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## National Epilepsy Awareness Month — November 2015

Epilepsy is a brain disorder characterized by recurrent seizures; an estimated 2.9 million persons in the United States have active epilepsy (*1*). A seizure is a brief change in normal brain activity that changes awareness, behavior, or body movement. More than 30 different types of seizures have been described (*2*). A report in this issue characterizes seizures in children and adolescents aged 6–17 years in the United States.

Because seizures can affect anyone, members of the public need to know how to safely assist a person having a seizure. Not all seizures are emergencies, and most will end within a few minutes. The first response to witnessing a seizure should be to remain calm and provide care and comfort. A person with a convulsive seizure might cry out, fall, stiffen, shake, or lose awareness. If possible, the person should be helped to sit safely or should be guided gently to the floor. Once on the floor, a person should be turned on the side to keep the airway clear; nearby objects should be moved to prevent injury, and the head should be cushioned. A person witnessing a seizure in someone should call 911 if a seizure lasts more than 5 minutes, causes an injury, occurs in a person with another known condition (e.g., pregnancy or low blood sugar in diabetes), or causes a person to have difficulty breathing or waking after the seizure is over.

CDC works to improve the health and well-being of persons with epilepsy and to educate the public about this disorder (*3*). Additional information about providing first aid for seizures is available at http://www.cdc.gov/epilepsy/basics/first-aid.htm and http://www.epilepsy.com/start-here/seizure-first-aid.

### References

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# Seizures in Children and Adolescents Aged 6–17 Years — United States, 2010–2014

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A seizure is a brief change in normal electrical brain activity resulting in alterations in awareness, perception, behavior, or movement. Seizures affect persons of all ages, but are particularly common in childhood. There are many causes of seizures in children, including epilepsy; high fever (febrile seizures); head injuries; infections (e.g., malaria, meningitis, and gastrointestinal illness); metabolic, neurodevelopmental, and cardiovascular conditions; and complications associated with birth (*1–3*). Outcomes associated with single or recurring seizures in children vary by seizure type (febrile compared with nonfebrile) and multiple risk factors (age, illness, family history, and family context). Outcomes range from no complications to increased risk for behavioral problems, epilepsy, or sudden unexpected death (*3–6*). No nationally representative estimates have been reported for the number of U.S. children and adolescents with seizures, co-occurring conditions,

## INSIDE



**Continuing Education** examination available at http://www.cdc.gov/mmwr/cme/conted_info.html#weekly.

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or health service utilization. To address these information gaps, CDC analyzed combined data on children and adolescents aged 6–17 years from the National Health Interview Survey (NHIS) for the period 2010–2014. Overall, 0.7% of children and adolescents (weighted national estimate = 336,000) were reported to have had at least one seizure during the preceding year. Compared with children and adolescents without seizures, a higher percentage of those with seizures were socially and economically disadvantaged. Children and adolescents with seizures had higher prevalences of various mental, developmental, physical, and functional co-occurring conditions than those without seizures; however, only 65.6% of those with seizures had visited a medical specialist (defined as a medical doctor who specializes in a particular medical disease or problem, other than an obstetrician/gynecologist, psychiatrist, or ophthalmologist) during the preceding 12 months. Public health agencies can work with other health and human service agencies to raise awareness about childhood seizures, implement strategies to prevent known causes and risk factors for seizures, study the associations between sociodemographic characteristics and seizure incidence, and ensure linkages for children with seizures to appropriate clinical and community providers.

NHIS is an ongoing annual, nationally representative multistage household survey of the U.S. civilian noninstitutionalized population (http://www.cdc.gov/nchs/nhis/about_nhis.htm). CDC analyzed combined 2010–2014 NHIS data from the Sample Child component (questions asked about one randomly selected child from each family in the NHIS), with an average final response rate of 70%. Because these data do not distinguish the relatively large proportion of young children who experience usually benign febrile seizures* from those who have seizures of other etiologies (*7*), only children and adolescents aged 6–17 years were selected for analysis. Those whose parents provided a "Yes" answer to the survey question, "During the past 12 months, has [your child] had any of the following conditions?" and indicated "seizures" were identified as respondents with seizures.

Multiple outcomes reported by parents of those with and without seizures were examined, including indicators of food insecurity; co-occurring conditions (e.g., neurodevelopmental disabilities, recent infectious illnesses), functional limitations, and taking prescription medications; barriers to care, represented by delaying getting care and being unable to afford care in the past 12 months; access to care or health service utilization in the past 12 months; and the number of missed school days associated with any illness or injury.

Multiple logistic regression was used to calculate the prevalences and 95% confidence intervals (CI) of co-occurring conditions and barriers and access to care, adjusted by sex, race/ethnicity, family poverty income ratio,† and mother's highest level of education, for children with and without seizures.

* Febrile seizures usually occur in children aged 6 months–5 years and affect about 2%–5% of children in that age range. Febrile seizures are usually benign and children with uncomplicated febrile seizures rarely go on to develop epilepsy (*7*).

† A ratio of the family's income to the appropriate federal poverty threshold. Each person or family is assigned one out of 48 possible poverty thresholds. Thresholds vary according to family size and ages of family members. If total family income is less than the threshold appropriate for that family, the family is in poverty.

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Statistical software was used to account for the NHIS complex survey design and sample child weights. Prevalences were considered statistically significantly different if their CIs did not overlap.

During 2010–2014, parents of 0.7% of children and adolescents aged 6–17 years (weighted national estimate = 336,000) reported that their child had seizures during the past 12 months (Table 1). Children and adolescents with seizures were significantly more likely than those without seizures to live in poverty and low-income families or households (41.6% compared with 28.6%), and were less likely to have mothers or fathers with a bachelor's degree or higher (20.4% compared with 30.6% and 22.4% compared with 34.0%, respectively), or to live in nuclear families or households[§] (30.3% compared with

[§] A nuclear family consists of one or more children living with two parents who are married to one another and are each biological or adoptive parents to all children in the family.

**TABLE 1. Number and weighted percentage of children and adolescents aged 6–17 years with seizures and without seizures, by selected characteristics — National Health Interview Survey, 2010–2014**

| Characteristic | With seizures | | Without seizures | |
|---|---|---|---|---|
| | No. in sample | Weighted % (95% CI) | No. in sample | Weighted % (95% CI) |
| **Total** | **298** | **0.7** | **41,711** | **99.3** |
| **Sex** | | | | |
| Male | 147 | 46.9 (39.8–54.1) | 21,552 | 51.2 (50.6–51.8) |
| Female | 151 | 53.1 (45.9–60.2) | 20,159 | 48.8 (48.2–49.4) |
| **Race/Ethnicity** | | | | |
| White, non-Hispanic | 125 | 50.7 (43.0–58.3) | 18,761 | 54.8 (53.7–55.9) |
| Black, non-Hispanic | 54 | 16.3 (11.5–22.7) | 6,445 | 13.8 (13.1–14.4) |
| Hispanic | 85 | 23.3 (17.7–29.9) | 12,145 | 22.7 (21.7–23.7) |
| Other | 34 | 9.7 (6.5–14.2) | 4,360 | 8.7 (8.3–9.2) |
| **Family poverty income ratio*** | | | | |
| ≤129% | 123 | 41.6 (34.4–49.1)† | 12,168 | 28.6 (27.7–29.5) |
| 130%–349% | 111 | 37.0 (29.8–44.7) | 16,257 | 38.1 (37.4–38.8) |
| ≥350% | 64 | 21.5 (16.2–27.9)† | 13,286 | 33.3 (32.3–34.4) |
| **Mother's education** | | | | |
| Less than high school diploma | 48 | 16.4 (11.7–22.4) | 6,486 | 15.2 (14.5–16.0) |
| High school | 65 | 25.7 (19.5–33.1) | 8,606 | 21.7 (21.1–22.3) |
| Some college | 103 | 37.5 (30.6–45.0) | 12,108 | 32.5 (31.8–33.3) |
| Bachelor's degree or higher | 57 | 20.4 (14.9–27.4)† | 10,501 | 30.6 (29.6–31.6) |
| **Father's education** | | | | |
| Less than high school diploma | 37 | 19.3 (13.2–27.4) | 5,066 | 15.3 (14.5–16.1) |
| High school | 43 | 24.5 (17.3–33.3) | 7,135 | 24.2 (23.4–25.1) |
| Some college | 55 | 33.8 (25.6–43.1) | 7,351 | 26.4 (25.6–27.2) |
| Bachelor's degree or higher | 34 | 22.4 (16.1–30.4)† | 8,503 | 34.0 (32.9–35.3) |
| **Family structure** | | | | |
| Single-parent family | 74 | 23.1 (17.6–29.8) | 8,180 | 17.9 (17.3–18.4) |
| Nuclear family | 80 | 30.3 (24.0–37.4)† | 15,333 | 41.9 (41.1–42.8) |
| Blending or cohabiting family | 43 | 16.5 (11.8–22.6) | 4,746 | 12.7 (12.2–13.2) |
| Extended family/Other | 101 | 30.0 (24.1–36.8) | 13,422 | 27.6 (27.0–28.1) |
| **Worried food would run out before had money to buy more (only asked in 2011–2014)** | | | | |
| Often true or sometimes true | 79 | 34.5 (27.1–42.6)† | 8,246 | 22.9 (22.1–23.6) |
| Never true | 157 | 65.5 (57.4–72.9)† | 26,143 | 77.1 (76.4–77.9) |
| **Food did not last before had money to get more (only asked in 2011–2014)** | | | | |
| Often true or sometimes true | 74 | 30.9 (23.3–39.5)† | 6,945 | 19.2 (18.5–19.8) |
| Never true | 162 | 69.1 (60.5–76.7)† | 27,445 | 80.8 (80.2–81.5) |
| **Could not afford to eat balanced meals (only asked in 2011–2014)** | | | | |
| Often true or sometimes true | 63 | 24.3 (18.4–31.4)† | 5,552 | 14.9 (14.3–15.4) |
| Never true | 173 | 75.7 (68.6–81.6)† | 28,832 | 85.1 (84.6–85.7) |
| **Insurance status** | | | | |
| Private | 129 | 46.4 (39.2–53.7)† | 22,134 | 56.3 (55.3–57.3) |
| Medicaid/Medicare | 124 | 36.1 (29.8–42.8)† | 11,317 | 26.1 (25.3–27.0) |
| Not covered | 14 | —§ | 3,591 | 7.4 (7.1–7.8) |
| Other | 30 | 12.7 (8.3–19.0)¶ | 4,492 | 10.2 (9.7–10.7) |

**Abbreviation:** CI = confidence interval.
* A ratio of the family's income to the appropriate federal poverty threshold. Each person or family is assigned one out of 48 possible poverty thresholds. Thresholds vary according to family size and ages of family members. If total family income is less than the threshold appropriate for that family, the family is in poverty.
† Estimate is statistically significantly different (p<0.01) from the "Without seizures" group for the same condition/variable.
§ Estimate suppressed because relative standard error was ≥30%.
¶ Estimate has a relative standard error of ≥20% and <30%.

41.9%). Parents of children with seizures also were more likely than parents of children without seizures to report worrying that food would run out (34.5% compared with 22.9%) or that food they bought would not last until they had money to get more (30.9% compared with 19.2%).

Co-occurring conditions were generally more frequently reported by parents of children and adolescents with seizures than by those without seizures (Table 2). Children with seizures had higher reported prevalences of mental or developmental co-occurring conditions, including learning disabilities (43.7% compared with 8.2%); other types of developmental delay (32.3% compared with 4.3%); intellectual disability (22.9% compared with 1.0%); and attention deficit hyperactivity disorder/attention deficit disorder (19.3% compared with 10.3%) than did children without seizures. Parents of children with seizures more frequently reported that their children had headaches or migraines (23.7% compared with 7.0%), hay fever (19.0% compared with 11.2%), and stuttering or stammering (11.3% compared with 1.6%). In addition, children with seizures were more frequently reported to have an impairment or health problem that limited their abilities to crawl, walk, run, or play (23.7% compared with 1.9%); to require special equipment because of impairment or health problems (21.4% compared with 1.1%); and to have taken prescription medication for ≥3 months (68.7% compared with 15.6%) (Table 2).

A significantly higher percentage of parents of children and adolescents with seizures reported delays in getting health care than did parents of children without seizures (14.4% compared with 8.8%) (Table 3). Children and adolescents with seizures were significantly more likely to see different types of health care providers, but 34.4% had not seen a medical specialist during the past 12 months. During the same time period, 41.0% of children and adolescents with seizures visited an emergency department, compared with 15.4% of children and adolescents without seizures. Children and adolescents with seizures reportedly missed six or more school days associated with any illness or injury significantly more frequently than did children and adolescents without seizures (41.9% compared with 14.3%) (Table 3).

**TABLE 2. Adjusted* prevalences of selected co-occurring health conditions for children and adolescents aged 6–17 years, with and without seizures — National Health Interview Survey, 2010–2014**

| | With seizures | | Without seizures | |
|---|---|---|---|---|
| **Condition** | **No. in sample** | **Weighted % (95% CI)** | **No. in sample** | **Weighted % (95% CI)** |
| Learning disability | 138 | 43.7 (36.6–51.2)† | 3,498 | 8.2 (7.9–8.6) |
| Intellectual disability | 70 | 22.9 (17.5–29.4)† | 475 | 1.0 (0.9–1.2) |
| Other developmental delay | 96 | 32.3 (25.6–39.8)† | 1,724 | 4.3 (4.1–4.6) |
| Attention deficit hyperactivity disorder/Attention deficit disorder | 69 | 19.3 (14.2–25.5)† | 4,227 | 10.3 (9.9–10.7) |
| Cerebral palsy | 31 | 15.0 (9.9–22.1)§ | 78 | 0.2 (0.1–0.3) |
| Autism spectrum disorder | 18 | 8.1 (4.8–13.5)§ | 405 | 1.2 (1.0–1.3) |
| Asthma | 62 | 19.0 (14.1–25.0) | 7,137 | 16.4 (15.8–16.9) |
| Hay fever, past 12 mos. | 51 | 19.0 (13.4–26.3)† | 4,565 | 11.2 (10.7–11.7) |
| Respiratory allergy, past 12 mos. | 51 | 16.1 (11.6–21.9) | 5,047 | 12.3 (11.9–12.8) |
| Food/Digestive allergy, past 12 mos. | 30 | 10.5 (6.9–15.7)§ | 2,202 | 5.5 (5.3–5.9) |
| Eczema/skin allergy, past 12 mos. | 43 | 14.0 (9.5–20.0) | 4,688 | 11.7 (11.3–12.1) |
| Diarrhea/colitis, past 12 mos. | 23 | 8.1 (4.9–13.4)§ | 521 | 1.3 (1.1–1.4) |
| Anemia, past 12 mos. | 17 | 5.8 (3.2–10.0)§ | 433 | 0.9 (0.8–1.1) |
| Had three or more ear infections, past 12 mos. | 25 | 8.2 (5.2–12.6)§ | 1,370 | 3.3 (3.1–3.5) |
| Had frequent headaches/migraines, past 12 mos. | 76 | 23.7 (18.3–30.2)† | 3,033 | 7.0 (6.6–7.3) |
| Had head/chest cold, past 2 wks. | 40 | 12.2 (8.3–17.5) | 5,220 | 12.8 (12.4–13.3) |
| Had stomach illness with vomiting/diarrhea, past 2 wks. | 26 | 7.5 (4.7–11.7)§ | 1,980 | 5.1 (4.9–5.4) |
| Stuttered/stammered, past 12 mos. | 44 | 11.3 (7.7–16.2)† | 707 | 1.6 (1.5–1.8) |
| Trouble seeing | 37 | 12.4 (8.1–18.6)§ | 1,373 | 3.2 (3.0–3.4) |
| Need special equipment due to impairment/health problem | 56 | 21.4 (16.0–28.0)† | 464 | 1.1 (1.0–1.3) |
| Impairment/Health problem limiting crawl/walk/run/play | 71 | 23.7 (18.0–30.5)† | 795 | 1.9 (1.7–2.1) |
| Taken prescription medication for ≥3 mos. | 197 | 68.7 (61.4–75.3)† | 6,361 | 15.6 (15.1–16.1) |
| **Hearing status without hearing aid or other listening device** | | | | |
| Excellent | 145 | 70.3 (62.5–77.1)† | 25,875 | 80.0 (79.3–80.6) |
| Good | 61 | 20.7 (14.9–27.9) | 6,148 | 17.6 (17.0–18.2) |
| Trouble hearing/deaf | 26 | 9.0 (5.5–14.5)§ | 762 | 2.4 (2.2–2.7) |
| **Health condition compared with 12 mos. ago** | | | | |
| Better | 81 | 26.0 (19.9–33.3)† | 8,347 | 18.2 (17.7–18.7) |
| Worse | 32 | 10.7 (7.0–16.0)§ | 588 | 1.4 (1.2–1.6) |
| Same | 184 | 63.2 (55.8–70.1)† | 32,755 | 80.4 (79.9–80.9) |

**Abbreviation:** CI = confidence interval.
* Adjusted for sex, race/ethnicity, family poverty income ratio, and mother's education.
† Estimate is statistically significantly different (p<0.01) from the "Without seizures" group for the same condition/variable.
§ Estimate has a relative standard error of ≥20% and <30%.

## Discussion

Seizures in children and adolescents vary by cause, severity, and impact. The risk for some seizures can be prevented or reduced by eliminating their causes, such as ensuring proper prenatal and perinatal care and preventing head injuries. The findings in this report indicate that seizures affect 0.7% of children and adolescents aged 6–17 years, and, relative to the general population, children and adolescents with seizures are socially and economically disadvantaged, more likely to have co-occurring conditions, and more likely to face barriers to care.

The higher observed prevalence of co-occurring conditions is consistent with previous research that has shown a higher prevalence of neurodevelopmental conditions and behavior problems among some children with seizures (*3*–*6*). In this analysis, approximately two in five children and adolescents with seizures were reported to have a learning disability and 20%–30% of them had an intellectual disability, attention deficit hyperactivity disorder/attention deficit disorder, or other developmental disorder. Associations between seizures and these conditions might be bidirectional,[¶] sharing some common pathophysiological mechanisms (*8*). Headaches,

¶ For example, a genetic mutation might disrupt neuronal development, resulting in seizures, autism spectrum disorder, or both, enhancing the progression of negative outcomes associated with either condition (*8*).

**TABLE 3. Adjusted* prevalences of barriers and access to health care variables for children and adolescents aged 6–17 years, with and without seizures — National Health Interview Survey, 2010–2014**

| | With seizures | | Without seizures | |
|---|---|---|---|---|
| **Barrier/Variable** | **No. in sample** | **Weighted % (95% CI)** | **No. in sample** | **Weighted % (95% CI)** |
| Delayed getting care for any reason, past 12 mos.[†] | 45 | 14.4 (10.1–20.1)[§] | 3,736 | 8.8 (8.4–9.2) |
| Didn't get something needed because you couldn't afford it, past 12 mos.[¶] | 49 | 15.6 (11.1–21.6) | 4,144 | 11.5 (11.1–12.0) |
| Saw/talked to eye doctor, past 12 mos. | 123 | 40.3 (33.7–47.2)[§] | 13,225 | 32.2 (31.5–32.9) |
| Saw/talked to foot doctor, past 12 mos. | 25 | 8.7 (5.3–13.8)** | 1,020 | 2.4 (2.2–2.6) |
| Saw/talked to therapist (PT/OT/etc.), past 12 mos. | 100 | 34.4 (27.6–41.8)[§] | 2,648 | 6.8 (6.4–7.1) |
| Saw/talked to a NP/PA, past 12 mos. | 94 | 38.1 (30.7–46.0)[§] | 6,112 | 16.3 (15.7–16.9) |
| Saw/talked to mental health professional, past 12 mos. | 72 | 22.7 (17.1–29.6)[§] | 3,638 | 8.5 (8.1–8.8) |
| Saw/talked to a medical specialist, past 12 mos.[††] | 172 | 65.6 (58.6–72.0)[§] | 5,703 | 14.4 (13.9–14.8) |
| Saw/talked to a general doctor, past 12 mos. | 265 | 92.4 (88.7–95.0)[§] | 32,885 | 81.2 (80.6–81.8) |
| Saw/talked to a doctor who treats both children and adults (asked among those who saw/talked to a general doctor) | 123 | 43.4 (35.8–51.4) | 13,955 | 39.7 (38.7–40.7) |
| Saw/talked to doctor for emotional/behavioral problem (asked among those who saw/talked to a general doctor) | 50 | 16.8 (11.9–23.3)[§] | 2,135 | 6.3 (5.9–6.6) |
| Had well-child checkup, past 12 mos. | 241 | 81.5 (75.1–86.5) | 31,284 | 77.5 (76.8–78.1) |
| Received home care from health professional, past 12 mos. | 25 | 10.5 (6.6–16.2)** | 212 | 0.5 (0.4–0.6) |
| **Number of times in emergency department, past 12 mos.** | | | | |
| None | 161 | 59.1 (51.3–66.4)[§] | 35,036 | 84.7 (84.1–85.2) |
| 1 | 63 | 21.1 (15.7–27.7)[§] | 4,419 | 10.5 (10.0–10.9) |
| ≥2 | 72 | 19.9 (14.7–26.2)[§] | 2,036 | 4.9 (4.6–5.2) |
| **Total number of office visits, past 12 mos.** | | | | |
| None or 1 | 37 | 12.8 (8.5–18.8)** | 15,704 | 36.2 (35.5–36.8) |
| 2–3 | 71 | 21.2 (15.9–27.6)[§] | 15,397 | 38.1 (37.4–38.7) |
| 4–5 | 53 | 17.7 (12.9–23.7) | 5,247 | 13.3 (12.9–13.8) |
| 6–7 | 42 | 16.0 (11.0–22.7)[§] | 1,904 | 4.8 (4.5–5.1) |
| 8–12 | 46 | 15.4 (10.9–21.4)[§] | 1,775 | 4.6 (4.3–4.9) |
| ≥13 | 46 | 17.0 (11.9–23.6)[§] | 1,255 | 3.1 (2.9–3.4) |
| **Time since last saw/talked to health professional** | | | | |
| ≤6 months | 260 | 89.3 (84.2–92.9)[§] | 28,697 | 70.7 (70.1–71.3) |
| >6 months or never | 36 | 10.7 (7.1–15.8)** | 12,627 | 29.3 (28.7–29.9) |
| **School days missed due to illness/injury, past 12 mos.** | | | | |
| Didn't go to school or none | 60 | 20.7 (14.9–28.1)[§] | 13,007 | 29.6 (29.0–30.3) |
| 1–2 days | 44 | 16.5 (11.8–22.7)[§] | 11,877 | 29.8 (29.2–30.4) |
| 3–5 days | 66 | 20.8 (15.2–27.9) | 10,642 | 26.3 (25.7–27.0) |
| 6–10 days | 50 | 17.9 (12.8–24.5)[§] | 3,941 | 9.8 (9.4–10.2) |
| ≥11 days | 73 | 24.0 (18.5–30.5)[§] | 1,885 | 4.5 (4.2–4.8) |

**Abbreviations:** CI = confidence interval; NP/PA = nurse practitioner/physician's assistant; PT/OT = physical therapist/occupational therapist.
* Adjusted for sex, race/ethnicity, family poverty-income ratio, and mother's education.
† Including the following reasons: couldn't get through on the phone, couldn't get appointment soon enough, wait was too long in doctor's office, not open when able to go, and no transportation.
§ Estimate is statistically significantly different (p<0.01) from the "Without seizures" group for the same condition/variable.
¶ Including the following situations: prescription medicine, follow-up care (only asked in 2011–2014), seeing a specialist (only asked in 2011–2014), receiving mental health care/counseling, dental care, and eyeglasses.
** Estimate has a relative standard error ≥20% and <30%.
†† A medical doctor who specializes in a particular medical disease or problem (other than obstetrician/gynecologist, psychiatrist, or ophthalmologist).

including migraines, hay fever, and functional disabilities also reportedly affected about one in five children and adolescents with seizures.

Although most children and adolescents with seizures had recently seen a general doctor, they frequently require the care of a specialist, such as a neurologist, and parents of approximately one third of those with seizures reported that they had not recently seen or talked to a medical specialist. Parents reported delays in obtaining care associated with cost and other factors, such as lack of transportation. Higher rates of home care might be associated with severity of co-occurring conditions or transportation barriers. Higher rates of emergency department use might reflect seizure severity, or associated conditions, barriers to routine health care, or other unmet caregiver needs. For example, caregivers might not understand seizure symptoms, or they might be uncomfortable with providing appropriate seizure response.

Overall, parents of children and adolescents with seizures reported higher prevalences of co-occurring conditions; these and the health care utilization patterns and social disadvantages reported by parents of children and adolescents with seizures highlight unmet needs and gaps in care. Children and adolescents with seizures might need coordinated care that ensures accurate diagnosis of seizures and any co-occurring conditions, and that links caregivers with other community organizations to improve health outcomes (*9*,*10*).

The findings in this study are subject to at least four limitations. First, the percentage of children and adolescents with seizures was ascertained through parent reports, which were not corroborated by other sources, and might be subject to misclassification or response biases. Second, this study might inadvertently include children and adolescents with febrile seizures. However, because febrile seizures usually occur in children aged 6 months–5 years (*7*), limiting analyses to children and adolescents aged 6–17 years should have excluded almost all children with febrile seizures. Third, because NHIS data are cross-sectional, causal relationships between seizures and some of the variables cannot be established. Finally, because NHIS does not ask about seizure type and frequency in children and adolescents, it is not possible to confirm whether children and adolescents with reported seizures had epilepsy, or to determine the etiology of the seizure or seizures.

Public health agencies can work with other health and human service agencies to raise awareness about seizures in children and adolescents (e.g., educate parents and school personnel), implement strategies to prevent known causes and risk factors for seizures (e.g., head injuries), study the associations between sociodemographic characteristics and seizure incidence, and ensure linkages to appropriate clinical and community providers for children and adolescents who experience seizures.

**Summary**

What is already known on this topic?

Children and adolescents with seizures can have more associated mental, developmental, and behavioral problems than children and adolescents without seizures. No nationally representative estimates of seizure burden and health service utilization for children and adolescents aged 6–17 years in the United States have been reported.

What is added by this report?

According to 2010–2014 NHIS data, seizures affected 0.7% of children and adolescents aged 6–17 years and, relative to the general population, those with seizures were socially and economically disadvantaged, more likely to have co-occurring conditions, and more likely to face barriers to care.

What are the implications for public health practice?

Public health agencies can work with other health and human service agencies to raise awareness about seizures that occur in children and adolescents (e.g., educate parents and school personnel), implement strategies to prevent known causes and risk factors for seizures (e.g., head injuries), study the associations between sociodemographic characteristics and seizure incidence, and ensure linkages for those with seizures to appropriate clinical and community providers.

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# Gestational Weight Gain — United States, 2012 and 2013

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The weight a woman gains during pregnancy, known as gestational weight gain (GWG), has important health implications for both mother and child (*1*). The Institute of Medicine (IOM) provides GWG recommendations that promote optimal health by balancing risks associated with too much or too little GWG and are specific to a woman's prepregnancy body mass index (BMI; weight [kg]/height [m]$^2$) (*1*). In a recent study, 21% of pregnant women gained less than the recommended amount of weight, and 47% gained more than the recommended amount; however, state-specific prevalence was not examined (*2*). To estimate state-specific prevalence of GWG below, within, and above recommendations (referred to as inadequate, appropriate, and excessive, respectively), CDC analyzed 2013 birth data for U.S. resident women who delivered full-term (37–41 weeks gestation), singleton infants from 43 jurisdictions (41 states, New York City, and the District of Columbia [DC]) that used the 2003 revised birth certificate, which collects maternal height, prepregnancy weight, and delivery weight. In addition, 2012 data from the Pregnancy Risk Assessment Monitoring System (PRAMS) were analyzed to estimate prevalence for five states with available data that had not yet adopted the 2003 birth certificate. Overall, 32.1% of women had appropriate GWG. States varied in prevalence of inadequate (range = 12.6%–25.5%), appropriate (range = 26.2%–39.0%), and excessive (range = 38.2%–54.7%) GWG. The prevalence of inadequate GWG was ≥20% in 20 states and New York City; the prevalence of excessive GWG was ≥50% in 17 states. Stratification by prepregnancy BMI category indicated variation by state persisted; notably, overweight women had the highest prevalence of excessive GWG in nearly every state. Given the high prevalence of excessive GWG and its associated risks, including macrosomia and maternal obesity (*1*), effective interventions to prevent excessive GWG during pregnancy are needed.

The primary data source was 2013 National Vital Statistics System birth data, a census of all births, for jurisdictions using the 2003 revision of the U.S. Standard Certificate of Live Birth,* which collects the maternal height, prepregnancy weight, and delivery weight data needed to examine GWG in relation to the BMI-specific IOM recommendations. Height and weight data are self-reported or abstracted from the medical record. The previous (1989) birth certificate version reports only total GWG (self-reported or abstracted from the medical record), and therefore, cannot be used to examine GWG in relation to BMI-specific recommendations. As of January 1, 2013, 41 states,† New York City, and DC had adopted the 2003 birth certificate. Data from PRAMS for 2012 were analyzed for five states§ that had yet to transition to the 2003 birth certificate and that had PRAMS data available.¶ PRAMS is an ongoing, state-based surveillance system that systematically surveys a stratified, random sample of mothers from birth certificates.** At approximately 4 months postpartum, participating mothers complete a questionnaire that assesses pregnancy-related health characteristics, including height and prepregnancy weight. Questionnaire data are linked with birth certificate data, including GWG, and are weighted to represent all women delivering live infants in each state. For this report, women were included if they were U.S. residents delivering full-term, singleton infants and did not have missing values for prepregnancy weight, height, or GWG. The resulting sample represents approximately 79% of annual U.S. births.

Prepregnancy BMI was calculated using height and prepregnancy weight from the 2003 birth certificate or the PRAMS questionnaire. Prepregnancy BMI was categorized as underweight (BMI <18.5), normal weight (BMI = 18.5–24.9), overweight (BMI = 25.0–29.9), and obese (BMI ≥30.0). GWG was calculated by subtracting prepregnancy weight from delivery weight, and was categorized as inadequate, appropriate, or excessive if a woman gained below, within, or above the BMI-specific IOM recommendations, respectively. The IOM recommendations for GWG are 28–40 pounds for underweight women, 25–35 pounds for normal-weight women, 15–25 pounds for overweight women, and 11–20 pounds for obese women (*1*). Birth certificate and weighted PRAMS data were used separately to estimate state-specific prevalence and combined to estimate overall prevalence of inadequate, appropriate, and excessive GWG. The rationale for combining the data sets was based on a comparison of birth certificate data with data from an earlier analysis of PRAMS data in 28 states (*2*), which resulted in nearly identical estimates of inadequate, appropriate, and excessive GWG. Because prepregnancy BMI

* Additional information available at: http://www.cdc.gov/nchs/births.htm.

† Alaska, California, Colorado, Delaware, Florida, Georgia, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, Nevada, New Hampshire, New Mexico, New York, North Carolina, North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania, South Carolina, South Dakota, Tennessee, Texas, Utah, Vermont, Virginia, Washington, Wisconsin, Wyoming.

§ Arkansas, Hawaii, Maine, New Jersey, Rhode Island.

¶ Data are unavailable for states that do not participate in PRAMS, do not reach the 65% response-rate threshold, or do not approve the analysis.

** Additional information available at http://www.cdc.gov/prams.

**Summary**

What is already known on this topic?

The amount of weight a woman gains during pregnancy, known as gestational weight gain (GWG), has important maternal and infant health implications. A recent study estimated that 68% of women had GWG outside Institute of Medicine guidelines, including both inadequate (below recommendations) and excessive (above recommendations) weight gain. However, little is known about state-specific prevalence of inadequate and excessive GWG.

What is added by this report?

Overall, 32.1% of women had appropriate (within recommendations) GWG. Prevalence of inadequate GWG ranged by state from 12.6%–25.5%; in 20 states and New York City, ≥20% of women had inadequate weight gain. Prevalence of excessive GWG ranged by state from 38.2%–54.7%; in 17 states, ≥50% of women had excessive GWG. Stratification by prepregnancy BMI category indicated overweight and obese women had the highest prevalence of excessive GWG in nearly every state.

What are the implications for public health practice?

Interventions that might promote appropriate GWG combine several strategies, including calorie goals, physical activity, routine self-monitoring of weight, and frequent provider contact.


is an important determinant of GWG (*1*,*2*), prevalences of inadequate, appropriate, and excessive GWG were stratified by prepregnancy BMI category. Stratified, state-specific prevalences standardized by race/ethnicity and age were also estimated.

The overall prevalence of appropriate GWG was 32.1%, whereas the prevalence of inadequate GWG was 20.4% and the prevalence of excessive GWG was 47.5% (Table 1). States varied in prevalence of inadequate, appropriate, and excessive GWG. Inadequate GWG ranged from 12.6% in Rhode Island to 25.5% in Georgia; appropriate GWG ranged from 26.2% in Alaska to 39.0% in New Jersey; and excessive GWG ranged from 38.2% in New Jersey to 54.7% in Missouri. The prevalence of inadequate GWG was ≥20% in 20 states and New York City (Figure 1) and the prevalence of excessive GWG was ≥50% in 17 states (Figure 2).

Stratified by prepregnancy BMI, the prevalence of inadequate GWG was 32.2% for underweight, 23.6% for normal weight, 12.6% for overweight, and 20.6% for obese women. The prevalence of excessive GWG was 23.5% for underweight, 37.6% for normal weight, 61.6% for overweight, and 55.8% for obese women (Table 2). Although the prevalence of inadequate and excessive GWG within each prepregnancy BMI category varied by state, overweight women had the highest prevalence of excessive GWG in nearly every state. Variation by state persisted after standardization by race/ethnicity and age.

**TABLE 1. State-specific prevalence of inadequate, appropriate, and excessive gestational weight gain* — 46 States, New York City, and District of Columbia, 2012 and 2013†**

| | Gestational weight gain | | |
|---|---|---|---|
| Location | Inadequate No. (%) | Appropriate No. (%) | Excessive No. (%) |
| Alaska | 1,770 (19.6) | 2,369 (26.2) | 4,896 (54.2) |
| Arkansas§ | 4,974 (17.2) | 10,974 (38.0) | 12,918 (44.8) |
| California | 89,026 (21.4) | 142,928 (34.3) | 184,910 (44.4) |
| Colorado | 12,804 (22.7) | 19,291 (34.3) | 24,230 (43.0) |
| Delaware | 1,800 (19.2) | 2,722 (29.0) | 4,850 (51.8) |
| District of Columbia | 1,316 (17.8) | 2,600 (35.1) | 3,491 (47.1) |
| Florida | 36,208 (20.4) | 55,701 (31.3) | 86,042 (48.4) |
| Georgia | 23,571 (25.5) | 27,445 (29.7) | 41,287 (44.7) |
| Hawaii§ | 3,411 (22.0) | 5,809 (37.5) | 6,276 (40.5) |
| Idaho | 3,458 (17.5) | 6,586 (33.2) | 9,768 (49.3) |
| Illinois | 27,448 (20.8) | 42,849 (32.5) | 61,491 (46.7) |
| Indiana | 13,867 (19.1) | 22,224 (30.7) | 36,410 (50.2) |
| Iowa | 5,615 (16.3) | 10,059 (29.1) | 18,871 (54.6) |
| Kansas | 6,597 (19.2) | 11,151 (32.4) | 16,663 (48.4) |
| Kentucky | 9,848 (20.7) | 14,026 (29.4) | 23,767 (49.9) |
| Louisiana | 11,474 (22.0) | 15,569 (29.9) | 25,075 (48.1) |
| Maine§ | 2,518 (22.2) | 3,783 (33.4) | 5,033 (44.4) |
| Maryland | 13,109 (22.1) | 17,072 (28.8) | 29,073 (49.1) |
| Massachusetts | 9,956 (17.4) | 19,128 (33.3) | 28,305 (49.3) |
| Michigan | 18,318 (19.2) | 29,265 (30.6) | 48,092 (50.3) |
| Minnesota | 12,624 (20.9) | 20,160 (33.4) | 27,551 (45.7) |
| Mississippi | 6,958 (21.5) | 9,519 (29.4) | 15,952 (49.2) |
| Missouri | 10,899 (17.3) | 17,614 (28.0) | 34,378 (54.7) |
| Montana | 2,010 (19.0) | 3,343 (31.7) | 5,211 (49.3) |
| Nebraska | 4,140 (18.2) | 6,689 (29.5) | 11,885 (52.3) |
| Nevada | 5,595 (18.6) | 9,095 (30.3) | 15,378 (51.1) |
| New Hampshire | 1,712 (16.8) | 3,140 (30.8) | 5,350 (52.4) |
| New Jersey§ | 17,992 (22.8) | 30,859 (39.0) | 30,187 (38.2) |
| New Mexico | 4,104 (18.6) | 7,131 (32.3) | 10,849 (49.1) |
| New York | 20,482 (20.5) | 33,010 (33.0) | 46,527 (46.5) |
| New York City | 22,329 (21.8) | 37,060 (36.2) | 42,945 (42.0) |
| North Carolina | 20,226 (19.9) | 30,831 (30.4) | 50,455 (49.7) |
| North Dakota | 1,884 (20.3) | 2,833 (30.6) | 4,549 (49.1) |
| Ohio | 20,832 (18.6) | 31,868 (28.5) | 59,092 (52.9) |
| Oklahoma | 9,631 (21.4) | 12,860 (28.5) | 22,564 (50.1) |
| Oregon | 6,875 (17.7) | 12,343 (31.7) | 19,702 (50.6) |
| Pennsylvania | 19,820 (18.9) | 31,359 (29.9) | 53,844 (51.3) |
| Rhode Island§ | 970 (12.6) | 2,792 (36.3) | 3,940 (51.2) |
| South Carolina | 10,345 (21.5) | 14,469 (30.1) | 23,246 (48.4) |
| South Dakota | 1,924 (18.0) | 3,142 (29.4) | 5,631 (52.6) |
| Tennessee | 12,269 (18.6) | 19,180 (29.0) | 34,587 (52.4) |
| Texas | 69,056 (20.4) | 111,958 (33.1) | 157,578 (46.5) |
| Utah | 8,087 (18.1) | 15,811 (35.3) | 20,838 (46.6) |
| Vermont | 1,013 (19.2) | 1,679 (31.9) | 2,580 (48.9) |
| Virginia | 11,578 (17.7) | 22,398 (34.2) | 31,569 (48.2) |
| Washington | 15,351 (21.3) | 23,391 (32.4) | 33,503 (46.4) |
| Wisconsin | 14,354 (24.9) | 16,612 (28.8) | 26,793 (46.4) |
| Wyoming | 1,109 (16.8) | 2,004 (30.3) | 3,495 (52.9) |
| **PRAMS jurisdictions§** | **29,865 (21.0)** | **54,217 (38.1)** | **58,352 (41.0)** |
| **BC jurisdictions** | **601,392 (20.4)** | **940,484 (31.8)** | **1,413,273 (47.8)** |
| **Overall** | **631,257 (20.4)** | **994,701 (32.1)** | **1,471,625 (47.5)** |

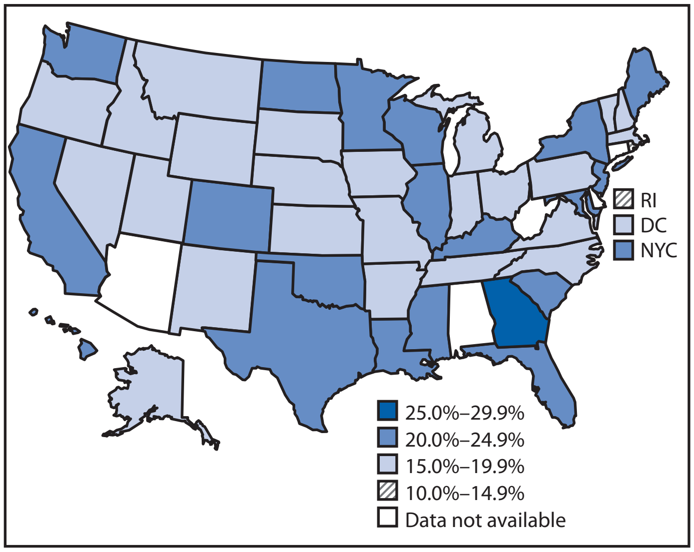
**Abbreviations:** BC = birth certificate; PRAMS = Pregnancy Risk Assessment Monitoring System.

* Gestational weight gain below (inadequate), within (appropriate), and above (excessive) Institute of Medicine recommendations, which are based on prepregnancy body mass index (BMI): 28–40 pounds for underweight women (BMI <18.5), 25–35 pounds for normal-weight women (BMI = 18.5–24.9), 15–25 pounds for overweight women (BMI 25.0–29.9), and 11–20 pounds for obese women (BMI ≥30.0).

† Based on analysis of data from 2012 PRAMS for five states and 2013 birth certificate for 41 states, New York City, and District of Columbia.

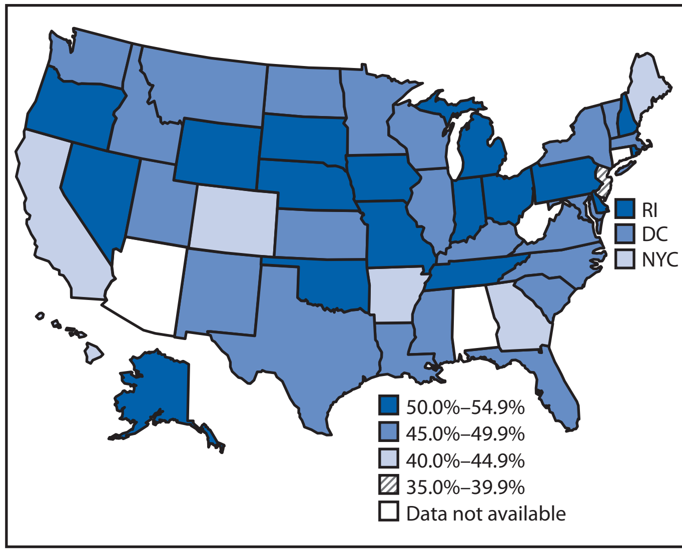
§ Data are from PRAMS and are presented as weighted frequencies and percent.

**FIGURE 1. Prevalence of inadequate gestational weight gain (GWG)* — 46 states, New York City, and District of Columbia, 2012–2013**




**Abbreviations:** DC = District of Columbia; NYC = New York City; RI = Rhode Island.
**Sources:** 2012 Pregnancy Risk Assessment Monitoring Systems for five states (Arkansas, Hawaii, Maine, New Jersey, Rhode Island) and 2013 birth certificates for 41 states, New York City, and District of Columbia.
* Gestational weight gain below Institute of Medicine recommendations, which are based on prepregnancy body mass index (BMI): 28–40 pounds for underweight women (BMI <18.5), 25–35 pounds for normal-weight women (BMI = 18.5–24.9), 15–25 pounds for overweight women (BMI = 25.0–29.9), and 11–20 pounds for obese women (BMI ≥30.0).

**FIGURE 2. Prevalence of excessive gestational weight gain (GWG)* — 46 states, New York City, and District of Columbia, 2012–2013**




**Abbreviations:** DC = District of Columbia; NYC = New York City; RI = Rhode Island.
**Sources:** 2012 Pregnancy Risk Assessment Monitoring Systems for five states (Arkansas, Hawaii, Maine, New Jersey, Rhode Island) and 2013 birth certificates for 41 states, New York City, and District of Columbia.
* Gestational weight gain above Institute of Medicine recommendations, which are based on prepregnancy body mass index (BMI): 28–40 pounds for underweight women (BMI <18.5), 25–35 pounds for normal-weight women (BMI = 18.5–24.9), 15–25 pounds for overweight women (BMI = 25.0–29.9), and 11–20 pounds for obese women (BMI ≥30.0).

## Discussion

Gestational weight gain outside the IOM recommendations has important short- and long-term health consequences for mothers and infants. Whereas, inadequate GWG increases the risk for low birthweight; excessive GWG increases the risk for macrosomia, postpartum weight retention, future maternal obesity, and possibly future childhood obesity (*1*). Among women from 46 states, New York City, and DC who delivered a full-term, singleton infant, only one third had appropriate GWG, whereas 20% had inadequate GWG and approximately half had excessive GWG. Excessive GWG was more prevalent than inadequate or appropriate GWG in every state; in 17 states, the prevalence of excessive GWG was ≥50%. Other studies have reported similar findings (*2*) and indicate that during the past decade, the prevalence of excessive GWG has increased and prevalence of inadequate GWG has remained stable (*3*). These findings indicate that effective interventions during pregnancy, in addition to routine prenatal care, are needed to promote appropriate GWG.

The American College of Obstetricians and Gynecologists recommends that clinicians calculate a woman's prepregnancy BMI at the first prenatal care visit, educate her on the importance of appropriate GWG goals, and counsel her on appropriate dietary and physical activity behaviors to achieve these goals. Education, counseling, and monitoring of GWG should continue throughout pregnancy (*4*). The IOM developed an evidence-based toolkit that includes educational materials for clinicians and women and a BMI-specific weight gain tracker that can be used to monitor and compare GWG with recommended ranges throughout pregnancy.[††]

Interventions that might promote appropriate GWG combine several strategies, including dietary goals, physical activity, routine self-monitoring of weight, and frequent provider contact. Most women need to consume an additional 340–450 calories per day only during the second and third trimesters to support the metabolic demands of pregnancy (*1*); dietary goals might be helpful to meet these additional energy requirements (*5*,*6*). Physical activity, when combined with dietary goals, has been found to be an effective strategy in preventing excessive GWG (*5*,*6*). Pregnant women should engage in 150 minutes per week of moderate-intensity physical activity, such as brisk walking (*7*). Routine self-monitoring of weight gain should begin early in pregnancy and continue frequently between prenatal care visits so that signals of inadequate or excessive GWG can be identified when small, corrective steps can be taken (*5*). Notably, excessive GWG early in pregnancy strongly predicts

[††] Additional information available at http://iom.nationalacademies.org/About-IOM/Leadership-Staff/IOM-Staff-Leadership-Boards/Food-and-Nutrition-Board/HealthyPregnancy.aspx.

**TABLE 2. State-specific prevalence of inadequate, appropriate, and excessive gestational weight gain by prepregnancy body mass index category* — 46 States, New York City, and District of Columbia, 2012 and 2013†**

| State | Underweight (n = 116,287) | | | Normal weight (n = 1,460,476) | | |
|---|---|---|---|---|---|---|
| | Inadequate No. (%) | Appropriate No. (%) | Excessive No. (%) | Inadequate No. (%) | Appropriate No. (%) | Excessive No. (%) |
| Alaska | 58 (24.4) | 113 (47.5) | 67 (28.2) | 758 (17.9) | 1,427 (33.7) | 2,048 (48.4) |
| Arkansas§ | ¶ | ¶ | ¶ | 3,013 (23.2) | 5,759 (44.4) | 4,199 (32.4) |
| California | 5,350 (33.8) | 7,155 (45.3) | 3,308 (20.9) | 51,251 (25.6) | 80,041 (39.9) | 69,182 (34.5) |
| Colorado | 771 (37.1) | 902 (43.4) | 407 (19.6) | 7,537 (26.3) | 11,517 (40.2) | 9,599 (33.5) |
| Delaware | 94 (30.5) | 135 (43.8) | 79 (25.7) | 872 (21.0) | 1,500 (36.2) | 1,775 (42.8) |
| District of Columbia | 89 (29.6) | 142 (47.2) | 70 (23.3) | 841 (21.2) | 1,722 (43.4) | 1,407 (35.4) |
| Florida | 2,465 (30.8) | 3,394 (42.3) | 2,157 (26.9) | 20,336 (23.8) | 31,173 (36.5) | 33,837 (39.7) |
| Georgia | 1,155 (32.5) | 1,581 (44.5) | 818 (23.0) | 10,012 (25.5) | 14,394 (36.7) | 14,855 (37.8) |
| Hawaii§ | ¶ | ¶ | ¶ | 2,557 (27.3) | 4,049 (43.2) | 2,771 (29.6) |
| Idaho | 201 (30.6) | 306 (46.7) | 149 (22.7) | 1,906 (19.6) | 3,925 (40.3) | 3,915 (40.2) |
| Illinois | 1,440 (33.6) | 1,921 (44.8) | 928 (21.6) | 14,834 (25.0) | 23,260 (39.1) | 21,338 (35.9) |
| Indiana | 796 (30.1) | 1,176 (44.5) | 672 (25.4) | 7,319 (23.1) | 11,745 (37.1) | 12,602 (39.8) |
| Iowa | 297 (28.6) | 487 (46.9) | 254 (24.5) | 2,802 (17.8) | 5,933 (37.7) | 6,991 (44.5) |
| Kansas | 375 (33.0) | 495 (43.5) | 267 (23.5) | 3,563 (22.4) | 6,416 (40.4) | 5,920 (37.2) |
| Kentucky | 621 (29.7) | 937 (44.8) | 532 (25.5) | 4,541 (22.3) | 7,321 (36.0) | 8,471 (41.7) |
| Louisiana | 730 (34.2) | 911 (42.7) | 493 (23.1) | 5,740 (25.2) | 8,281 (36.3) | 8,791 (38.5) |
| Maine§ | ¶ | ¶ | ¶ | 1,459 (27.3) | 2,075 (38.8) | 1,810 (33.9) |
| Maryland | 632 (32.6) | 855 (44.1) | 453 (23.4) | 6,071 (22.0) | 10,424 (37.7) | 11,148 (40.3) |
| Massachusetts | 624 (29.6) | 950 (45.1) | 533 (25.3) | 5,878 (19.4) | 12,831 (42.4) | 11,557 (38.2) |
| Michigan | 952 (31.3) | 1,333 (43.8) | 760 (25.0) | 9,841 (23.1) | 15,837 (37.2) | 16,844 (39.6) |
| Minnesota | 506 (37.0) | 624 (45.6) | 238 (17.4) | 6,907 (25.0) | 11,340 (41.0) | 9,396 (34.0) |
| Mississippi | 468 (31.4) | 653 (43.8) | 369 (24.8) | 3,408 (26.2) | 4,459 (34.3) | 5,144 (39.5) |
| Missouri | 664 (26.2) | 1,099 (43.4) | 772 (30.5) | 5,397 (18.3) | 10,537 (35.6) | 13,635 (46.1) |
| Montana | 116 (31.5) | 174 (47.3) | 78 (21.2) | 1,116 (21.5) | 1,985 (38.3) | 2,083 (40.2) |
| Nebraska | 224 (31.3) | 306 (42.8) | 185 (25.9) | 2,126 (19.7) | 4,041 (37.4) | 4,641 (42.9) |
| Nevada | 345 (26.3) | 615 (47.0) | 350 (26.7) | 2,949 (20.4) | 5,314 (36.7) | 6,226 (43.0) |
| New Hampshire | 86 (27.6) | 137 (43.9) | 89 (28.5) | 990 (19.7) | 1,879 (37.4) | 2,158 (42.9) |
| New Jersey§ | ¶ | ¶ | ¶ | 12,379 (28.6) | 19,079 (44.0) | 11,872 (27.4) |
| New Mexico | 269 (30.9) | 380 (43.6) | 222 (25.5) | 2,274 (23.0) | 3,746 (37.8) | 3,882 (39.2) |
| New York | 1,083 (35.2) | 1,340 (43.5) | 657 (21.3) | 11,693 (25.2) | 18,339 (39.6) | 16,333 (35.2) |
| New York City | 1,899 (34.7) | 2,549 (46.5) | 1,031 (18.8) | 14,910 (27.2) | 22,447 (41.0) | 17,443 (31.8) |
| North Carolina | 1,288 (32.0) | 1,731 (43.0) | 1,005 (25.0) | 10,740 (23.3) | 16,980 (36.8) | 18,481 (40.0) |
| North Dakota | 55 (26.8) | 99 (48.3) | 51 (24.9) | 930 (23.5) | 1,516 (38.4) | 1,507 (38.1) |
| Ohio | 1,251 (28.6) | 1,939 (44.4) | 1,179 (27.0) | 10,143 (19.5) | 18,762 (36.0) | 23,147 (44.5) |
| Oklahoma | 579 (29.8) | 795 (40.9) | 569 (29.3) | 4,516 (22.8) | 6,956 (35.2) | 8,305 (42.0) |
| Oregon | 339 (27.1) | 581 (46.5) | 330 (26.4) | 3,828 (20.2) | 7,341 (38.8) | 7,758 (41.0) |
| Pennsylvania | 1,146 (29.0) | 1,801 (45.5) | 1,010 (25.5) | 10,353 (20.1) | 19,394 (37.7) | 21,757 (42.2) |
| Rhode Island§ | ¶ | ¶ | ¶ | 632 (15.7) | 1,788 (44.5) | 1,595 (39.7) |
| South Carolina | 584 (31.7) | 808 (43.8) | 453 (24.6) | 4,925 (24.1) | 7,529 (36.8) | 8,008 (39.1) |
| South Dakota | 87 (26.7) | 158 (48.5) | 81 (24.9) | 982 (19.5) | 1,869 (37.0) | 2,199 (43.5) |
| Tennessee | 824 (28.1) | 1,259 (42.9) | 850 (29.0) | 6,367 (20.7) | 11,164 (36.4) | 13,174 (42.9) |
| Texas | 4,251 (32.9) | 5,641 (43.6) | 3,043 (23.5) | 39,514 (25.1) | 62,032 (39.4) | 55,859 (35.5) |
| Utah | 614 (31.3) | 963 (49.1) | 385 (19.6) | 4,731 (19.5) | 10,348 (42.6) | 9,201 (37.9) |
| Vermont | 58 (37.7) | 68 (44.2) | ¶ | 532 (20.9) | 1,061 (41.6) | 955 (37.5) |
| Virginia | 792 (31.8) | 1,135 (45.5) | 567 (22.7) | 6,688 (20.9) | 13,441 (42.0) | 11,911 (37.2) |
| Washington | 637 (30.1) | 954 (45.1) | 526 (24.9) | 7,774 (23.4) | 13,231 (39.8) | 12,272 (36.9) |
| Wisconsin | 447 (32.6) | 616 (44.9) | 310 (22.6) | 5,537 (22.2) | 9,453 (37.9) | 9,973 (40.0) |
| Wyoming | 74 (30.3) | 94 (38.5) | 76 (31.2) | 649 (19.3) | 1,279 (38.0) | 1,439 (42.7) |
| **PRAMS jurisdictions§** | **2,068 (39.5)** | **2,186 (41.7)** | **984 (18.8)** | **20,041 (26.7)** | **32,750 (43.6)** | **22,248 (29.6)** |
| **BC jurisdictions** | **35,336 (31.8)** | **49,312 (44.4)** | **26,401 (23.8)** | **324,081 (23.4)** | **534,190 (38.6)** | **527,167 (38.1)** |
| **Overall** | **37,404 (32.2)** | **51,498 (44.3)** | **27,385 (23.5)** | **344,122 (23.6)** | **566,940 (38.8)** | **549,415 (37.6)** |

See table footnotes on next page.

**TABLE 2. (*Continued*) State-specific prevalence of inadequate, appropriate, and excessive gestational weight gain by prepregnancy body mass index category* — 46 States, New York City, and District of Columbia, 2012 and 2013†**

| | Overweight (n = 793,191) | | | Obese (n = 727,628) | | |
|---|---|---|---|---|---|---|
| State | Inadequate No. (%) | Appropriate No. (%) | Excessive No. (%) | Inadequate No. (%) | Appropriate No. (%) | Excessive No. (%) |
| Alaska | 364 (15.6) | 436 (18.7) | 1,533 (65.7) | 590 (26.5) | 393 (17.6) | 1,248 (55.9) |
| Arkansas§ | ¶ | 2,209 (29.5) | 4,761 (63.6) | ¶ | 2,480 (32.7) | 3,688 (48.6) |
| California | 14,395 (13.1) | 32,108 (29.3) | 63,039 (57.6) | 18,030 (19.8) | 23,624 (26.0) | 49,381 (54.2) |
| Colorado | 2,146 (14.9) | 3,965 (27.5) | 8,300 (57.6) | 2,350 (21.0) | 2,907 (26.0) | 5,924 (53.0) |
| Delaware | 316 (12.7) | 562 (22.6) | 1,612 (64.7) | 518 (21.3) | 525 (21.6) | 1,384 (57.0) |
| District of Columbia | 161 (9.8) | 396 (24.1) | 1,088 (66.1) | 225 (15.1) | 340 (22.8) | 926 (62.1) |
| Florida | 5,944 (13.0) | 11,826 (25.8) | 28,037 (61.2) | 7,463 (19.2) | 9,308 (24.0) | 22,011 (56.8) |
| Georgia | 4,861 (20.2) | 5,722 (23.7) | 13,547 (56.1) | 7,543 (29.8) | 5,748 (22.7) | 12,067 (47.6) |
| Hawaii§ | ¶ | 860 (29.0) | 1,875 (63.2) | ¶ | 682 (26.8) | 1,508 (59.3) |
| Idaho | 511 (10.1) | 1,249 (24.8) | 3,281 (65.1) | 840 (19.2) | 1,106 (25.3) | 2,423 (55.5) |
| Illinois | 4,480 (12.6) | 9,722 (27.4) | 21,257 (60.0) | 6,694 (20.5) | 7,946 (24.4) | 17,968 (55.1) |
| Indiana | 2,082 (11.1) | 4,771 (25.4) | 11,959 (63.6) | 3,670 (18.9) | 4,532 (23.4) | 11,177 (57.7) |
| Iowa | 750 (8.4) | 1,837 (20.5) | 6,366 (71.1) | 1,766 (20.0) | 1,802 (20.4) | 5,260 (59.6) |
| Kansas | 997 (11.3) | 2,221 (25.3) | 5,571 (63.4) | 1,662 (19.4) | 2,019 (23.5) | 4,905 (57.1) |
| Kentucky | 1,640 (13.6) | 2,808 (23.4) | 7,579 (63.0) | 3,046 (23.1) | 2,960 (22.4) | 7,185 (54.5) |
| Louisiana | 1,815 (13.9) | 3,115 (23.9) | 8,118 (62.2) | 3,189 (22.6) | 3,262 (23.1) | 7,673 (54.3) |
| Maine§ | ¶ | 853 (28.7) | 1,740 (58.5) | ¶ | ¶ | 1,394 (54.8) |
| Maryland | 2,579 (16.6) | 3,220 (20.8) | 9,718 (62.6) | 3,827 (27.0) | 2,573 (18.2) | 7,754 (54.8) |
| Massachusetts | 1,518 (10.6) | 3,167 (22.1) | 9,640 (67.3) | 1,936 (18.1) | 2,180 (20.4) | 6,575 (61.5) |
| Michigan | 2,757 (11.2) | 6,200 (25.1) | 15,766 (63.8) | 4,768 (18.8) | 5,895 (23.2) | 14,722 (58.0) |
| Minnesota | 2,129 (13.0) | 4,397 (26.9) | 9,817 (60.1) | 3,082 (20.6) | 3,799 (25.4) | 8,100 (54.1) |
| Mississippi | 1,116 (13.9) | 1,984 (24.7) | 4,942 (61.5) | 1,966 (19.9) | 2,423 (24.5) | 5,497 (55.6) |
| Missouri | 1,524 (10.0) | 3,080 (20.1) | 10,716 (70.0) | 3,314 (21.4) | 2,898 (18.7) | 9,255 (59.8) |
| Montana | 292 (10.8) | 643 (23.8) | 1,771 (65.5) | 486 (21.1) | 541 (23.5) | 1,279 (55.5) |
| Nebraska | 639 (10.9) | 1,236 (21.0) | 3,999 (68.1) | 1,151 (21.7) | 1,106 (20.8) | 3,060 (57.6) |
| Nevada | 968 (12.7) | 1,780 (23.3) | 4,899 (64.1) | 1,333 (20.1) | 1,386 (20.9) | 3,903 (58.9) |
| New Hampshire | 202 (7.9) | 584 (23.0) | 1,757 (69.1) | 434 (18.7) | 540 (23.3) | 1,346 (58.0) |
| New Jersey§ | ¶ | 6,114 (31.7) | 11,424 (59.3) | 2,360 (17.6) | ¶ | 6,458 (48.2) |
| New Mexico | 668 (11.4) | 1,565 (26.8) | 3,613 (61.8) | 893 (16.3) | 1,440 (26.4) | 3,132 (57.3) |
| New York | 3,143 (11.8) | 7,439 (28.0) | 15,983 (60.2) | 4,563 (19.0) | 5,892 (24.5) | 13,554 (56.5) |
| New York City | 3,142 (12.6) | 7,775 (31.0) | 14,128 (56.4) | 2,378 (14.0) | 4,289 (25.2) | 10,343 (60.8) |
| North Carolina | 3,060 (11.8) | 6,396 (24.8) | 16,378 (63.4) | 5,138 (20.2) | 5,724 (22.5) | 14,591 (57.3) |
| North Dakota | 331 (13.2) | 600 (23.9) | 1,583 (63.0) | 568 (21.9) | 618 (23.8) | 1,408 (54.3) |
| Ohio | 3,097 (11.2) | 5,716 (20.7) | 18,858 (68.2) | 6,341 (22.9) | 5,451 (19.7) | 15,908 (57.4) |
| Oklahoma | 1,740 (15.3) | 2,611 (22.9) | 7,044 (61.8) | 2,796 (23.4) | 2,498 (20.9) | 6,646 (55.7) |
| Oregon | 990 (10.2) | 2,303 (23.8) | 6,395 (66.0) | 1,718 (19.0) | 2,118 (23.4) | 5,219 (57.6) |
| Pennsylvania | 3,013 (11.7) | 5,513 (21.5) | 17,173 (66.8) | 5,308 (22.2) | 4,651 (19.5) | 13,904 (58.3) |
| Rhode Island§ | ¶ | 433 (23.5) | 1,292 (70.1) | 110 (7.2) | ¶ | 981 (64.3) |
| South Carolina | 1,731 (14.3) | 2,955(24.4) | 7,411 (61.3) | 3,105 (22.7) | 3,177 (23.3) | 7,374 (54.0) |
| South Dakota | 303 (10.9) | 600 (21.6) | 1,872 (67.5) | 552 (21.7) | 515 (20.2) | 1,479 (58.1) |
| Tennessee | 1,846 (11.5) | 3,546 (22.0) | 10,715 (66.5) | 3,232 (19.8) | 3,211 (19.7) | 9,848 (60.5) |
| Texas | 10,784 (12.3) | 24,372 (27.8) | 52,461 (59.9) | 14,507 (18.0) | 19,913 (24.7) | 46,215 (57.3) |
| Utah | 1,029 (10.0) | 2,530 (24.7) | 6,688 (65.3) | 1,713 (20.8) | 1,970 (23.9) | 4,564 (55.3) |
| Vermont | 143 (11.1) | 270 (21.0) | 872 (67.9) | 280 (21.8) | 280 (21.8) | 725 (56.4) |
| Virginia | 1,611 (9.7) | 4,281 (25.6) | 10,808 (64.7) | 2,487 (17.4) | 3,541 (24.7) | 8,283 (57.9) |
| Washington | 2,646 (13.9) | 4,946 (25.9) | 11,483 (60.2) | 4,294 (24.2) | 4,260 (24.0) | 9,222 (51.9) |
| Wisconsin | 3,101 (20.2) | 3,335 (21.7) | 8,946 (58.2) | 5,269 (32.9) | 3,208 (20.0) | 7,564 (47.2) |
| Wyoming | 130 (8.3) | 326 (20.7) | 1,118 (71.0) | 256 (18.0) | 305 (21.4) | 862 (60.6) |
| **PRAMS jurisdictions§** | **2,987 (8.6)** | **10,469 (30.3)** | **21,092 (61.1)** | **4,769 (17.3)** | **8,811 (31.9)** | **14,029 (50.8)** |
| **BC jurisdictions** | **96,694 (12.7)** | **194,108 (25.6)** | **467,841 (61.7)** | **145,281 (20.8)** | **162,874 (23.3)** | **391,864 (56.0)** |
| **Overall** | **99,681 (12.6)** | **204,577 (25.9)** | **488,933 (61.6)** | **150,050 (20.6)** | **171,685 (23.6)** | **405,893 (55.8)** |

**Abbreviations:** BC = birth certificate; PRAMS = Pregnancy Risk Assessment Monitoring System.

* Gestational weight gain below (inadequate) and above (excessive) Institute of Medicine recommendations, which are based on prepregnancy body mass index (BMI): 28–40 pounds for underweight women (BMI <18.5), 25–35 pounds for normal-weight women (BMI = 18.5–24.9), 15–25 pounds for overweight women (BMI 25.0–29.9), and 11–20 pounds for obese women (BMI ≥30.0).

† Based on data from the 2012 PRAMS for five states and 2013 birth certificate for 41 states, New York City, and District of Columbia.

§ Data are from PRAMS and are presented as weighted frequencies and percent.

¶ Data suppressed because of small (<30) sample size.

total excessive GWG (*8*), suggesting that women with early excessive GWG might need to be prioritized for interventions. Frequent, ongoing contact with health care providers beyond routine prenatal care, such as nurses or nutrition specialists, might also help women achieve appropriate GWG (*5*).

Prepregnancy BMI is an important determinant of inappropriate GWG: underweight and class II or III obesity (BMI ≥35–<40 or BMI ≥40, respectively) increase risk for inadequate GWG whereas overweight and any obesity increase risk for excessive GWG (*1*,*2*). Within prepregnancy BMI categories, risk for inadequate and excessive GWG has been found to vary by maternal race/ethnicity and age (*2*). After adjustment for prepregnancy BMI and demographic characteristics associated with inappropriate GWG, state variation in prevalence of inadequate and excessive GWG persisted, suggesting that social, environmental, and policy determinants of GWG should be considered. Public health campaigns designed to raise awareness about GWG recommendations and alter social norms around diet and physical activity during pregnancy might be needed to effectively promote appropriate GWG (*9*). Some women might also believe that physical activity during pregnancy is risky (*9*); however, physical activity is safe and recommended for most pregnant women and might reduce some pregnancy-related complications (*7*,*10*). Access to healthy foods, opportunities for physical activity, and expanded medical and nutrition services for pregnant women are plausible environmental and policy determinants of GWG; however, more studies are needed to evaluate these influences on inadequate or excessive GWG (*1*).

The findings in this report are subject to at least three limitations. First, weight data from the birth certificate were derived from medical records or self-reported and weight data from the PRAMS questionnaire were obtained approximately 4 months postpartum; consequently, prepregnancy BMI or GWG might be misclassified. Second, analyses were restricted to pregnancies resulting in full-term, singleton infants; thus, findings might not be applicable to all pregnancies. Finally, because nationally representative data are not available, two data sources with different sampling and variable ascertainment methodologies were used; this might affect some state-to-state comparisons and actual overall results. However, comparison of estimates of GWG using only birth certificate data from the current analysis with an analysis of PRAMS data from 28 states (*2*) found nearly identical inadequate, appropriate and excessive GWG prevalence estimates, suggesting that the two data sources are comparable in their aggregate prevalence estimates.

Fewer than one third of women had GWG within IOM recommendations. The high prevalence of excessive GWG, which varies by state and prepregnancy BMI, is of concern because excessive GWG increases the risk for macrosomia, postpartum weight retention, and obesity in mothers and possibly children. To improve maternal and child health, intensified, multifaceted strategies are important for increasing the proportion of women who achieve appropriate GWG.

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PRAMS Working Group. List of members available at http://www.cdc.gov/prams/pdf/workinggroup_7-2012.pdf.

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# Vital Signs: Multistate Foodborne Outbreaks — United States, 2010–2014

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## Abstract

**Introduction:** Millions of U.S. residents become ill from foodborne pathogens each year. Most foodborne outbreaks occur among small groups of persons in a localized area. However, because many foods are distributed widely and rapidly, and because detection methods have improved, outbreaks that occur in multiple states and that even span the entire country are being recognized with increasing frequency.

**Methods:** This report analyzes data from CDC's Foodborne Disease Outbreak Surveillance System to describe multistate foodborne outbreaks that occurred in the United States during 2010–2014.

**Results:** During this 5-year period, 120 multistate foodborne disease outbreaks (with identified pathogen and food or common setting) were reported to CDC. These multistate outbreaks accounted for 3% (120 of 4,163) of all reported foodborne outbreaks, but were responsible for 11% (7,929 of 71,747) of illnesses, 34% (1,460 of 4,247) of hospitalizations, and 56% (66 of 118) of deaths associated with foodborne outbreaks. *Salmonella* (63 outbreaks), Shiga toxin-producing *E. coli* (34), and *Listeria monocytogenes* (12) were the leading pathogens. Fruits (17), vegetable row crops (15), beef (13), sprouts (10), and seeded vegetables (nine) were the most commonly implicated foods. Traceback investigations to identify the food origin were conducted for 87 outbreaks, of which 55 led to a product recall. Imported foods were linked to 18 multistate outbreaks.

**Conclusions:** Multistate foodborne disease outbreaks account for a disproportionate number of outbreak-associated illnesses, hospitalizations, and deaths relative to their occurrence. Working together, food industries and public health departments and agencies can develop and implement more effective ways to identify and to trace contaminated foods linked to multistate outbreaks. Lessons learned during outbreak investigations can help improve food safety practices and regulations, and might prevent future outbreaks.

## Introduction

Each year, millions of U.S. residents become ill from eating contaminated food (*1*). Some of these illnesses are associated with a recognized foodborne disease outbreak. Although most outbreaks occur locally, some are widely dispersed, affecting persons in more than one state, or even nationally.

This report characterizes the epidemiology of multistate foodborne disease outbreaks that occurred in the United States during 2010–2014 and describes how the food industries and local, state, and federal agencies collaborate to investigate outbreaks and use lessons learned to prevent future outbreaks.

## Methods

Local, state, and federal public health officials submit reports on multistate foodborne disease outbreaks to CDC's Foodborne Disease Outbreak Surveillance System, which is part of CDC's National Outbreak Reporting System. Foodborne outbreaks are defined as two or more cases of a similar illness caused by ingesting the same food. Multistate foodborne disease outbreaks are defined as foodborne outbreaks in which the exposure occurred in more than one state. Information reported includes dates of the outbreak; number of illnesses, hospitalizations, and deaths; states and territories involved; etiologic agent; and food involved (*2*).

Foods were categorized according to methods developed by the Interagency Food Safety Analytics Collaboration (*3*), a partnership between CDC, the Food and Drug Administration (FDA), and the Department of Agriculture's Food Safety and Inspection Service (USDA-FSIS).

## Results

During 2010–2014, 120 multistate foodborne disease outbreaks were reported to the Foodborne Disease Outbreak Surveillance System. An average of 24 outbreaks occurred per year (range = 19–26). The median number of states involved in each outbreak was six (range = 2–37). All states, the District of Columbia, and Puerto Rico were affected by one or more multistate foodborne disease outbreaks during the 5-year period. The median number of cases per outbreak was 22 (range = 2–1,939). Overall, these multistate outbreaks accounted for 3% (120 of 4,163) of all U.S. foodborne disease outbreaks, but they were responsible for 11% (7,929 of 71,747) of illnesses, 34% (1,460 of 4,247) of hospitalizations, and 56% (66 of 118) of deaths in foodborne outbreaks. The leading etiologic agents in multistate foodborne outbreaks were *Salmonella* (63 outbreaks), Shiga toxin-producing *E. coli* (STEC) (34), and *Listeria monocytogenes* (12) (Table 1).

*Salmonella* accounted for the majority of illnesses (82%; 6,530 of 7,929) and hospitalizations (65%; 952 of 1,460) associated with multistate foodborne disease outbreaks (Table 2), and was responsible for the three largest outbreaks, which were linked to eggs (an estimated 1,939 illnesses), chicken (634), and a raw scraped ground tuna product (425). *Salmonella* outbreaks involved nearly twice as many food categories as any other pathogen, including fruit (13 outbreaks; 21%), the most frequent category, followed by seeded vegetables (nine outbreaks), nuts and seeds (eight), and sprouts (seven). Foods from land animals, such as beef (five outbreaks), chicken (four), and eggs (one), also were sources of multistate *Salmonella* outbreaks (Table 1). The three most common *Salmonella* serotypes were Newport (10 outbreaks; 16%), Enteritidis (six; 10%), and Javiana (five; 8%).

Among the 34 STEC outbreaks, almost half (14 outbreaks; 41%) were linked to vegetable row crops (e.g., leafy greens) and another quarter (8 outbreaks; 24%) to beef. Dairy products (two outbreaks), sprouts (two), and fish (one) also were reported (Table 1). Twenty (59%) of the multistate STEC outbreaks were caused by serogroup O157. Serogroups O26 and O145 were responsible for three outbreaks each.

*Listeria monocytogenes* caused 12 multistate outbreaks. Six resulted from contaminated dairy products, three from contaminated fruit, and one from sprouts (Table 1). *Listeria* was the most deadly pathogen among those isolated in multistate foodborne disease outbreaks, accounting for 57 deaths, 86% of the total. Thirty-three (58%) of the deaths occurred in a single outbreak linked to cantaloupe.

Eighteen (15%) outbreaks were linked to imported foods (Table 3). These outbreaks accounted for 18% (1,439 of 7,929) of illnesses, 21% (300 of 1,460) of hospitalizations, and 9% (6 of 66) of deaths. Mexico was the leading source of imported food linked to multistate outbreaks (six), followed by Turkey (three). Six of the outbreaks caused by imported food (35%) were linked to fruit, four to nuts and seeds, and two each to fish and seeded vegetables. *Salmonella* was the etiologic agent for 15 (83%) outbreaks. The only multistate foodborne outbreak attributed to a parasite (*Cyclospora*) was associated with a bagged salad mix imported from Mexico.

During 2010–2014, investigators conducted product tracebacks for 87 of the multistate outbreaks (73%). The tracebacks led to food product recalls in 55 outbreaks (46%).

**TABLE 1. Multistate foodborne disease outbreaks (N = 120), by pathogen and food category — Foodborne Disease Outbreak Surveillance System, United States, 2010–2014**

| Food category | Pathogen: *Salmonella* | STEC* | *Listeria* | *Vibrio* | Other† | Total No. | Total (%) |
|---|---|---|---|---|---|---|---|
| Fruits | 13 | — | 3 | — | 1 | **17** | (14) |
| Vegetable row crops | 1 | 14 | — | — | — | **15** | (13) |
| Beef | 5 | 8 | — | — | — | **13** | (11) |
| Sprouts | 7 | 2 | 1 | — | — | **10** | (8) |
| Seeded vegetables | 9 | — | — | — | — | **9** | (8) |
| Dairy | — | 2 | 6 | — | — | **8** | (7) |
| Nuts/Seeds | 8 | 1 | — | — | — | **9** | (8) |
| Mollusks | — | — | — | 6 | 1 | **7** | (6) |
| Chicken | 4 | — | — | — | 1 | **5** | (4) |
| Fish | 3 | 1 | — | — | — | **4** | (3) |
| Turkey | 3 | — | — | — | — | **3** | (3) |
| Eggs | 1 | — | — | — | — | **1** | (<1) |
| Game | — | 1 | — | — | — | **1** | (<1) |
| Oils/Sugars | 1 | — | — | — | — | **1** | (<1) |
| Pork | 1 | — | — | — | — | **1** | (<1) |
| Other§ | 7 | 5 | 2 | — | 2 | **16** | (13) |
| **Total (%)** | **63 (53)** | **34 (28)** | **12 (10)** | **6 (5)** | **5 (4)** | **120** | **(100)** |

* Shiga toxin–producing *E. coli*.
† Includes one outbreak each caused by *Campylobacter*, a chemical, *Cyclospora*, Hepatitis A virus, and norovirus.
§ Includes multiple foods (seven outbreaks), uncategorized food (four), and unknown food (five).

**TABLE 2. Number of outbreaks, illnesses, hospitalizations, and deaths associated with multistate foodborne disease outbreaks (N = 120) — Foodborne Disease Outbreak Surveillance System, United States, 2010–2014**

| Pathogen | Outbreaks No. | Outbreaks (%) | Illnesses No. | Illnesses (%) | Hospitalizations No. | Hospitalizations (%) | Deaths No. | Deaths (%) |
|---|---|---|---|---|---|---|---|---|
| *Salmonella* | 63 | (53) | 6,530 | (82) | 952 | (65) | 8 | (12) |
| STEC* | 34 | (28) | 636 | (8) | 178 | (12) | 1 | (2) |
| *Listeria* | 12 | (10) | 271 | (3) | 244 | (17) | 57 | (86) |
| *Vibrio* | 6 | (5) | 89 | (1) | 6 | (<1) | 0 | (0) |
| Other† | 5 | (4) | 403 | (5) | 80 | (5) | 0 | (0) |
| **Total (%)** | **120** | **(100)** | **7,929** | **(100)** | **1,460** | **(100)** | **66** | **(100)** |

* Shiga toxin–producing *E. coli*.
† Includes one outbreak each caused by *Campylobacter*, a chemical, *Cyclospora*, Hepatitis A virus, and norovirus.

## Conclusions and Comment

Multistate foodborne outbreaks were responsible for a disproportionate number of outbreak-associated hospitalizations and deaths compared with single state outbreaks in the United States during 2010–2014. The pathogens that caused most

**TABLE 3. Multistate foodborne diseases outbreaks (N = 18) from imported foods, by selected characteristics — Foodborne Disease Outbreak Surveillance System, United States, 2010–2014**

| Year | Country of origin | Pathogen | Food category | Food | No. of states | No. of illnesses | No. of hospitalizations | No. of deaths |
|---|---|---|---|---|---|---|---|---|
| 2010 | Guatemala | *Salmonella* | Fruits | Mamey shake | 3 | 12 | 9 | 0 |
| 2010 | Unknown | *Salmonella* | Fish | Ahi tuna | 12 | 51 | Unknown | Unknown |
| 2011 | Guatemala | *Salmonella* | Fruits | Cantaloupe | 10 | 20 | 3 | 0 |
| 2011 | Lebanon | *Salmonella* | Nuts/Seeds | Hummus | 8 | 23 | 0 | 0 |
| 2011 | Mexico | *Salmonella* | Fruits | Papaya | 25 | 106 | 10 | 0 |
| 2011 | Turkey | *Salmonella* | Nuts/Seeds | Pine nuts | 6 | 53 | 2 | 0 |
| 2012 | India | *Salmonella* | Fish | Scraped ground tuna | 29 | 425 | 55 | 0 |
| 2012 | Italy | *Listeria* | Dairy | Ricotta cheese | 14 | 23 | 21 | 5 |
| 2012 | Mexico | *Salmonella* | Fruits | Mango | 15 | 129 | 33 | 0 |
| 2013 | Mexico | *Cyclospora* | No category* | Bagged salad mix | 2 | 161 | 10 | 0 |
| 2013 | Mexico | *Salmonella* | Seeded vegetables | Cucumber | 18 | 84 | 17 | 0 |
| 2013 | Turkey | *Salmonella* | Nuts/Seeds | Tahini | 10 | 17 | 1 | 1 |
| 2013 | Turkey | Hepatitis A virus | Fruits | Pomegranate seeds | 10 | 157 | 69 | 0 |
| 2013 | Vietnam | *Salmonella* | Oils/Sugars | Sugarcane | 2 | 7 | 1 | 0 |
| 2014 | Canada | *Salmonella* | Nuts/Seeds | Chia seed powder | 16 | 31 | 5 | 0 |
| 2014 | China | *Salmonella* | Sprouts | Mung bean sprouts | 12 | 115 | 19 | 0 |
| 2014 | Mexico | *Salmonella* | Fruits | Mango | 4 | 4 | 1 | 0 |
| 2014 | Mexico | *Salmonella* | Seeded vegetables | Sweet mini peppers | 10 | 21 | 5 | 0 |

* The outbreak was not attributed to a single food.

of the multistate outbreaks (*Salmonella*, STEC, and *Listeria monocytogenes*) are more likely to cause severe disease and death than the leading cause of single state outbreaks, norovirus, which typically causes a milder illness (*4*). Rapid identification of the food that caused the outbreak, discovering where the contamination occurred along a complex supply chain, and recalling a food distributed across the country and perhaps around the world are challenging tasks. Public health departments and government agencies can work more closely with the food industries, which understand how their foods are produced and distributed, to speed up multistate state foodborne disease outbreak and traceback investigations. Lessons learned from these investigations can inform industry and government efforts to improve food safety practices.

Focusing on foods that are prominent in multistate outbreaks can guide industry and government in targeting interventions. The finding that many multistate outbreaks were caused by contaminated produce suggests a need for strengthening produce safety. Stronger safety measures in the production of fruits and vegetables are a key provision in the Food Safety Modernization Act (FSMA), enacted in 2011. FSMA granted FDA, the federal agency responsible for oversight of produce safety, new powers to improve the safe production and harvesting of produce by creating standards for environmental factors including staff hygiene, microbial levels in agricultural water, uses of animal waste in growing foods, and equipment sanitation (*5*).

A second important area for improving food safety is through enhanced ability to monitor the quality and to improve traceability of imported foods. Tracking suspected foods to their source is often arduous for domestic products, and is even more difficult for imported products, in part because of different food traceability standards in other countries. In addition, U.S. food safety laws and regulations are difficult to enforce for foods produced in foreign countries. FSMA addresses these issues by granting FDA, which is responsible for monitoring most imported foods, new import authorities and mandates, including importer food safety accountability, third-party certification of food safety compliance for high-risk foods, and increased authority to refuse entry of imported foods (*6*).

Industry-led best practices also help improve food safety and can be informed by lessons learned from outbreaks. For example, the Beef Industry Food Safety Council was created in 1997 following a large STEC outbreak caused by contaminated beef a few years earlier. The council endorses the principle that "food safety is a noncompetitive issue" and that best practices should be shared throughout the industry (*7*). The California Leafy Green Products Handler Marketing Agreement was drafted by California farmers after a 2006 STEC O157 outbreak linked to produce and consists of best practices to ensure leafy green vegetable safety. Members also consent to audits by USDA-certified inspectors throughout the growing season (*8*). Industry best practices can complement food safety laws and regulations and help ensure that foods remain safe during growing, processing, and shipping.

Regulations, performance standards, and adherence to industry-developed best practices can improve food safety but are not a guarantee that food products will be contaminant-free; even in highly sanitary environments, contamination can occur. When an outbreak occurs, local, state, and federal investigators need state-of-the-art tools, such as whole genome sequencing (which is expected to replace current PulseNet subtyping methods over the next few years) and electronic platforms for data sharing, to identify the suspected food item and trace it to its source. Rapidly determining common food exposures among patients, often in distant localities, is the key, yet patients sometimes have difficulty remembering the foods they have eaten and when and where they purchased these foods. Therefore, investigators are collaborating with retailers to use data from loyalty cards (i.e., shopper cards) and store membership programs to obtain specific purchase date and brand information on products that consumers purchased before their illness (*9*). Investigators also seek out clusters of illnesses within an outbreak among persons who reported eating at the same restaurant location, attending the same event, or shopping at the same grocery store because these clusters can provide critical clues about the source of an outbreak. Once a specific food is identified, detailed records are essential to trace it back to the processing plant, the producer, or the farm. Without such records, outbreak investigators might not be able to identify the ultimate source of the contaminated food, even when they have identified the food itself (*10*).

When industry and government agencies collaborate, they not only speed up outbreak investigation and traceback processes but also can use lessons learned to reduce the likelihood of future outbreaks. For example, during 2013–2014, investigators linked an outbreak of 634 *Salmonella* serotype Heidelberg infections to handling or consuming chicken from a single producer (*11*). Despite the large number of reported infections, they likely represent only a small fraction of the actual number of infected persons, as with all foodborne disease outbreaks (*1*). Public health agencies worked with the involved industry to identify the ultimate sources of the outbreak and to implement control measures. The affected company has since established new hygiene requirements at its farms and processing plants and in its product transportation practices (*12*). In January 2015, in part in response to this outbreak, USDA-FSIS proposed new production facility performance standards intended to reduce *Salmonella* and *Campylobacter* contamination of chicken and turkey parts (*13*). These standards are part of the larger body of USDA-FSIS guidance aimed at improving food safety in the meat, poultry, and egg industries (*14*). The development and implementation of industry best practices and standards, coupled with regulations that enable a rapid public health response can help enhance food safety and prevent future multistate foodborne disease outbreaks in the United States.


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### *Key Points*

- Multistate foodborne outbreaks are being identified more often in the United States because of better surveillance. Greater centralization of food processing and distribution practices could be increasing the frequency and size of multistate foodborne outbreaks.
- From 2010 through 2014, multistate foodborne outbreaks accounted for only 3% of all U.S. foodborne outbreaks detected, but caused over one third of the hospitalizations and more than half of the deaths.
- *Salmonella*, Shiga toxin-producing *Escherichia coli*, and *Listeria monocytogenes* were the leading pathogens causing multistate foodborne outbreaks. In order of frequency, fruits, vegetable row crops, beef, sprouts, and seeded vegetables were the leading contaminated foods.
- Food industries can effectively prevent or limit the size of outbreaks by making food safety a core part of company culture and by meeting or exceeding new food safety regulations and standards. Companies can maintain records that enable rapid tracing of foods from source to destination and use only those suppliers that use food safety best practices. Store loyalty cards can help identify foods that caused illness and enable more rapid notification of customers who bought a specific product.
- Additional information is available at http://www.cdc.gov/vitalsigns.


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# Notes from the Field

## Primary Amebic Meningoencephalitis Associated with Hot Spring Exposure During International Travel — Seminole County, Florida, July 2014

Peggy J. Booth[1]; Dean Bodager MPA[2]; Tania A. Slade, MPH[1]; Swannie Jett, DrPH[1]

On July 2, 2014, the Florida Department of Health was notified of a suspected case of primary amebic meningoencephalitis (PAM). PAM is a rare, devastating infection of the brain caused by *Naegleria fowleri,* a free-living ameba found in warm, fresh water bodies throughout the world. Amebae are aspirated into the nasal cavity through swimming, splashing, or nasal irrigation, and after attaching to the nasal mucosa, migrate across the cribriform plate to the brain via the olfactory nerves, causing extensive damage to the frontal lobes of the brain (*1*). In August 2013, miltefosine, an antiparasitic drug with activity against *N. fowleri,* became available from CDC as an investigational drug used for the treatment of free-living ameba infections in combination with other antimicrobial drugs (*2*).

On June 27, 2014, the patient, a boy aged 11 years, had experienced a headache, low grade fever, stiff neck, nausea, and vomiting. He was hospitalized on June 29, with a presumptive diagnosis of viral meningitis. The initial cerebral spinal fluid (CSF) analysis was negative for motile ameba. All other routine tests were negative. His condition deteriorated, progressing to altered mental status, slurred speech, and seizures. On July 1 the patient required intubation and mechanical ventilation. A second CSF specimen was collected in the evening of July 1, and motile ameba were observed and reported in the early morning of July 2. Physician consultation with CDC was immediately facilitated by the Florida Department of Health to arrange for the release and delivery of miltefosine from Atlanta, Georgia, to Orlando, Florida; however, the patient died before its arrival on July 2. On July 9, CDC confirmed the presence of *N. fowleri* in the CSF by real-time polymerase chain reaction.

An interview of the patient's parents conducted by the Florida Department of Health in Seminole County revealed that the family had traveled to Costa Rica during June 19–June 27, 2014, where they had engaged in swimming, zip lining, and water slide use at a resort hot springs on June 23. The parents reported having avoided exposure to bodies of fresh water in Florida, because of public awareness of *N. fowleri*, but said they were unaware of the risk for PAM internationally. No other swimming or nasal insufflation of water was reported either in Costa Rica or in Florida during the week before illness onset. *N. fowleri* was detected in water samples from the hot springs and river pond located at the resort (*3*).

PAM is typically fatal; only three nonfatal cases have ever been reported in the United States (*4*). Miltefosine was administered as part of the successful treatment of a case of PAM in 2013 (*5*). Miltefosine can be requested from CDC upon clinical suspicion of PAM infection and before laboratory confirmation. Physicians should consider a diagnosis of PAM in persons with a clinically compatible illness who have a history of fresh water exposure 1–9 days before illness onset. Early diagnosis and prompt treatment are thought to be essential because of the high mortality rate. Strategic placement of miltefosine in Texas and Florida, where approximately half of all cases in the United States have been reported, is being considered and might reduce the time to initiating treatment associated with transport of the medication, thereby increasing the possibility of patient survival. Health care professionals and the public need to be aware that *N. fowleri* can be found in any warm, fresh water body throughout the world, including latitudes in the northern United States previously thought to have a climate incompatible with ameba activity (*6*).

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# Announcement

## World Pneumonia Day — November 12, 2015

November 12, 2015, is the seventh annual World Pneumonia Day, observed to raise awareness and promote interventions to protect against, treat, and prevent pneumonia, which continues to be a global public health concern. Each year approximately 900,000 children aged <5 years die from pneumonia worldwide; 70% of childhood pneumonia hospitalizations in the United States are in this age group (*1*,*2*). Pneumonia is also a leading infectious cause of hospitalization and death among U.S. adults, resulting in >$10 billion in hospital expenses in 2011 (*3*). Preventing future pneumonia-related deaths and illnesses among children and adults globally depends on vaccination against some of the pathogens that cause pneumonia; reductions in medical conditions and behaviors, such as smoking, that increase the risk for pneumonia; improved diagnostic tests; and appropriate antimicrobial therapy and supportive care.

Ongoing research on diagnostics, prevention, and treatment, better access to existing tools, as well as the concerted efforts of national governments, the international community, civil society, and the private sector to guide policy and funding, are also important.

To strengthen surveillance efforts CDC is joining with other U.S. government agencies and global partners to advance a Global Health Security Agenda (additional information available at http://www.globalhealth.gov/global-health-topics/global-health-security/GHS%20Agenda.pdf). Additional information about World Pneumonia Day is available at http://worldpneumoniaday.org, including the new Pneumonia and Diarrhea Progress Report 2015.

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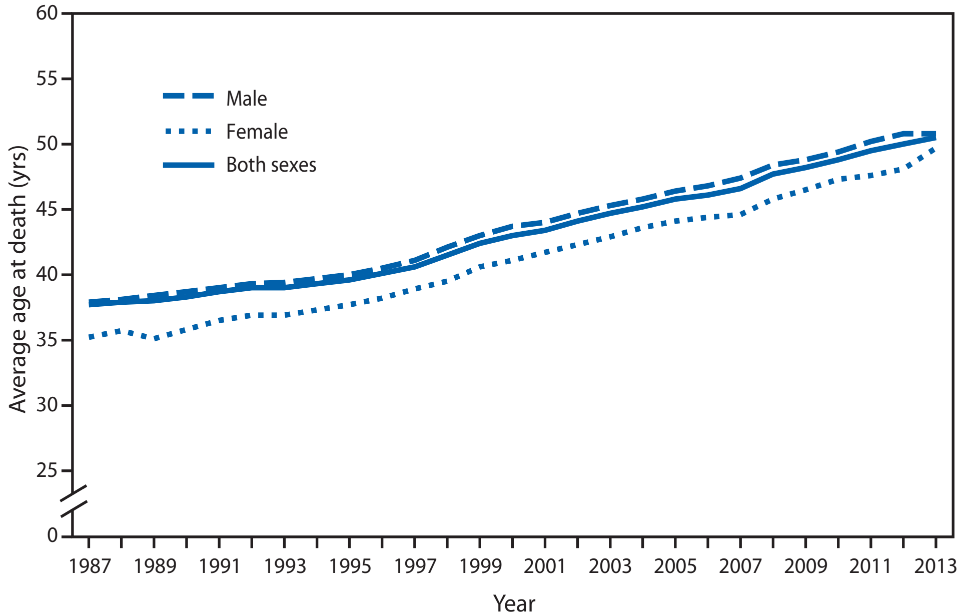
# QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

## Average Age* at Death† from HIV Disease,§ by Sex — United States, 1987–2013




**Abbreviation:** HIV = human immunodeficiency virus.

* The average age at death is the sum of age at death for all HIV deaths, divided by the total number of HIV deaths.

† Records with age not stated were not included.

§ Deaths from HIV disease are identified using underlying causes of death with codes 042-044 (1987–1998) and B20-B24 (1999–2013) in the *International Classification of Disease, Ninth and Tenth revisions*.

During 1987–2013, the average age at death from HIV disease increased steadily for both males and females. The average age at death increased 34.0% among males, from 37.9 years in 1987 to 50.8 years in 2013. Among females, the average age at death increased 41.2%, from 35.2 years in 1987 to 49.7 years in 2013. Throughout the period, the average age at death from HIV disease for males was higher than that for females.

**Source:** National Vital Statistics System. U.S. mortality data files, 1987–2013. Available at http://www.cdc.gov/nchs/data_access/vitalstatsonline.htm.

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