specimen collection were attributed to *Shigella* infection, it is possible that these outcomes were caused by comorbid conditions. Moreover, we were unable to assess modes of transmission, including the possibility of sexual transmission among adolescents, and were unable to assess treatment and antibiotic resistance, which may have contributed to severe infections.

Finally, we were unable to account for the complex social and environmental factors that influence health disparities, such as socioeconomic status, clean water and sanitation access, health literacy, childcare utilization, and other behavioral and social factors. Information regarding these social determinants of health is not routinely collected as part of national infectious disease surveillance systems; however, integration of case data with census tract-level data may aid in evaluating these determinants at an ecological scale [8, 9]. Racial/ethnic disparities have been previously described for other enteric pathogens including *Salmonella* and *Campylobacter* [38], and further investigation of contributing factors should be a priority for enteric disease epidemiology in the United States. Further evaluation of

knowledge, attitudes, and practices related to *Shigella* prevention among different racial/ethnic and age groups can allow for targeted prevention messages and evaluation of interventions to reduce health disparities.

CONCLUSION

The incidence and severity of *Shigella* infections among US children vary by age, race/ethnicity, and *Shigella* species, warranting further investigation of unique risk factors among different pediatric subpopulations. Socioeconomic factors, health care-seeking practices, health literacy, access to prevention measures, and variability in transmission exposures (eg, childcare and travel-associated exposures) might drive these differences. Further evaluation of these social determinants of health is needed to guide interventions to reduce disparities in pediatric shigellosis, and intersectionality of risk factors should be further explored. Heightened awareness among pediatric clinicians of disparities in *Shigella* infections and targeted actions to assess and address health disparities in practice, including provision of culturally competent care [39], are important in improving health outcomes among disproportionately affected racial/ethnic groups. Improved collection of race and ethnicity in national surveillance systems may facilitate enhanced understanding of health disparities. Finally, reflex cultures of specimens from children with *Shigella* infections identified by CIDTs should be encouraged to identify species and provide important information for clinical decision making.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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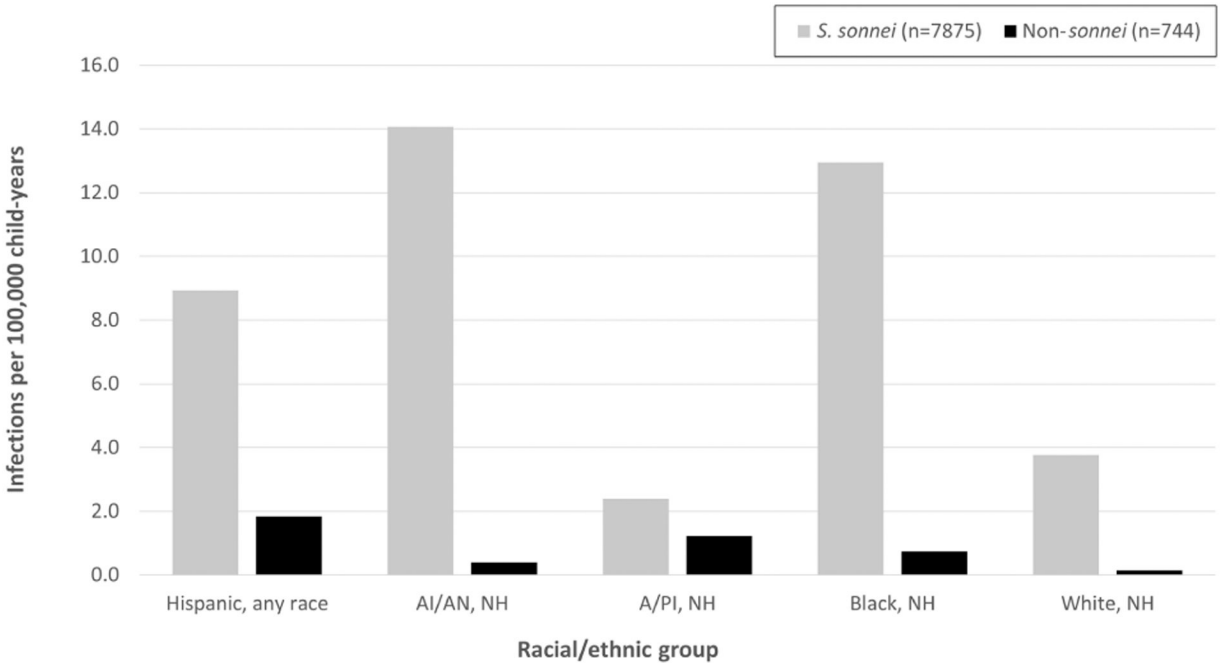

Figure 1.

Incidence rate of *Shigella sonnei* and non-*sonnei* species[a] infections by race/ethnicity among children—Foodborne Diseases Active Surveillance Network, 2009–2018. Abbreviations: A/PI, Asian/Pacific Islander; AI/AN, American Indian/Alaska Native; NH, non-Hispanic.

[a]Includes *S. flexneri*, *S. boydii*, and *S. dysenteriae*.

Table 1.

Demographics and Species of Total and Severe *Shigella* Infections Among Children—Foodborne Diseases Active Surveillance Network, 2009–2018 (n = 10 537)[a]

	Total Infections		Severe Infections[b]	
Characteristic	**No.**	**%**	**No.**	**%**
All	10 537	100.0	1472	100.0
Sex				
Female	5307	50.4	736	50.0
Male	5209	49.4	733	49.8
Unknown	21	0.2	3	0.2
Age group				
<1 year	353	3.4	44	3.0
1–4 years	4658	44.2	560	38.0
5–8 years	3605	34.2	523	35.5
9–12 years	1205	11.4	193	13.1
13–17 years	716	6.8	152	10.3
Race/ethnicity				
Hispanic, any race	2534	24.1	446	30.3
American Indian/Alaska Native, non-Hispanic	158	1.5	26	1.8
Asian/Pacific Islander, non-Hispanic	314	3.0	33	2.2
Black, non-Hispanic	3208	30.5	448	30.4
White, non-Hispanic	2928	27.8	414	28.1
Multiple/other race, non-Hispanic	258	2.5	32	2.2
Unknown race/ethnicity	1137	10.8	73	5.0
FoodNet site				
California	427	4.1	43	2.9
Colorado	260	2.5	46	3.1
Connecticut	173	1.6	44	3.0
Georgia	4820	45.7	612	41.6
Maryland	716	6.8	115	7.8
Minnesota	738	7.0	122	8.3
New Mexico	501	4.8	102	6.9
New York	275	2.6	45	3.1
Oregon	175	1.7	34	2.3
Tennessee	2452	23.3	309	21.0
Species				
S. sonnei	7875	74.7	1072	72.8
S. flexneri	702	6.7	212	14.4
S. boydii	30	0.3	9	0.6
S. dysenteriae	12	0.1	2	0.1
Unknown[c]	1918	18.2	117	12.0

[a] Includes cases with a known age and not associated with an outbreak.

[b] Criteria for severe classification were hospitalization, bacteremia, or death.

[c] Among 1918 infections caused by unknown species, 612 (31.9%) were positive by culture but had an undetermined species and 1306 (68.1%) were positive by culture-independent diagnostic test alone.

Table 2.

Incidence Rate of Total and Severe *Shigella* Infections and Percentage Severe Among Children—Foodborne Diseases Active Surveillance Network, 2009–2018

	Incidence Rate per 100 000 Child-Years		
Characteristic	**Total Infections**	**Severe Infections[a]**	**% Severe**
All	9.5	1.3	14.0
Sex			
Female	9.8	1.4	13.9
Male	9.2	1.3	14.1
Age group			
<1 year	6.0	0.8	12.5
1–4 years	19.5	2.3	12.0
5–8 years	14.7	2.1	14.5
9–12 years	4.8	0.8	15.9
13–17 years	2.3	0.5	21.2
Race/ethnicity			
Hispanic, any race	13.1	2.3	17.6
Asian/Pacific Islander, non-Hispanic	5.5	0.6	10.5
American Indian/Alaska Native, non-Hispanic	15.2	2.5	16.5
Black, non-Hispanic	16.2	2.3	14.0
White, non-Hispanic	4.9	0.7	14.1
FoodNet site			
California	6.0	0.6	10.1
Colorado	3.7	0.7	17.7
Connecticut	2.2	0.6	25.4
Georgia	19.3	2.5	12.7
Maryland	5.3	0.9	16.1
Minnesota	5.7	1.0	16.5
New Mexico	9.9	2.0	20.4
New York	3.1	0.5	16.4
Oregon	2.0	0.4	19.4
Tennessee	16.4	2.1	12.6
Species			
S. sonnei	7.1	1.0	13.6
Non-*sonnei*[b]	0.7	0.2	30.2

[a] Criteria for severe classification were hospitalization, bacteremia, or death.

[b] Includes *S. flexneri*, *S. boydii*, and *S. dysenteriae*.

Table 3.

Odds Ratios for Developing a Severe *Shigella* Infection[a] Among Children—Foodborne Diseases Active Surveillance Network, 2009–2018

	Unadjusted	Adjusted[b]
Characteristic	**Odds Ratio (95% CI)**	**Odds Ratio (95% CI)**
Sex (male vs female)	1.02 (0.91–1.14)	1.02 (0.90–1.16)
Age group		
<1 year	1.00 (ref)	1.00 (ref)
1–4 years	0.96 (0.69–1.33)	0.80 (0.54–1.18)
5–8 years	1.19 (0.86–1.66)	0.92 (0.62–1.37)
9–12 years	1.34 (0.94–1.90)	1.01 (0.66–1.55)
13–17 years	1.89 (1.32–2.72)	1.43 (0.92–2.21)
Race/ethnicity		
Hispanic, any race	1.30 (1.12–1.50)	1.11 (0.93–1.31)
American Indian/Alaska Native, non-Hispanic	1.20 (0.78–1.85)	1.01 (0.62–1.64)
Asian/Pacific Islander, non-Hispanic	0.71 (0.49–1.04)	0.57 (0.36–0.90)
Black, non-Hispanic	0.99 (0.85–1.14)	0.99 (0.85–1.16)
White, non-Hispanic	1.00 (ref)	1.00 (ref)
Species (non-*sonnei* species[c] vs *S. sonnei*)	2.72 (2.29–3.22)	2.58 (2.12–3.14)

Abbreviation: ref, reference group for odds ratio.

[a] Criteria for severe classification were hospitalization, bacteremia, or death.

[b] Results of multivariable model including sex, age group, race/ethnicity, *Shigella* species (*S. sonnei* vs non-*sonnei* species [*S. flexneri*, *S. boydii*, and *S. dysenteriae*]) and FoodNet site.

[c] Includes *S. flexneri*, *S. boydii*, and *S. dysenteriae*.