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Changes in High Weight-for-Length among Infants Enrolled in Special Supplemental Nutrition Program for Women, Infants, and Children during 2010–2018

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Abstract

Background: Infants and young children with high weight-for-length are at increased risk for obesity in later life. This study describes prevalence of high weight-for-length and examines changes during 2010–2018 among 11,366,755 infants and young children 3–23 months of age in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC).

Methods: Children's weights and lengths were measured. High weight-for-length was defined as ≥2 standard deviations above sex and age-specific median on World Health Organization growth charts. Adjusted prevalence differences (APDs) between years were calculated as 100 times marginal effects from logistic regression models. APD was statistically significant if 95% confidence interval did not include 0.

Results: Adjusted prevalence of high weight-for-length decreased from 2010 to 2014, and leveled off through 2018 overall, in boys and girls, those 6–11 and 18–23 months of age, and non-Hispanic whites, non-Hispanic blacks, Hispanics, and Asians/Pacific Islanders. For 12–17 months old and American Indian/Alaska Native infants and young children, adjusted prevalence decreased from 2010 to 2014, and then increased slightly through 2018. Among 56 WIC state or territorial agencies, 33 had significant decreases between 2010 and 2018, whereas 8 had significant increases. Between 2014 and 2018, prevalence decreased significantly in 12 agencies and increased significantly in 23.

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Author Disclosure Statement

The authors have indicated they have no potential conflicts of interest to disclose.

Conclusions: The results indicate overall declines in prevalence of high weight-for-length from 2010 to 2018, with a prevalence stabilization since 2014. Continued surveillance is needed. Obesity prevention strategies in WIC and multiple settings are important for ensuring healthy child growth.

Keywords

childhood obesity; high weight-for-length; prevalence; trend; WIC; young children

Introduction

Infants and young children with a high weight-for-length are at increased risk for obesity in childhood and adulthood.[1,2] Children with obesity during childhood are at increased risk for cardiovascular risk factors, impaired glucose tolerance, respiratory and joint problems, fatty liver disease, social and psychological problems, and other chronic diseases.[3,4] Many previous studies[5–8] examined trends in the prevalence of obesity among children and adolescents 2 years of age and above in the United States. Based on the measured weight and height data in the National Health and Nutrition Examination Survey (NHANES), the prevalence of obesity was 19.3% among US children 2–19 years of age in 2017–2018.[9] Few studies have assessed trends of high weight-for-length among infants. An NHANES study defining high weight-for-length as ≥95th percentile of the CDC growth charts found that the prevalence increased from 1976–1980 to 1999–2000 among infants and young children 6–23 months old.[7] Another NHANES study in which high weight-for-length was defined as the sex- and age-specific z scores ≥2 standard deviations of the median values or the 97.7th percentiles of the World Health Organization (WHO) growth standards[10] reported that prevalence decreased from 1999–2000 to 2011–2012, and then increased until 2015–2016 among infants and young children <2 years of age. In 2015–2016, 8.9% of those <2 years old had high weight-for-length in the United States.[11]

It is important to monitor the prevalence of high weight-for-length among infants and young children in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) because the prevalence of obesity is higher among children from low-income families.[12] Only one previous study,[13] however, examined the secular trends among infants and young children 3–23 months of age enrolled in WIC through a collaboration between CDC and the USDA. The study using the WIC Participant and Program Characteristics (WIC PC) data found that the prevalence of high weight-for-length increased from 13.4% in 2000 to 14.5% in 2004, remained stable until 2010, and then decreased to 12.3% in 2014.[13] The present study uses WIC PC to examine whether declines in high weight-for-length observed between 2010 and 2014 continued through 2018 in the population subgroups by examining prevalence differences during 2010–2018, 2010–2014, and 2014–2018 by age, sex, race/ethnicity, and WIC state or territorial agency among infants and young children 3–23 months of age enrolled in WIC.

Materials and Methods

Study Population in WIC PC

WIC is a federal assistance program to improve health care and nutrition of low-income infants; children under the age of 5 years; and pregnant, postpartum, and breastfeeding women. WIC is funded by the USDA and administered by the State Health Departments or Indian Tribal Organizations (ITOs) in all states and territories.[14] To be eligible for WIC, the applicants must live in the state where they apply and have certain medical or dietary conditions. They also need to meet the income eligibility criteria, which is having a gross household income ≤185% of the US Poverty Level or being enrolled in other federally funded nutrition and health programs, including the Supplemental Nutrition Assistance Program, Temporary Assistance for Needy Families, or Medicaid.[15] The WIC coverage rate for eligible infants is higher than that for older children and women. In 2016, almost 50% of all infants in the United States and over 80% of the infants who were eligible for WIC were enrolled in the program in the United States.[16]

WIC PC is a biennial census containing select information on all WIC enrollees, including data on the nutritional status and biometric data of enrollees. The dataset includes all WIC participants who are certified to receive the WIC benefits in the reference month of reporting years (usually April of even years). WIC professionals collect breastfeeding information about participating infants and young children and characteristics of nutritional risks, such as anthropometric, biochemical, medical history, and dietary information, from all applicants and participants during the WIC application and certification process. The weights and lengths of WIC participants are measured by trained WIC professionals according to standard data collection and recording protocols. Weights are measured to the nearest one-quarter pound, and length to the nearest one-eighth inch.[17] All WIC PC data collected during the application and certification process are stored in states' and ITOs' data reporting systems. Data for participants certified to receive benefits in the reference month are then extracted by the WIC state or territorial agencies in the reporting year and sent to the USDA contractor for cleaning and compiling. CDC determined that this study did not need review by institutional review board because deidentified secondary data were used.

The initial study population included ~ 11.6 million infants and young children 3–23 months of age enrolled in WIC from the 56 WIC agencies in states, the District of Columbia, and the US territories during 2010–2018. The study excluded 12 infants and young children whose weight and length were measured 2 years or more before the data reporting year, 161,152 (1.39%) infants and young children whose sex, weight, or length were missing, and 65,819 (0.57%) who have biologically implausible anthropometric data,[18] yielding an analytic sample of 11,366,755 infants and young children ranging from 2,083,443 in 2018 to 2,345,567 in 2016 annually.

Defining High Weight-for-Length

High weight-for-length was defined as the sex- and age-specific z-scores ≥2 standard deviations of the median values, or the 97.7th percentiles on the WHO growth standards.[19,20] CDC recommends using the WHO growth standards,[20] rather than the CDC

growth charts,[18] to assess the growth of infants and young children under <24 months of age in the United States.[19] Infants and young children with the weight-for-length z-scores or percentiles above these cutoff points are at increased risk for obesity in mid and late childhood and early adulthood.[2]

Statistical Analyses

Descriptive analyses were conducted in SAS 9.4 (SAS Institute, Cary, NC) stratified by age (3–5, 6–11, 12–17, and 18–23 months), sex, race/ethnicity [5 groups were available: non-Hispanic white, non-Hispanic black, Hispanic, American Indian/Alaska Native (AIAN), and Asian/Pacific Islander (PI)], and WIC state or territorial agency. Unadjusted prevalence and 95% confidence intervals (CIs) of high weight-for-length in each reporting year were calculated overall and for each demographic subgroup and WIC state or territorial agency. To account for differences in population distributions across years, marginal effects of year in multiple logistic regression models were obtained in SUDAAN 11.0.1 (RTI International, Research Triangle Park, NC) controlling for age in month, sex, and race/ethnicity. The adjusted prevalence differences (APDs, 2018 vs. 2010, 2014 vs. 2010, and 2018 vs. 2014) were then calculated as 100 times the marginal effects from logistic regression models. The difference in adjusted prevalence of high weight-for-length was considered as statistically significant if the 95% CI for APD did not include 0. A positive number of APD means that the adjusted prevalence in the later year was higher than that in the earlier year, and a negative number means the opposite. The interaction terms between year and demographic variables were included in the models to test whether the prevalence changes during 2010–2018 differed significantly within population subgroups. Differences in prevalence changes were considered statistically significant if the two-sided p-value for the interaction was <0.05.

Results

Differences in the demographic distributions of infant enrollees 3–23 months of age are shown in Table 1. Reflecting declines in WIC enrollment, the present study included fewer WIC infant enrollees in 2018 (~2.1 million) than the previous years (~2.3 million annually). The study populations in 2010 and 2012 were older than those in more recent years, with higher proportions of infants and young children 18–23 months of age enrolled. Furthermore, there were slightly lower proportions of non-Hispanic whites and slightly higher proportions of non-Hispanic blacks in 2014–2018 than in earlier years (Table 1).

The prevalence of high weight-for-length in all years increased with the age of infants and young children; the highest prevalence was seen among those 18–23 months of age and the lowest among those 3–5 months old (Table 2). The annual unadjusted prevalence was 1.8–2.0 percentage points (all the % changes described in Results are in absolute percentage points) higher among boys than among girls. In all years, the prevalence was the highest among AIAN and Hispanic infants and young children and the lowest among Asian/PI infants and young children (Table 2).

The overall prevalence of high weight-for-length decreased from 14.5% in 2010 to 12.3% in 2014, and then remained relatively stable until 2018 (12.2%). Since the declining trend

in the overall prevalence started to level off in 2014, we presented the APDs in high weight-for-length during 2010–2014 and 2014–2018 separately for all the demographic subgroups (Table 2) and 56 WIC state or territorial agencies (Table 3).

There were similar decreasing and then levelling off trends over the study period for infants and young children in most age, sex, and racial/ethnic groups except for 12–17 months old and AIAN young children for which the adjusted prevalence decreased from 2010 to 2014 and then increased slightly through 2018, and infants 3–5 months of age for which the adjusted prevalence decreased over the entire study period (Table 2). The overall prevalence of high weight-for-length decreased by 1.8% between 2010 and 2018 after adjusting for age in month, sex, and race/ethnicity. By age group, the decrease in adjusted prevalence was greatest among infants and young children 3–5 months of age and 12–17 months (2.0% for both groups) and smallest among those 6–11 months old (1.5%). By sex, the decrease between 2010 and 2018 was 2.0% among boys and 1.7% among girls. By race/ethnicity, Hispanic infants and young children had the greatest decrease (2.7%) in adjusted prevalence of high weight-for-length, and non-Hispanic white infants and young children had the smallest decrease (0.8%) during the study period (Table 2).

In 2010, unadjusted prevalence of high weight-for-length ranged from 8.1% in Colorado to 24.0% in Virginia (Table 3). Prevalence was ≥15% in 16 WIC state or territorial agencies and was <10% in 5 WIC agencies. In 2018, the unadjusted prevalence ranged from 6.3% in Colorado to 19.9% in American Samoa. Prevalence of high weight-for-length was ≥15% in 5 WIC state or territorial agencies and was <10% in ten WIC agencies.

Between 2010 and 2018, 33 of 56 WIC state or territorial agencies had significant decreases in the prevalence of high weight-for-length (Table 3 and Fig. 1). The decrease in adjusted prevalence between 2010 and 2018 was >3% in 7 states or territorial agencies (California, Mississippi, Northern Mariana Islands, Puerto Rico, South Carolina, Utah, and Virginia), and the largest decreases were seen in Puerto Rico (APD = 11.3%) and Virginia (APD = 9.1%). Eight WIC state or territorial agencies (American Samoa, Iowa, Maryland, North Carolina, North Dakota, Vermont, West Virginia, and Virgin Islands) had significant increases between 2010 and 2018. The largest significant increases occurred in the Virgin Islands (APD = 5.1%) and American Samoa (APD = 4.2%) (Table 3).

Most of the decreases mentioned above occurred during 2010–2014. Between 2010 and 2014, 38 states or territorial agencies had significant decreases in the adjusted prevalence of high weight-for-length, and only 3 agencies (American Samoa, North Carolina, West Virginia) had significant increases. Between 2014 and 2018, the adjusted prevalence decreased significantly in only 12 states or territorial WIC agencies, increased significantly in 23 WIC agencies, and remained relatively stable in 21 WIC agencies (Table 3).

Discussion

A previous study[13] found that the prevalence of high weight-for-length increased from 2000 to 2004, remained relatively unchanged until 2010, and then decreased from 2010 to 2014 among WIC enrollees 3–23 months of age. The present study found that the prevalence

leveled off from 2014 to 2018. The prevalence of high weight-for-length decreased from 2010 to 2018 overall, in all age, sex, and racial/ethnic groups, and 33 of 56 WIC state or territorial agencies, but most of the decreases were observed between 2010 and 2014. The prevalence decreased further in only 12 WIC state or territorial agencies between 2014 and 2018. Although most of the decreases were small, they indicate progress in obesity prevention among this vulnerable population in recent years in contrast to the increasing prevalence trends among young WIC enrollees in the early 2000s.

A few NHANES studies based on smaller samples examined trends of high weight-for-length among US infants and young children living in families of all income levels.[7,11,21] A NHANES study, in which high weight-for-length was defined based on the WHO growth standards, found that the prevalence was 6.2% in 1976–1980 and 7.7% in 2011–2014 among infants and young children 6–23 months old, but no significantly increasing or decreasing trends were detected over the study period.[21] Another study that defined high weight-for-length based on the WHO growth standards reported that the prevalence of high weight-for-length was 9.6% in 2009–2010, 8.4% in 2013–2014, and 9.0% in 2015–2016 among children 6–23 months of age, but the study did not examine the prevalence differences across years.[11] If our analysis is limited to WIC children 6–23 months of age, the prevalence of high weight-for-length was 14.9% in 2010, 12.6% in 2014, and 12.7% in 2016 (data not shown). This comparison shows that the prevalence of high weight-for-length was higher among young WIC enrollees than among those from all income levels.

Multiple factors may have contributed to the overall prevalence declines in high weight-for-length among WIC infants and young children and continued declines in some states. The interim final rule released by the USDA required WIC agencies to revise the WIC food packages by October 2009.[22] The new food packages encourage WIC enrollees to purchase more healthful fruits, vegetables, and whole wheat products,[22] which has improved the dietary intake of WIC enrollees.[23–26] WIC also provides ongoing nutrition education and breastfeeding support for pregnant, postpartum, and breastfeeding women.[27] There have also been federal, state, and community efforts in hospitals and birth facilities to improve maternity care practices and promote breastfeeding guidelines and recommendations.[28,29] The proportion of 6- to 13-month-old infants in WIC who were ever breastfed or still breastfeeding increased from 65% in 2010 to 72% in 2018.[30,31] Additionally, a number of federal programs have emerged to foster high-quality early care and education (ECE). CDC has worked closely with partners and states since 2012 to encourage ECE stakeholders to include breastfeeding, nutrition, screen time, and physical activity standards in state ECE systems such as licensing and quality rating systems.[32,33] Future evaluation efforts are needed to determine the impact of implementing system changes.

Despite the overall decreases in the prevalence of high weight-for-length among infants and young children in WIC from 2010 to 2018, overall trends have stabilized since 2014. Of further concern is that 23 WIC agencies exhibited significant increases in this time period. Multiple factors, such as variations in lifestyles, social and culture norms, policy and environmental changes to promote healthy food choices and physical activity, and levels of state funds to support local WIC agencies and clinics, may have led to the differences in trends of high weight-for-length across states. The reasons for the overall stabilization

and increases in many states are unclear. However, data suggest that efforts that contributed to the decline before 2014 may not be sufficient to sustain the trend and new strategies or amplification of existing strategies may be needed. As interventions are developed, they will need to be culturally tailored and to consider how the social determinants of health such as economic stability, social and community context, and built environments might contribute to a child's growth and weight.[34–36] Furthermore, as the nation faces higher unemployment due to the coronavirus disease 2019 (COVID-19) pandemic, there may be needs to further support low-income families with children as they are at greater risks for housing instability and food insecurity, which may impact future trends.[37,38]

The study was based on census data of over 11 million infants and young children enrolled in WIC. Over 80% of infants who are eligible for WIC in the United States are enrolled in the program. The weights and lengths of infants and young children were measured according to standardized criteria. Therefore, our study findings are representative of trends for all infants and young children enrolled in WIC. The study is subject to at least two limitations, however. First, the dataset was limited to infants and young children enrolled in WIC, who had lower household incomes on average than those not enrolled; thus, the study findings may not apply to those from families of all income levels. Additionally, this study did not include infants and young children enrolled in WIC in ITOs. Second, starting from 2011, WIC expanded the nutrition risk criteria by including high weight-for-length.[39] Therefore, it is possible that proportionally more infants and young children with high weight-for-length were enrolled in WIC in recent years than in 2010, which may have led to the underestimation of the declines in the prevalence of high weight-for-length from 2010 to 2018. However, as there is no evidence that income-eligible infants and young children were denied access to WIC benefits before 2011 regardless of their weight-for-length status, this limitation may not have meaningful effect on the study findings.

Conclusions

Our findings about the declines in prevalence of high weight-for-length indicate that obesity prevention efforts may have made modest progress among infants and young children enrolled in WIC since 2010. However, the stabilization of trends since 2014 indicates greater attention is needed to ensure the patterns are not reversed, especially with greater unemployment overall and changes in food and nutrition security among young children and pregnant women due to the COVID-19 pandemic.[37,38] To support healthy infant growth among all US children and to reduce disparities in obesity risk, comprehensive approaches are needed to support caregivers of infants and young children. In addition, multiple community stakeholders have opportunities to maintain and broaden their support of low-income families and WIC participants, including federally qualified health centers and community centers, WIC clinics, Head Start and other ECE settings, and food retailers that accept WIC cards and vouchers.

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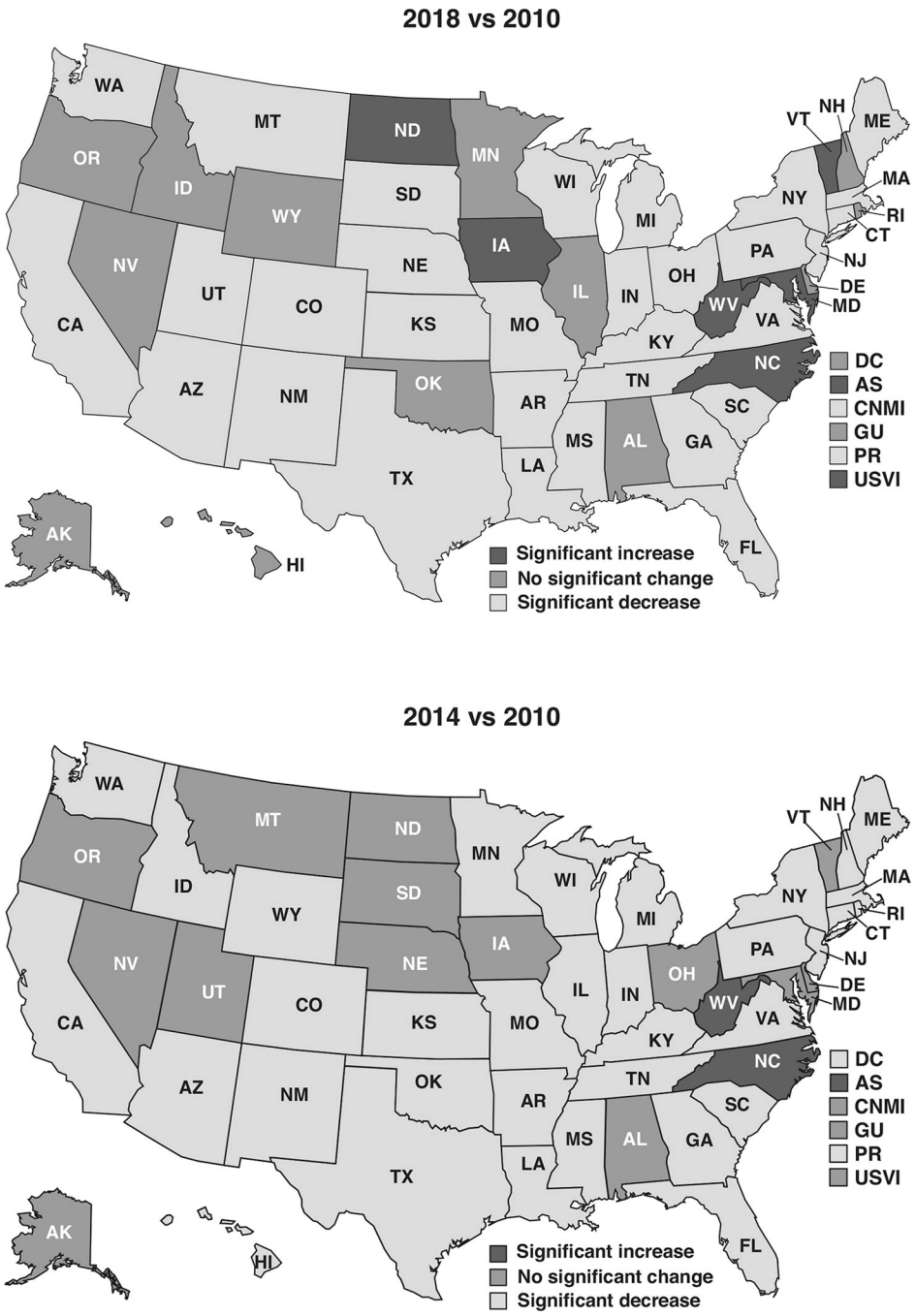

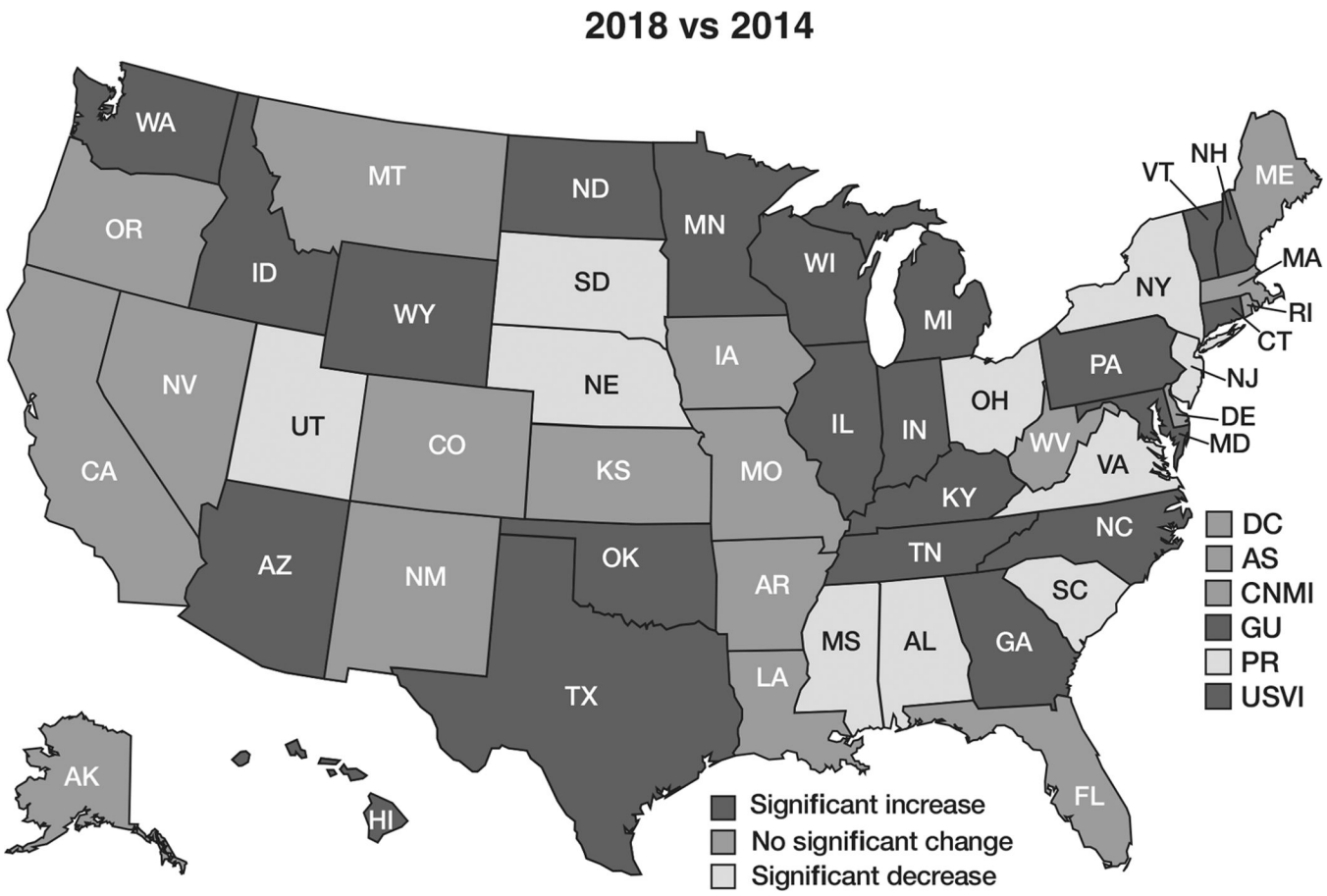

Figure 1.

Changes in the prevalence of high weight-for-length among US infants 3–23 months of Age enrolled in WIC, by WIC state or territorial agency. Significant increase. Significant decrease. No significant change. Three maps: 2018 vs. 2010, 2014 vs. 2010, and 2018 vs. 2014. WIC, Special Supplemental Nutrition Program for Women, Infants, and Children.

Table 1.

Characteristics of Infants 3–23 Months of Age Enrolled in Special Supplemental Nutrition Program for Women, Infants, and Children during 2010–2018

	2010, *n* (%)	**2012, *n* (%)**	**2014, *n* (%)**	**2016, *n* (%)**	**2018, *n* (%)**
Total[a]	2,319,712 (100)	2,277,422 (100)	2,340,611 (100)	2,345,567 (100)	2,083,443 (100)
Age at the time of weight/height measurement (months)					
3–5	189,045 (8.1)	178,192 (7.8)	187,354 (8.0)	210,888 (9.0)	203,908 (9.8)
6–11	525,316 (22.6)	529,782 (23.3)	620,714 (26.5)	640,996 (27.3)	583,767 (28.0)
12–17	868,676 (37.4)	883,792 (38.8)	988,285 (42.2)	966,233 (41.2)	838,373 (40.2)
18–23	736,675 (31.8)	685,656 (30.1)	544,258 (23.3)	527,450 (22.5)	457,395 (22.0)
Sex					
Boys	1,176,994 (50.7)	1,158,070 (50.9)	1,190,132 (50.8)	1,192,499 (50.8)	1,062,371 (51.0)
Girls	1,142,718 (49.3)	1,119,352 (49.1)	1,150,479 (49.2)	1,153,068 (49.2)	1,021,072 (49.0)
Race/ethnicity[b]					
Non-Hispanic white	748,889 (32.6)	719,133 (31.8)	730,586 (31.3)	702,650 (30.0)	616,781 (29.6)
Non-Hispanic black	464,419 (20.2)	469,092 (20.8)	503,362 (21.5)	523,183 (22.3)	485,675 (23.3)
Hispanic	970,555 (42.2)	948,891 (42.0)	968,864 (41.5)	982,069 (41.9)	853,982 (41.0)
American Indian/Alaska Native	27,183 (1.2)	28,308 (1.3)	29,030 (1.2)	28,741 (1.2)	26,407 (1.3)
Asian/Pacific Islander	88,591 (3.9)	94,925 (4.2)	105,288 (4.5)	107,581 (4.6)	99,708 (4.8)

[a]Includes children who were enrolled in WIC State agencies in 50 states, the District of Columbia, and 5 US territories. The sample sizes in the subgroups may not add to the total because of missing data.

[b]No multiple racial/ethnic group was included.

WIC, Special Supplemental Nutrition Program for Women, Infants, and Children.

Table 2.

Prevalence of High Weight-for-Length Among Infants 3–23 Months of Age Enrolled in Special Supplemental Nutrition Program for Women, Infants, and Children, by Age, Sex, and Race/Ethnicity, 2010–2018

	2010		2012		2014		2016		2018		2018 vs. 2010	2014 vs. 2010	2018 vs. 2014
Characteristics	**No.**	**Crude prevalence % (SE)**	**No.**	**Crude prevalence % (SE)**	**No.**	**Crude prevalence % (SE)**	**No.**	**Crude prevalence % (SE)**	**No.**	**Crude prevalence % (SE)**	**APD,[a] % (95% CI)**	**APD,[a] % (95% CI)**	**APD,[a] % (95% CI)**
Overall	2,319,712	14.5 (0.02)	2,277,422	13.1 (0.02)	2,340,611	12.3 (0.02)	2,345,567	12.3 (0.02)	2,083,443	12.2 (0.02)	−1.8 (−1.9 to −1.8)	−1.9 (−2.0 to −1.8)	0.0 (0.0 to 0.1)
Age (months)													
3–5	189,045	9.9 (0.07)	178,192	8.6 (0.07)	187,354	8.4 (0.06)	210,888	8.7 (0.06)	203,908	8.2 (0.06)	−2.0 (−2.1 to −1.8)	−1.6 (−1.8 to −1.4)	−0.4 (−0.5 to −0.2)
6–11	525,316	12.4 (0.05)	529,782	11.1 (0.04)	620,714	11.0 (0.04)	640,996	11.1 (0.04)	583,767	10.9 (0.04)	−1.5 (−1.6 to −1.3)	−1.6 (−1.7 to −1.5)	0.1 (0.0 to 0.2)
12–17	868,676	15.0 (0.04)	883,792	13.5 (0.04)	988,285	12.5 (0.03)	966,233	12.6 (0.03)	838,373	12.6 (0.04)	−2.0 (−2.1 to −1.9)	−2.1 (−2.2 to −2.0)	0.1 (0.05 to 0.2)
18–23	736,675	16.6 (0.04)	685,656	15.4 (0.04)	544,258	14.8 (0.05)	527,450	14.8 (0.05)	457,395	14.9 (0.05)	−1.8 (−1.9 to −1.7)	−1.9 (−2.0 to −1.7)	0.1 (0.0 to 0.3)
Sex													
Boys	1,176,994	15.5 (0.03)	1,158,070	14.1 (0.03)	1,190,132	13.2 (0.03)	1,192,499	13.2 (0.03)	1,062,371	13.1 (0.03)	−2.0 (−2.1 to −1.9)	−2.0 (−2.1 to −1.9)	0.0 (−0.1 to 0.1)
Girls	1,142,718	13.5 (0.03)	1,119,352	12.2 (0.03)	1,150,479	11.4 (0.03)	1,153,068	11.4 (0.03)	1,021,072	11.3 (0.03)	−1.7 (−1.8 to −1.6)	−1.8 (−1.8 to −1.7)	0.1 (0.0 to 0.1)
Race/ethnicity[b]													
White, non-Hispanic	748,889	12.1 (0.04)	719,133	11.2 (0.04)	730,586	11.0 (0.04)	702,650	11.2 (0.04)	616,781	11.0 (0.04)	−0.8 (−0.9 to −0.6)	−0.9 (−1.0 to −0.8)	0.1 (0.0 to 0.2)
Black, non-Hispanic	464,419	13.9 (0.05)	469,092	12.7 (0.05)	503,362	11.9 (0.05)	523,183	11.9 (0.04)	485,675	11.7 (0.05)	−1.8 (−2.0 to −1.7)	−1.7 (−1.8 to −1.6)	−0.1 (−0.3 to 0.0)

Characteristics	2010		2012		2014		2016		2018		2018 vs. 2010	2014 vs. 2010	2018 vs. 2014
	No.	Crude prevalence % (SE)	No.	Crude prevalence % (SE)	No.	Crude prevalence % (SE)	No.	Crude prevalence % (SE)	No.	Crude prevalence % (SE)	APD,[a] % (95% CI)	APD,[a] % (95% CI)	APD,[a] % (95% CI)
Hispanic	970,555	17.0 (0.04)	948,891	15.1 (0.04)	968,864	13.8 (0.04)	982,069	13.6 (0.03)	853,982	13.7 (0.04)	−2.7 (−2.8 to −2.6)	−2.8 (−2.9 to −2.7)	0.1 (0.0 to 0.2)
American Indian/Alaska Native	27,183	18.7 (0.24)	28,308	17.5 (0.23)	29,030	15.6 (0.21)	28,741	16.6 (0.22)	26,407	16.1 (0.23)	−1.9 (−2.5 to −1.3)	−2.6 (−3.3 to −2.0)	0.7 (0.1 to 1.3)
Asian/Pacific Islander	88,591	10.6 (0.10)	94,925	9.5 (0.10)	105,288	8.5 (0.09)	107,581	8.6 (0.09)	99,708	8.5 (0.09)	−1.9 (−2.2 to −1.6)	−2.0 (−2.2 to −1.7)	0.1 (−0.2 to 0.3)

[a] Calculated as 100 times the marginal effect of year (2018 vs. 2010, 2014 vs. 2010, and 2018 vs. 2014) from logistic regression model controlling for age, sex, and race/ethnicity. The difference in adjusted prevalence weight-for-length across years was considered statistically significant if the 95% CI for APD did not include 0. A positive number means that the adjusted prevalence in the later year was higher than that in the earlier year and a negative number means the opposite.

[b] The sample sizes in the race/ethnicity subgroups may not add to the total because of missing data.

APD, adjusted prevalence difference; CI, confidence interval; SE, standard error.

Table 3.

Prevalence of High Weight-for-Length Among Infants 3–23 Months of Age Enrolled in Special Supplemental Nutrition Program for Women, Infants, and Children, by Special Supplemental Nutrition Program for Women, Infants, and Children State or Territory Agency, 2010–2018

	2010		2014		2018		2018 vs. 2010	2014 vs. 2010	2018 vs. 2014
WIC agency	**No.**	**% (95% CI)**	**No.**	**% (95% CI)**	**No.**	**% (95% CI)**	**APD,[a] % (95% CI)**	**APD,[a] % (95% CI)**	**APD,[a] % (95% CI)**
State									
Alabama	43,957	12.9 (12.6 to 13.3)	41,679	13.0 (12.7 to 13.3)	24,820	13.6 (13.1 to 14.0)	−0.4 (−0.9 to 0.1)	0.2 (−0.2 to 0.7)	−0.5 (−1.1 to −0.002)
Alaska	6100	16.5 (15.6 to 17.5)	5006	14.4 (13.4 to 15.3)	4739	14.4 (13.4 to 15.4)	−0.1 (−1.5 to 1.2)	1.1 (−0.3 to 2.5)	−0.8 (−2.1 to 0.6)
Arizona	41,678	15.3 (14.9 to 15.6)	38,232	12.0 (11.6 to 12.3)	44,646	12.5 (12.2 to 12.8)	−2.2 (−2.6 to −1.7)	−2.7 (−3.2 to −2.3)	0.5 (0.04 to 0.9)
Arkansas	20,972	13.1 (12.6 to 13.5)	17,953	10.7 (10.2 to 11.2)	16,595	11.0 (10.5 to 11.5)	−1.4 (−2.1 to −0.7)	−2.0 (−2.6 to −1.3)	0.6 (−0.1 to 1.2)
California	403,041	17.3 (17.2 to 17.4)	403,294	13.3 (13.2 to 13.4)	317,635	13.2 (13.1 to 13.3)	−3.7 (−3.8 to −3.5)	−3.5 (−3.7 to −3.4)	−0.1 (−0.3 to 0.0)
Colorado	25,245	8.1 (7.8 to 8.5)	33,222	6.1 (5.8 to 6.3)	32,247	6.3 (6.0 to 6.5)	−0.7 (−1.1 to −0.3)	−1.0 (−1.4 to −0.5)	0.2 (−0.1 to 0.6)
Connecticut	13,164	12.3 (11.7 to 12.8)	11,828	9.5 (9.0 to 10.1)	14,847	8.6 (8.1 to 9.0)	−2.6 (−3.3 to −1.9)	−1.6 (−2.4 to −0.8)	−1.1 (−1.8 to −0.5)
Delaware	5201	14.0 (13.0 to 14.9)	6133	13.4 (12.5 to 14.2)	4618	11.8 (10.8 to 12.7)	−1.3 (−2.6 to 0)	−0.1 (−1.4 to 1.2)	−1.2 (−2.5 to 0.1)
District of Columbia	3579	12.8 (11.7 to 13.9)	3044	10.9 (9.8 to 12.0)	3464	10.5 (9.5 to 11.5)	−1.4 (−2.9 to 0.2)	−1.7 (−3.2 to −0.1)	0.3 (−1.2 to 1.9)
Florida	115,168	14.2 (14.0 to 14.4)	121,606	11.7 (11.5 to 11.8)	166,687	11.3 (11.1 to 11.4)	−2.1 (−2.3 to −1.8)	−2.1 (−2.4 to −1.8)	−0.1 (−0.3 to 0.1)
Georgia	106,764	11.5 (11.3 to 11.7)	101,060	9.8 (9.6 to 10.0)	78,098	10.3 (10.1 to 10.5)	−1.2 (−1.5 to −0.9)	−1.7 (−2.0 to −1.5)	0.6 (0.3 to 0.9)
Hawaii	13,437	11.2 (10.7 to 11.8)	11,957	10.0 (9.4 to 10.5)	10,710	11.1 (10.5 to 11.7)	0.0 (−0.8 to 0.8)	−1.3 (−2.1 to −0.6)	1.3 (0.5 to 2.1)
Idaho	11,818	10.2 (9.7 to 10.7)	13,717	8.4 (8.0 to 8.9)	11,576	9.5 (8.9 to 10.0)	0.1 (−0.7 to 0.8)	−0.9 (−1.6 to −0.2)	1.0 (0.3 to 1.7)
Illinois	100,445	12.5 (12.3 to 12.7)	87,223	11.5 (11.3 to 11.7)	71,008	11.7 (11.5 to 11.9)	−0.3 (−0.6 to 0.0)	−0.6 (−0.9 to −0.3)	0.3 (0.03 to 0.7)
Indiana	37,011	13.6 (13.2 to 13.9)	31,428	11.5 (11.2 to 11.9)	48,501	10.8 (10.5 to 11.1)	−1.2 (−1.7 to −0.8)	−1.9 (−2.4 to −1.4)	0.7 (0.3 to 1.2)
Iowa	25,237	13.4 (13.0 to 13.8)	23,850	13.5 (13.0 to 13.9)	23,154	14.1 (13.7 to 14.6)	0.8 (0.2 to 1.5)	0.4 (−0.2 to 1.0)	0.5 (−0.1 to 1.1)
Kansas	25,911	12.6 (12.2 to 13.0)	22,138	10.7 (10.3 to 11.1)	20,108	10.8 (10.4 to 11.3)	−1.6 (−2.2 to −1.0)	−1.8 (−2.4 to −1.3)	0.2 (−0.4 to 0.8)
Kentucky	27,129	19.6 (19.1 to 20.1)	26,700	12.2 (11.8 to 12.5)	23,504	16.5 (16.0 to 17.0)	−2.9 (−3.6 to −2.3)	−7.4 (−8.0 to −6.8)	4.4 (3.8 to 5.1)
Louisiana	33,380	16.8 (16.4 to 17.2)	28,228	15.3 (14.8 to 15.7)	24,157	15.1 (14.6 to 15.5)	−1.8 (−2.4 to −1.2)	−1.6 (−2.2 to −1.0)	−0.3 (−0.9 to 0.3)
Maine	9976	12.7 (12.0 to 13.3)	8717	10.2 (9.5 to 10.8)	6989	10.8 (10.1 to 11.5)	−1.7 (−2.6 to −0.7)	−2.3 (−3.2 to −1.4)	0.6 (−0.4 to 1.6)
Maryland	31,121	14.7 (14.3 to 15.1)	32,655	13.6 (13.3 to 14.0)	30,486	14.9 (14.5 to 15.3)	0.7 (0.1 to 1.2)	−0.5 (−1.0 to 0.1)	1.2 (0.6 to 1.7)
Massachusetts	28,266	16.7 (16.3 to 17.1)	31,239	14.3 (13.9 to 14.7)	27,947	14.7 (14.3 to 15.2)	−2.1 (−2.7 to −1.5)	−2.4 (−3.0 to −1.8)	0.3 (−0.3 to 0.8)
Michigan	51,570	12.9 (12.6 to 13.2)	72,751	11.6 (11.4 to 11.9)	52,313	11.9 (11.6 to 12.1)	−0.5 (−0.9 to −0.1)	−1.0 (−1.4 to −0.6)	0.5 (0.1 to 0.9)
Minnesota	30,457	12.3 (11.9 to 12.6)	32,094	10.8 (10.5 to 11.1)	28,651	11.5 (11.2 to 11.9)	−0.5 (−1.0 to 0.1)	−1.2 (−1.7 to −0.7)	0.7 (0.2 to 1.2)
Mississippi	24,126	17.7 (17.2 to 18.2)	16,811	15.5 (14.9 to 16.0)	31,540	12.7 (12.3 to 13.0)	−4.1 (−4.7 to −3.5)	−2.3 (−3.1 to −1.6)	−1.7 (−2.3 to −1)

WIC agency	2010		2014		2018		2018 vs. 2010	2014 vs. 2010	2018 vs. 2014
	No.	% (95% CI)	No.	% (95% CI)	No.	% (95% CI)	APD,[a] % (95% CI)	APD,[a] % (95% CI)	APD,[a] % (95% CI)
Missouri	46,897	12.4 (12.1 to 12.7)	44,490	9.6 (9.3 to 9.9)	38,430	9.4 (9.1 to 9.7)	−2.7 (−3.1 to −2.3)	−2.5 (−2.9 to −2.1)	−0.2 (−0.6 to 0.2)
Montana	7748	10.2 (9.5 to 10.8)	7291	9.3 (8.6 to 10.0)	6372	9.4 (8.7 to 10.1)	−1.1 (−2.1 to −0.1)	−0.9 (−1.9 to −0.01)	−0.2 (−1.1 to 0.8)
Nebraska	13,439	14.1 (13.5 to 14.6)	10,530	14.9 (14.2 to 15.6)	12,830	11.4 (10.9 to 12.0)	−2.4 (−3.2 to −1.6)	0.6 (−0.3 to 1.5)	−2.8 (−3.7 to −2.0)
Nevada	23,255	12.4 (11.9 to 12.8)	23,120	12.2 (11.8 to 12.6)	22,203	11.6 (11.2 to 12.0)	−0.4 (−1.0 to 0.2)	0.1 (−0.5 to 0.7)	−0.5 (−1.1 to 0.1)
New Hampshire	6411	13.0 (12.2 to 13.8)	5279	11.4 (10.5 to 12.3)	5058	13.1 (12.2 to 14.1)	0.1 (−1.1 to 1.3)	−1.5 (−2.7 to −0.3)	1.6 (0.3 to 2.8)
New Jersey	53,110	15.0 (14.7 to 15.4)	49,455	13.9 (13.6 to 14.2)	40,053	13.5 (13.1 to 13.8)	−1.6 (−2.1 to −1.2)	−1.1 (−1.5 to −0.6)	−0.6 (−1.0 to −0.1)
New Mexico	13,097	13.1 (12.5 to 13.7)	13,025	9.7 (9.2 to 10.2)	10,885	10.4 (9.9 to 11.0)	−2.1 (−2.9 to −1.3)	−2.5 (−3.3 to −1.7)	0.5 (−0.3 to 1.3)
New York	107,374	14.1 (13.9 to 14.3)	119,681	11.0 (10.8 to 11.2)	100,744	10.4 (10.2 to 10.6)	−2.6 (−2.9 to −2.3)	−2.1 (−2.3 to −1.8)	−0.5 (−0.8 to −0.3)
North Carolina	58,763	11.8 (11.5 to 12.0)	76,195	11.6 (11.3 to 11.8)	85,869	11.7 (11.5 to 12.0)	0.8 (0.5 to 1.1)	0.5 (0.1 to 0.8)	0.4 (0.1 to 0.7)
North Dakota	5065	12.3 (11.4 to 13.2)	4653	11.1 (10.2 to 12.0)	4611	14.4 (13.3 to 15.4)	2.1 (0.7 to 3.4)	−1.1 (−2.3 to 0.2)	3.2 (1.8 to 4.5)
Ohio	104,540	12.2 (12.0 to 12.4)	87,974	12.3 (12 to 12.5)	76,085	11.3 (11.1 to 11.6)	−0.7 (−1.0 to −0.4)	0.2 (−0.1 to 0.5)	−0.9 (−1.2 to −0.6)
Oklahoma	21,964	12.8 (12.4 to 13.3)	30,424	9.7 (9.4 to 10.1)	25,279	11.4 (11 to 11.8)	−0.2 (−0.8 to 0.4)	−2.4 (−2.9 to −1.8)	2.1 (1.5 to 2.6)
Oregon	36,551	10.6 (10.3 to 10.9)	32,615	10.7 (10.3 to 11.0)	27,910	10.6 (10.3 to 11.0)	0.3 (−0.2 to 0.8)	0.2 (−0.2 to 0.7)	0.0 (−0.5 to 0.5)
Pennsylvania	57,842	13.6 (13.3 to 13.8)	59,151	11.8 (11.6 to 12.1)	55,029	13.0 (12.8 to 13.3)	−0.5 (−0.9 to −0.1)	−1.5 (−1.9 to −1.1)	1.1 (0.7 to 1.4)
Rhode Island	5764	15.9 (15.0 to 16.9)	5115	14.2 (13.3 to 15.2)	4816	14.7 (13.7 to 15.7)	−1.3 (−2.7 to 0.0)	−1.8 (−3.1 to −0.4)	0.5 (−0.9 to 1.9)
South Carolina	27,838	13.7 (13.3 to 14.1)	22,129	12.1 (11.7 to 12.5)	27,352	9.8 (9.5 to 10.2)	−3.1 (−3.7 to −2.6)	−1.5 (−2.1 to −1.0)	−1.5 (−2.0 to −0.9)
South Dakota	4973	16.2 (15.2 to 17.2)	4372	15.3 (14.2 to 16.3)	5353	12.8 (11.9 to 13.7)	−2.7 (−4.0 to −1.3)	−0.3 (−1.8 to 1.2)	−2.4 (−3.8 to −1.0)
Tennessee	36,840	15.0 (14.6 to 15.3)	55,647	11.9 (11.6 to 12.2)	48,584	12.3 (12.0 to 12.6)	−1.3 (−1.8 to −0.9)	−2.0 (−2.4 to −1.5)	0.6 (0.2 to 1.0)
Texas	221,750	16.2 (16.0 to 16.3)	249,894	14.6 (14.5 to 14.8)	197,668	15.5 (15.3 to 15.7)	−0.4 (−0.6 to −0.2)	−1.3 (−1.5 to −1.1)	0.9 (0.7 to 1.1)
Utah	24,944	11.3 (10.9 to 11.7)	21,700	6.9 (6.5 to 7.2)	17,491	6.5 (6.1 to 6.8)	−4.9 (−5.4 to −4.3)	−4.3 (−4.8 to −3.8)	−0.5 (−1.0 to −0.04)
Vermont	5183	9.0 (8.2 to 9.7)	4351	9.6 (8.7 to 10.5)	3779	11.2 (10.2 to 12.2)	2.4 (1.1 to 3.7)	0.6 (−0.6 to 1.8)	1.7 (0.3 to 3.0)
Virginia	33,245	24.0 (23.5 to 24.5)	40,505	22.6 (22.2 to 23.0)	33,839	14.8 (14.4 to 15.2)	−9.1 (−9.7 to −8.5)	−1.1 (−1.7 to −0.5)	−7.9 (−8.5 to −7.4)
Washington	64,628	12.8 (12.5 to 13)	61,003	11.1 (10.8 to 11.3)	51,063	11.5 (11.2 to 11.8)	−1.2 (−1.6 to −0.9)	−1.6 (−2.0 to −1.3)	0.4 (0.02 to 0.8)
West Virginia	15,477	9.4 (9.0 to 9.9)	10,320	11.9 (11.3 to 12.5)	7768	12.5 (11.8 to 13.3)	2.7 (1.8 to 3.5)	2.0 (1.2 to 2.8)	0.7 (−0.3 to 1.6)
Wisconsin	28,409	15.4 (15.0 to 15.9)	24,617	13.5 (13.1 to 14.0)	22,192	14.1 (13.6 to 14.5)	−0.9 (−1.5 to −0.2)	−1.9 (−2.5 to −1.3)	1.0 (0.4 to 1.6)
Wyoming	2997	9.8 (8.7 to 10.8)	3767	5.5 (4.8 to 6.2)	3387	7.3 (6.4 to 8.2)	−1.2 (−2.6 to 0.1)	−2.9 (−4.2 to −1.6)	1.7 (0.6 to 2.9)
Territory									
American Samoa	1322	16.1 (14.1 to 18.1)	1455	22.4 (20.3 to 24.6)	1303	19.9 (17.7 to 22)	4.2 (1.2 to 7.1)	6.2 (3.3 to 9.1)	−2.2 (−5.2 to 0.9)
Guam	2021	9.7 (8.4 to 11.0)	2022	8.0 (6.8 to 9.2)	2141	10.0 (8.8 to 11.3)	0.0 (−1.8 to 1.9)	−1.7 (−3.5 to 0.0)	2.1 (0.3 to 3.8)

WIC agency	2010		2014		2018		2018 vs. 2010	2014 vs. 2010	2018 vs. 2014
	No.	% (95% CI)	No.	% (95% CI)	No.	% (95% CI)	APD,[a] % (95% CI)	APD,[a] % (95% CI)	APD,[a] % (95% CI)
Northern Mariana Islands	1022	13.1 (11.0 to 15.2)	811	11.6 (9.4 to 13.8)	751	9.2 (7.1 to 11.3)	−4.3 (−7.2 to −1.4)	−1.5 (−4.5 to 1.5)	−2.4 (−5.5 to 0.6)
Puerto Rico	51,259	19.1 (18.7 to 19.4)	45,515	10.5 (10.2 to 10.7)	24,916	7.8 (7.5 to 8.1)	−11.3 (−11.8 to −10.8)	−9.3 (−9.7 to −8.9)	−1.9 (−2.3 to −1.4)
Virgin Islands	1231	11.0 (9.3 to 12.8)	940	11.8 (9.7 to 13.9)	642	16.5 (13.6 to 19.4)	5.1 (1.8 to 8.5)	0.7 (−2.0 to 3.4)	4.3 (0.8 to 7.9)

[a]Calculated as 100 times the marginal effect of year (2018 vs. 2010, 2014 vs. 2010, and 2018 vs. 2014) from logistic regression model controlling for age, sex, and race/ethnicity. The difference in adjusted prevalence of high weight-for-length across years was considered statistically significant if the 95% CI for APD did not include 0. A positive number means that the adjusted prevalence in the later year was higher than that in the earlier year and a negative number means the opposite. The data reporting systems changed in Alabama, North Carolina, West Virginia, and Virginia in 2016, which might affect the prevalence trends.

APD, adjusted prevalence difference; CI, confidence interval; SE, standard error.