HHS Public Access

Author manuscript

Pediatrics. Author manuscript; available in PMC 2025 January 01.

Published in final edited form as:

Pediatrics. 2024 January 01; 153(1): . doi:10.1542/peds.2023-062461.

Trends in Severe Obesity Among Children Aged 2 to 4 Years in WIC: 2010 to 2020

Lixia Zhao, PhD,

David S. Freedman, PhD,

Heidi M. Blanck, PhD,

Sohyun Park, PhD

Division of Nutrition, Physical Activity, and Obesity, Centers for Disease Control and Prevention, Atlanta, Georgia

Abstract

OBJECTIVES: To examine the prevalence and trends in severe obesity among 16.6 million children aged 2 to 4 years enrolled in the Special Supplemental Nutrition Program for Women, Infants, and Children from 2010 to 2020.

METHODS: Severe obesity was defined as a sex-specific BMI for age ≥120% of the 95th percentile on the Centers for Disease Control and Prevention growth charts or BMI ≥35kg/m^2. Joinpoint regression was used to identify when changes occurred in the overall trend. Logistic regression was used to compute the adjusted prevalence differences between years controlling for sex, age, and race and ethnicity.

RESULTS: The prevalence of severe obesity significantly decreased from 2.1% in 2010 to 1.8% in 2016 and then increased to 2.0% in 2020. From 2010 to 2016, the prevalence decreased significantly among all sociodemographic subgroups except for American Indian/Alaska Native children. The largest decreases were among 4-year-olds, Asian/Pacific Islander and Hispanic children, and children from higher-income households. However, from 2016 to 2020, the prevalence increased significantly overall and among sociodemographic subgroups, except for American Indian/Alaska Native and non-Hispanic white children. The largest increases occurred in 4-year-olds and Hispanic children. Among 56 Special Supplemental Nutrition Program for Women, Infants, and Children agencies, the prevalence significantly declined in 17 agencies, and 1 agency (Mississippi) showed a significant increase from 2010 to 2016. In contrast, 21 agencies had significant increases, and only Alaska had a significant decrease from 2016 to 2020.

Address correspondence to Lixia Zhao, PhD, Division of Nutrition, Physical Activity, and Obesity, National Center for Chronic Disease Prevention and Health Promotion, Centers for Disease Control and Prevention, 4770 Buford Highway, NE, Atlanta, GA 30341. ynl3@cdc.gov.

Dr Zhao conducted the data analyses, drafted the initial manuscript, revised the manuscript, and contributed to conceptualization of the study; Drs Freedman, Blanck, and Park contributed to the conceptualization, writing, reviewing, and editing of the manuscript; and all authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

CONFLICT OF INTEREST DISCLOSURES: The authors have indicated they have no potential conflicts of interest relevant to this article to disclose.

COMPANION PAPER: A companion to this article can be found online at www.pediatrics.org/cgi/doi/10.1542/peds.2023-063799.

CONCLUSIONS: Although severe obesity prevalence in toddlers declined from 2010 to 2016, recent trends are upward. Early identification and access to evidence-based family healthy weight programs for at-risk children can support families and child health.

The prevalence of childhood obesity remains high in the United States; ~1 in 5 US children and adolescents have obesity.[1,2] The trends of childhood obesity have been well-documented by using the National Health and Nutrition Examination Survey (NHANES). Among youth aged 2 to 19 years, obesity prevalence has plateaued or slightly increased in the recent decades,[2–6] whereas the prevalence of severe obesity rose from 3.6% in 1999 and 2000 to 6.1% in 2017 and 2018.[5] In addition to these trends, recent cohort studies revealed substantial weight gain, particularly among children with excessive weight, during the early phase of the coronavirus disease 2019 (COVID-19) pandemic.[7,8] However, it is noteworthy that the accelerated weight gain during the early pandemic was largely attenuated later in the pandemic (January to November 2021).[9] These findings indicate a potential fluctuation in weight changes among children and the need for ongoing monitoring and interventions.

Children with severe obesity, compared with their peers with moderate obesity (BMI ≥95th percentile to <120% of the 95th percentile), are at a greater risk of various health complications, including cardiovascular disease, metabolic syndrome, type 2 diabetes, fatty liver disease, and premature death.[10–12] Despite these significant health implications, there has been limited attention given to understanding the prevalence of severe obesity among children aged 2 to 5 years, a critical age group for public health interventions.[13–15] Nevertheless, the authors of a few NHANES studies examined the prevalence and trends of severe obesity among children aged 2 to 5 years. One study revealed that the prevalence of severe obesity among this age group was 3.0% in 2009 and 2010, 1.7% in 2015 and 2016, and 2.9% in 2017 and 2018.[4] Hales and colleagues reported similar changes between 2009 to 2010 (2.7%) and 2015 to 2016 (1.8%).[3] Another study revealed that the prevalence of severe obesity was 2.2% from 2015 to 2018.[6] However, the 95% confidence intervals (CIs) for these estimates were wide, and no significant trends were observed over the study period. As a result of the small sample size and low cases of severe obesity, NHANES data provide limited ability to monitor trends among this age group, especially by sociodemographic characteristics.

Data from the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) Participant and Program Characteristics study have been used to monitor weight status among low-income children <5 years of age.[16–20] WIC is a federal assistance program that provides healthy foods, nutrition education, health care referrals, and other services to millions of low-income pregnant and postpartum women, as well as infants and children up to age 5, who are at nutritional risk.[21] In 2019, 20.4% of children in the United States received WIC benefits.[22] A previous study that examined trends in severe obesity among young children enrolled in WIC reported an increase from 1.80% in 2000 to 2.11% in 2004, followed by a modest decline from 2.11% to 1.96% from 2004 to 2014.[23] However, it is unknown whether this declining trend has been sustained, and little is known about the prevalence and trends in severe obesity at the state level. Understanding the ongoing state-specific trends can help inform targeted intervention strategies for children at risk. In this study, with the latest data from WIC Participant and Program Characteristics (WIC-PC),

we aimed to provide an updated prevalence of severe obesity among low-income children aged 2 to 4 years enrolled in WIC, and we examined trends in severe obesity by sex, age, race and ethnicity, household income, and by WIC State agency from 2010 to 2020.

METHODS

Data Sources and Study Population

The WIC-PC is a biennial census of participants certified to receive WIC benefits as of April of the reporting years (even years). WIC benefits include nutritious supplemental foods, nutrition education and counseling, and referrals to health care and social services, etc.[21] It is one of the largest federal nutrition programs, serving millions of people. The program helps maintain and improve the health of low-income pregnant, postpartum, and breastfeeding women, as well as infants and children up to age 5, who are at nutritional risk.[21] Enrollees must meet residential, nutritional risk, and income requirements to qualify for the benefits. Income eligibility is based on a household income of no more than 185% of the federal poverty income guidelines or participation in other federal programs, such as the Supplemental Nutrition Assistance Program, Temporary Assistance for Needy Families, or Medicaid.[24] The US Department of Agriculture's (USDA's) Food and Nutrition Service manages WIC at the federal level, and WIC is administered at the local level by state health departments or Indian tribal organizations in each state or territory. Children's weight and height (or length) are measured and collected by trained program staff during certification or recertification visits, and the data are used to calculate BMI. Weights were measured to the nearest one-quarter pound, and heights to the nearest one-eighth inch according to the Centers for Disease Control and Prevention (CDC) nutrition surveillance program standards.[25,26] The validity of these measurements was found to be sufficiently accurate.[27] This study did not need review by the Institutional Review Board of the CDC because we used deidentified secondary data.

The data for this study are from 6 WIC-PC censuses (2010 to 2020). The initial population included ~17.2 million children aged 2 to 4 years enrolled in WIC from 50 states, the District of Columbia, and 5 territories. We excluded 17 children whose weight and height were measured >1 year before the reporting year and 206 912 children whose sex, weight, height, or BMI were missing or biologically implausible based on the suggested CDC cutpoints.[28] We further excluded 308 091 children who were certified in March and April 2020 given data quality concerns due to the COVID-19 pandemic, which is ~15.8% of 2020 WIC participating children.[29] This yielded an analytical sample of 16 557 172 children ranging from 3 307 442 in 2010 to 1 646 747 in 2020.

Defining Severe Obesity

Severe obesity was defined as a sex-specific BMI for age ≥120% of the 95th percentile based on the CDC growth charts or a BMI ≥35 kg/m^2. Of the 4717 children in this analysis who had a BMI ≥35 kg/m^2, none were <120% of the 95th percentile.

Sociodemographic Characteristics

Sociodemographic variables included sex, age group (2, 3, or 4 years), race and ethnicity, and household income. Race and ethnicity are social constructs and were based on self-reports. USDA's WIC study team classified these self-reports into 5 mutually exclusive categories (American Indian/Alaska Native [AI/AN], Asian/Pacific Islander, Black, non-Hispanic [Black], Hispanic, or white, non-Hispanic [white]). Children with multiple race and ethnicity designations were not forced into a single category. Instead, a mapping approach developed by the USDA was employed to assign individuals to the appropriate category within the 5-category classification.[25] Children whose race or ethnicity was unknown were not included in analyses that specifically focused on (or adjusted for) race and ethnicity. Household income included income from all sources that were assessed at each WIC certification or recertification appointment. It was expressed as a percentage of the federal poverty level (% FPL) and categorized into <50% FPL, 50% to <100% FPL, 100% to <150% FPL, and ≥150% FPL.

Statistical Analyses

Descriptive analyses were conducted in SAS 9.4 (SAS Institute, Cary, NC) for the overall population, by sociodemographic characteristics and WIC state or territorial agency. The unadjusted prevalence of severe obesity and 95% CI were computed overall and for each subgroup. For trend analyses, we first used Joinpoint trend analysis software (National Cancer Institute, version 4.9.0, https://surveillance.cancer.gov/joinpoint) to identify possible knots in the overall trend in severe obesity prevalence from 2010 to 2020, and the software identified 2016 as the inflection year. Therefore, we focused on 2 periods, 2010 to 2016 and 2016 to 2020, to study the prevalence differences between years. We used logistic regression controlling for age in months, sex, and race and ethnicity to obtain the adjusted prevalence differences (APDs) during each period. We included race and ethnicity as a confounding factor in the analysis, in addition to age and sex, because previous studies have revealed racial and ethnic disparities in severe obesity among young children.[15,23] The APDs were computed as 100 times the average marginal effect of year (2010 vs 2016 and 2016 vs 2020). The calculations were conducted in R with the "margins" package.[30,31] The APD was considered statistically significant if the 2-sided *P* value was <.05. A negative number of APD means that the adjusted prevalence in the latter year decreased compared with the earlier year.

RESULTS

The sociodemographic characteristics of children aged 2 to 4 years enrolled in WIC are shown in Table 1. The number of children included in this analysis was ~3.3 million in 2010, ~2.8 million in 2016, and ~1.6 million in 2020. The study population in 2010 had a slightly higher proportion of 4-year-olds than those in more recent years. The proportion of Black children increased from 18.7% in 2010% to 22.7% in 2020, whereas the proportion of Hispanic children decreased from 46.5% in 2010% to 43.3% in 2020. In addition, the proportion of children from families with household income <50% FPL increased from 2010 to 2020 (Table 1).

In all years, girls had slightly higher severe obesity prevalence than boys, the prevalence of severe obesity increased with age, and the highest prevalence was observed among 4-year-olds. Within racial and ethnic subgroups, AI/AN and Hispanic children had the highest prevalence. The prevalence of severe obesity was higher among children from families below the poverty level (<100% FPL) than children from families with relatively higher (100% to <150% FPL) or highest (≥150% FPL) household income (Table 2, Fig 1).

From 2010 to 2016, the overall prevalence of severe obesity decreased significantly by 0.19% points (95% CI [−0.21 to −0.16]; P <.001) after adjusting for age, sex, and race and ethnicity (Table 2). There were significant decreasing trends among all sociodemographic subgroups except for AI/AN children, for whom the adjusted prevalence decrease was not statistically significant (Table 2, Fig 1). Within the various subgroups, the largest adjusted prevalence decreases were observed among 4-year-olds (−0.32%, 95% CI [−0.38 to −0.27]), Asian/Pacific Islander (−0.32% [−0.41 to −0.23]), Hispanic children (−0.31% [−0.34 to −0.27]), and children from families with relative higher household income (100% to <150% FPL) (−0.27% [−0.32 to −0.22]; Table 2).

From 2016 to 2020, the prevalence of severe obesity increased significantly from 1.8% to 2.0% overall (APD, 0.23% [0.21 to 0.26], P <.001) and among most sociodemographic subgroups except for AI/AN and white children, for which the prevalence remained stable between 2016 and 2020 (Table 2, Fig 1). The adjusted prevalence increases were similar among boys and girls and among household income subgroups. The largest adjusted prevalence increases occurred among 4-year-olds (0.35% [0.28 to 0.42]) and Hispanic children (0.41% [0.36 to 0.46]; Table 2).

Table 3 reveals the crude prevalence and adjusted prevalence changes of severe obesity during the study period for the 56 WIC agencies, including 50 US states, the District of Columbia, and 5 territories. From 2010 to 2016, after adjusting for age, sex, and race and ethnicity, 14 states and 3 territories revealed significant decreases in the prevalence of severe obesity, and 1 state (Mississippi) showed a significant increase. The largest significant decrease among states was observed in Arizona (APD, −0.74% [−0.88 to −0.60]), and the largest decrease among territories was in the Northern Mariana Islands (APD, −1.99% [−2.78 to −1.20]). In contrast, from 2016 to 2020, the prevalence significantly increased in 20 states and Puerto Rico (APD, 0.30% [0.12 to 0.48]). Seven states had a significant increase of >0.3%, and the largest significant increase was in California (APD, 0.54% [0.45 to 0.62]). Alaska was the only WIC agency showing a significant decrease (APD, −0.59% [−1.18 to 0.0]) between 2016 and 2020.

DISCUSSION

We found a modest declining trends in severe obesity prevalence from 2010 to 2016, followed by a modestly increasing trend from 2016 to 2020 among low-income children aged 2 to 4 years enrolled in WIC. Although the magnitudes of the decline and the increase were small, the finding of a reversal in trends from decreasing to increasing is concerning, particularly if the upward trend continues. Our data reveal that the prevalence of severe obesity increased significantly from 2016 to 2020 overall and among all age, sex, household

income groups, and race and ethnicity groups, except for American Indian/Alaska Native and non-Hispanic white children. Additionally, we found that 21 of 56 WIC agencies had a significant increase, and only Alaska had a significant decrease in severe obesity prevalence between 2016 and 2020. Our study revealed that 2.0% of low-income young children had severe obesity in 2020. A previous WIC-PC study revealed that the severe obesity prevalence increased from 2000 to 2004 and decreased from 2004 to 2014 among low-income children aged 2 to 4 years.[23] The decrease is similar to what we observed in our study.

A few earlier studies have revealed decreasing trends in obesity among WIC infants and young children from 2000 to 2016 or 2018, but none of these studies examined trends in severe obesity.[18–20] Multiple factors might have contributed to the declines, as noted in these studies. For example, the decreasing trends could be influenced by the revised 2009 WIC food packages that provided cash allowances for various healthy food options in addition to federal, state, and local obesity prevention initiatives and programs. The revised WIC food package includes extra cash allowances for fruits, vegetables, and whole grains, reductions in milk, cheese, and juice allowances, restrictions on milk fat content, and incentives to encourage breastfeeding.[32] Several studies have revealed that these revisions improved the dietary intake habits of WIC participants, potentially contributing to the reduction in obesity prevalence among WIC children.[33–35] However, it is important to note that the effects of the revised food packages on the prevalence of obesity may vary by sex.[36,37] For instance, the food package changes appear to have limited benefits for girls, suggesting that other factors beyond the food packages may influence obesity trends. Additionally, the recent upward trends in severe obesity since 2016 are concerning, indicating that current population-level preventive efforts may not be fully effective. This highlights the need for the ongoing evaluation and refinement of obesity prevention strategies to address the persistent challenge of severe obesity among WIC children and identify additional interventions that can complement the impact of the revised food package.

In addition, we found significant increases in severe obesity among 21 of 56 WIC agencies from 2016 to 2020. The reasons for these increases remain unclear and are likely influenced by a complex interplay of various factors. These factors may include levels of state social resources to families (eg, earned income tax credit, wage supports, Medicaid, housing supports) and variations in funding to support local WIC agencies and clinics, as well as the implementation of the WIC benefits (such as breastfeeding support, provision of supplemental foods, and nutrition education and counseling). Additionally, state policy and environmental changes to improve the availability of healthier food and opportunities for physical activity in communities, alongside efforts to incorporate breastfeeding support, nutrition, and physical activity requirements, into early care and education programs,[38,39] may have played a role. However, further research is needed to understand the specific factors driving the increases in severe obesity across different states.

Although our study did not capture data during the COVID-19 pandemic, it is important to acknowledge the substantial impact of the pandemic on the daily routines of children and adolescents. The pandemic has introduced various challenges, including reduced opportunities for physical activity, increased sedentary behaviors, limited access to healthy

food, and heightened stress levels within households.[40] These factors can have significant implications for weight gain, particularly among children with excessive weight, and may potentially influence future trend in severe obesity.[41]

An important avenue for addressing the problem of severe obesity for all children, including those with low household incomes, is ensuring quality treatment. For young children aged 2 to 5 years who are obese, the American Academy of Pediatrics' new clinical practice guideline recommends intensive health behavior and lifestyle treatment (IHBLT), also called Family Healthy Weight Programs.[42,43] The most effective IHBLT interventions include 26 or more hours of intense, in-person, family-based multicomponent treatment from health care providers over a 3- to 12-month period. IHBLT includes coaching on nutrition, physical activity, and behavioral change support, such as parent modeling of healthy behaviors. Such intensive treatment is not universally available and needs training and support to deliver.[42] Collaborative and continued efforts involving multiple sectors, including state, local, communities, and clinicians, can help ensure that these family-centered intervention strategies are accessible for low-income young children with severe obesity.

The findings in this study are subject to several limitations that should be considered when interpreting the results. Firstly, the findings apply to low-income children enrolled in WIC, limiting the generalizability of the results to children from families of all income levels. Secondly, we did not include children participating in the tribal WIC programs. Therefore, the prevalence and trends of severe obesity among AI/AN children may not be representative of all AI/AN children enrolled in WIC. Thirdly, although height and weight were measured by trained program staff following standardized protocols, potential variations in data collection practices across different WIC agencies could exist. Moreover, it is important to note that the number of children enrolled in the WIC program has steadily decreased since 2010,[44] and nearly 16% of records in 2020 were excluded from the analysis because of data quality issues related to the COVID-19 pandemic. Consequently, children's demographic characteristics in the sample may have changed throughout the study. We accounted for some of these changes in the trend analyses. However, residual confounding resulting from other factors, such as socioeconomic status, parental education level, and household composition, may remain.

CONCLUSIONS

Despite the declining trend of severe obesity among young children enrolled in the WIC program from 2010 to 2016, the small upward trend in severe obesity since 2016 is concerning. Given that children with higher BMI are at greater risk of future health consequences, continued understanding of the ongoing state trends of obesity, especially severe obesity among young children, is warranted. Ensuring that children and families from low-income households have access to early clinical detection, and referrals to effective and sustainable family-based interventions, could help promote healthy child growth.

ACKNOWLEDGMENTS

We thank Amanda Reat (USDA) for the critical review of the article. We also acknowledge the staff from USDA Food and Nutrition Service for providing WIC-PC data.

ABBREVIATIONS

AI/AN	American Indian/Alaska Native
APD	adjusted prevalence difference
CDC	Centers for Disease Control and Prevention
CI	confidence interval
COVID-19	coronavirus disease 2019
FPL	federal poverty level
IHBLT	intensive behavior and lifestyle treatment
NHANES	National Health and Nutrition Examination Survey
USDA	US Department of Agriculture
WIC	Special Supplemental Nutrition Program for Women, Infants, and Children
WIC-PC	WIC Participant and Program Characteristics

REFERENCES

1. National Center for Health Statistics. NHANES 2017–March 2020 prepandemic data files. Available at: https://www.cdc.gov/nchs/data/nhsr/nhsr158-508.pdf. Accessed February 17, 2023
2. Hu K, Staiano AE. Trends in obesity prevalence among children and adolescents aged 2 to 19 years in the US from 2011 to 2020. JAMA Pediatr. 2022;176(10):1037–1039 [PubMed: 35877133]
3. Hales CM, Fryar CD, Carroll MD, et al. Trends in obesity and severe obesity prevalence in US youth and adults by sex and age, 2007–2008 to 2015–2016. JAMA. 2018;319(16):1723–1725 [PubMed: 29570750]
4. Tsoi MF, Li HL, Feng Q, et al. Prevalence of childhood obesity in the United States in 1999–2018: a 20-year analysis. Obes Facts. 2022;15(4):560–569 [PubMed: 35358970]
5. QuickStats: prevalence of obesity* and severe obesity† among persons aged 2–19 years - national health and nutrition examination survey, 1999–2000 through 2017–2018. MMWR Morb Mortal Wkly Rep. 2020;69(13):390 [PubMed: 32240130]
6. Ogden CL, Fryar CD, Martin CB, et al. Trends in obesity prevalence by race and Hispanic origin-1999–2000 to 2017–2018. JAMA. 2020; 324(12):1208–1210 [PubMed: 32857101]
7. Woolford SJ, Sidell M, Li X, et al. Changes in body mass index among children and adolescents during the COVID-19 pandemic. JAMA. 2021;326(14):1434–1436 [PubMed: 34448817]
8. Lange SJ, Kompaniyets L, Freedman DS, et al. ; DNP3. Longitudinal trends in body mass index before and during the COVID-19 pandemic among persons aged 2–19 years - United States, 2018–2020. MMWR Morb Mortal Wkly Rep. 2021;70(37):1278–1283 [PubMed: 34529635]
9. Pierce SL, Kompaniyets L, Freedman DS, et al. Children's rates of BMI change during pre-pandemic and two COVID-19 pandemic periods, IQVIA Ambulatory Electronic Medical Record, January 2018 through November 2021. Obesity (Silver Spring). 2023;31(3):693–698 [PubMed: 36350181]
10. Kelly AS, Barlow SE, Rao G, et al. ; American Heart Association Atherosclerosis, Hypertension, and Obesity in the Young Committee of the Council on Cardiovascular Disease in the Young, Council on Nutrition, Physical Activity and Metabolism, and Council on Clinical Cardiology. Severe obesity in children and adolescents: identification, associated health risks, and

treatment approaches: a scientific statement from the American Heart Association. Circulation. 2013;128(15):1689–1712 [PubMed: 24016455]

11. Bass R, Eneli I. Severe childhood obesity: an under-recognised and growing health problem. Postgrad Med J. 2015;91(1081): 639–645 [PubMed: 26338983]
12. Calcaterra V, Klersy C, Muratori T, et al. Prevalence of metabolic syndrome (MS) in children and adolescents with varying degrees of obesity. Clin Endocrinol (Oxf). 2008;68(6):868–872 [PubMed: 17980007]
13. Porter RM, Tindall A, Gaffka BJ, et al. A review of modifiable risk factors for severe obesity in children ages 5 and under. Child Obes. 2018;14(7):468–476 [PubMed: 30156438]
14. Mirza N, Phan TL, Tester J, et al. A narrative review of medical and genetic risk factors among children age 5 and younger with severe obesity. Child Obes. 2018;14(7):443–452 [PubMed: 29791184]
15. Tester JM, Phan TT, Tucker JM, et al. Characteristics of children 2 to 5 years of age with severe obesity. Pediatrics. 2018; 141(3):e20173228 [PubMed: 29487163]
16. Pan L, Freedman DS, Sharma AJ, et al. Trends in obesity among participants aged 2–4 years in the Special Supplemental Nutrition Program for Women, Infants, and Children - United States, 2000–2014. MMWR Morb Mortal Wkly Rep. 2016;65(45):1256–1260 [PubMed: 27855143]
17. Freedman DS, Sharma AJ, Hamner HC, et al. Trends in weight-for-length among infants in WIC From 2000 to 2014. Pediatrics. 2017;139(1):e20162034 [PubMed: 27965380]
18. Pan L, Freedman DS, Park S, et al. Changes in obesity among US children aged 2 through 4 years enrolled in WIC during 2010–2016. JAMA. 2019;321(23):2364–2366 [PubMed: 31211336]
19. Pan L, Blanck HM, Park S, et al. State-specific prevalence of obesity among children aged 2–4 years enrolled in the Special Supplemental Nutrition Program for Women, Infants, and Children - United States, 2010–2016. MMWR Morb Mortal Wkly Rep. 2019;68(46):1057–1061 [PubMed: 31751324]
20. Pan L, Blanck HM, Galuska DA, et al. Changes in high weight-for-length among infants enrolled in Special Supplemental Nutrition Program for Women, Infants, and Children during 2010–2018. Child Obes. 2021;17(6):408–419 [PubMed: 33960827]
21. USDA Food and Nutrition Services. The Special Supplemental Nutrition Program for Women, Infants and Children (WIC). Available at: https://www.fns.usda.gov/wic/about-wic. Accessed February 17, 2023
22. Farson Gray K, Balch-Crystal E, Giannarelli L, Johnson P; U.S. Department of Agriculture Food and Nutrition Service. National- and state-level estimates of WIC eligibility and WIC program reach in 2019. Available at: https://fns-prod.azureedge.us/sites/default/files/resource-files/WICEligibles2019-Volume1-revised.pdf. Accessed April 28, 2023
23. Pan L, Park S, Slayton R, et al. Trends in severe obesity among children aged 2 to 4 years enrolled in Special Supplemental Nutrition Program for Women, Infants, and Children From 2000 to 2014. JAMA Pediatr. 2018;172(3):232–238 [PubMed: 29309485]
24. USDA Food and Nutrition Services. WIC eligibility requirements. Available at: https://www.fns.usda.gov/wic/wic-eligibility-requirements. Accessed February 17, 2023
25. US Department of Agriculture. National sample file for public use codebook: WIC participant and program characteristics 2018. Available at: https://data.nal.usda.gov/dataset/wic-participant-and-program-characteristics-2018/resource/e5bf8469-d6de-48c0-99e0-0fc2efa254d8. Accessed June 6, 2023
26. Minnesota Department of Health. WIC anthropometrics manual 2022. Available at: https://www.health.state.mn.us/docs/people/wic/localagency/training/nutrition/nst/anthro.pdf. Accessed June 6, 2023
27. Crespi CM, Alfonso VH, Whaley SE, Wang MC. Validity of child anthropometric measurements in the Special Supplemental Nutrition Program for Women, Infants, and Children. Pediatr Res. 2012;71(3):286–292 [PubMed: 22337260]
28. Centers for Disease Control and Prevention (CDC). The SAS Program for CDC growth charts that includes the extended BMI calculations. Available at: https://www.cdc.gov/nccdphp/dnpao/growthcharts/resources/sas.htm. Accessed February 17, 2023

29. USDA Food and Nutrition Services. WIC participant and program characteristics 2020 final report. Available at: https://fns-prod.azureedge.us/sites/default/files/resource-files/WICPC2020-1.pdf. Accessed February 17, 2023
30. Leeper TJ; CRAN. Margins: marginal effects for model objects. R package version 0.3.26. Available at: https://rdrr.io/cran/margins/. Accessed XX
31. R Core Team; R Foundation for Statistical Computing. R: a language and environment for statistical computing. Available at: https://www.R-project.org/. Accessed XX
32. USDA Food and Nutrition Services. Special Supplemental Nutrition Program for Women, Infants and Children (WIC): revisions in the WIC food packages, 2009. Available at: https://www.federalregister.gov/documents/2009/12/31/E9-30991/special-supplemental-nutrition-program-for-women-infants-and-children-wic-revisions-in-the-wic-food. Accessed June 6, 2023
33. Daepp MIG, Gortmaker SL, Wang YC, et al. WIC food package changes: trends in childhood obesity prevalence. Pediatrics. 2019;143(5):e20182841 [PubMed: 30936251]
34. Schultz DJ, Byker Shanks C, Houghtaling B. The impact of the 2009 Special Supplemental Nutrition Program for Women, Infants, and Children food package revisions on participants: a systematic review. J Acad Nutr Diet. 2015;115(11): 1832–1846 [PubMed: 26276067]
35. Andreyeva T, Tripp AS. The healthfulness of food and beverage purchases after the federal food package revisions: the case of two New England states. Prev Med. 2016;91:204–210 [PubMed: 27527573]
36. Chaparro MP, Anderson CE, Crespi CM, et al. The effect of the 2009 WIC food package change on childhood obesity varies by gender and initial weight status in Los Angeles County. Pediatr Obes. 2019;14(9):e12526 [PubMed: 30942561]
37. Chaparro MP, Crespi CM, Anderson CE, et al. The 2009 Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) food package change and children's growth trajectories and obesity in Los Angeles County. Am J Clin Nutr. 2019;109(5):1414–1421 [PubMed: 31011750]
38. Centers for Disease Control and Prevention (CDC). Priority obesity strategy: early care and education (ECE) policies and activities. Available at: https://www.cdc.gov/obesity/strategies/priority-obesity-strategy.html. Accessed February 24, 2023
39. Pelletier JE, Schreiber LRN, Laska MN. Minimum stocking requirements for retailers in the Special Supplemental Nutrition Program for Women, Infants, and Children: disparities across US states. Am J Public Health. 2017;107(7):1171–1174 [PubMed: 28520477]
40. Browne NT, Snethen JA, Greenberg CS, et al. When pandemics collide: the impact of COVID-19 on childhood obesity. J Pediatr Nurs. 2021;56:90–98 [PubMed: 33293199]
41. Cena H, Fiechtner L, Vincenti A, et al. COVID-19 pandemic as risk factors for excessive weight gain in pediatrics: the role of changes in nutrition behavior. A narrative review. Nutrients. 2021;13(12):4255 [PubMed: 34959805]
42. Hampl SE, Hassink SG, Skinner AC, et al. Clinical practice guideline for the evaluation and treatment of children and adolescents with obesity. Pediatrics. 2023;151(2):e2022060640 [PubMed: 36622115]
43. Centers for Disease Control and Prevention (CDC). Family healthy weight programs. Available at: https://www.cdc.gov/obesity/strategies/family-healthy-weight-programs.html. Accessed March 22, 2023
44. USDA Food and Nutrition Services. WIC participant and program characteristics 2020 - charts. Available at: https://www.fns.usda.gov/wic/participant-program-characteristics-2020-charts. Accessed February 24, 2023

WHAT'S KNOWN ON THIS SUBJECT:

The prevalence of severe obesity among low-income children modestly declined from 2004 to 2014. However, little is known about (1) whether this declining trend has continued and (2) the state-level prevalence and trends in severe obesity.

WHAT THIS STUDY ADDS:

The declining trends in severe obesity among 16.6 million low-income children between 2010 and 2016 have been reversed. The upward trends are concerning. Early identification and referral to family healthy weight programs for at-risk children can support healthy child growth.

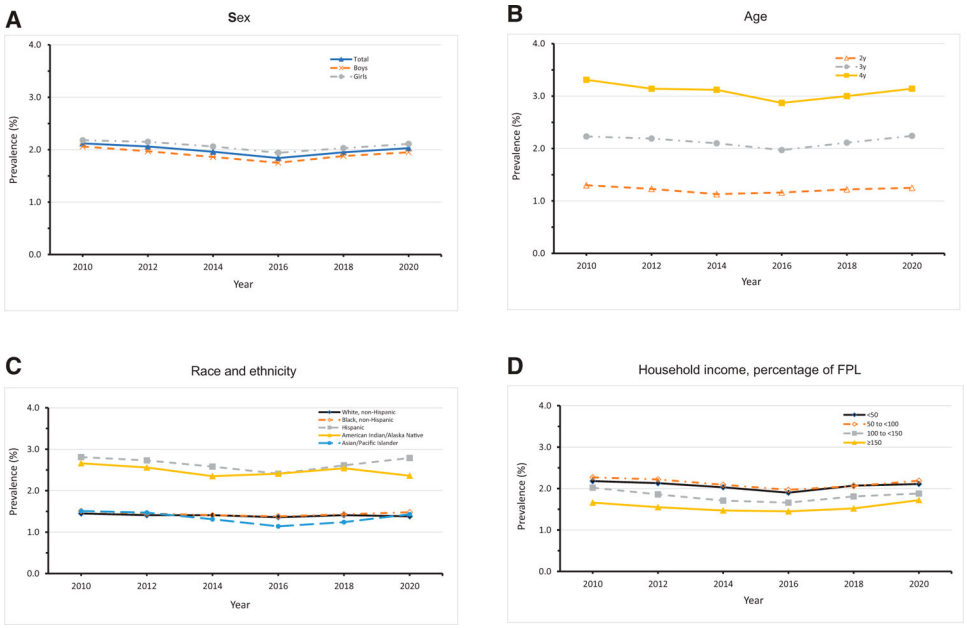

FIGURE 1.

Trends in the prevalence of severe obesity among children aged 2 to 4 years enrolled in WIC from 2010 to 2020 by (A) sex, (B) age, (C) race and ethnicity, and (D) household income.

TABLE 1

Sociodemographic Characteristics of Children Aged 2 to 4 Years Enrolled in WIC Program in Selected Years, 2010 to 2020[a]

Characteristics	2010 *n* (%)	2016 *n* (%)	2020[b] *n* (%)
Total, *n*	3 307 442	2 818 594	1 646 747
Sex			
Male	1 676 395 (50.7)	1 431 197 (50.8)	837 069 (50.8)
Female	1 631 047 (49.3)	1 387 397 (49.2)	809 678 (49.2)
Age, y			
2	1 333 334 (40.3)	1 152 176 (40.9)	678 668 (41.2)
3	1 166 350 (35.3)	1 027 505 (36.5)	606 069 (36.8)
4	807 758 (24.4)	638 913 (22.7)	362010 (22.0)
Race/ethnicity			
American Indian/Alaska Native	38 661 (1.2)	35 682 (1.3)	20 977 (1.3)
Asian/Pacific Islander	121 667 (3.7)	136141 (4.8)	83 365 (5.1)
Black, non-Hispanic	618 580 (18.7)	594060 (21.1)	373 567 (22.7)
Hispanic	1 536 644 (46.5)	1 274 650 (45.2)	712 904 (43.3)
White, non-Hispanic	966 673 (29.2)	776 843 (27.6)	455 005 (27.6)
Unknown	25 217 (0.8)	1218 (0.04)	929 (0.1)
Household income, % FPL			
<50	980 903 (29.7)	904 683 (32.1)	522 630 (31.7)
50 to <100	1 137 558 (34.4)	983 100 (34.9)	533 270 (32.4)
100 to <150	630 706 (19.1)	497 656 (17.7)	317 305 (19.3)
≥150	331 316 (10.0)	225 424 (8.0)	169 206 (10.3)
Unknown	226 959 (6.9)	207 731 (7.4)	104 336 (6.3)

[a]Included children who were enrolled in WIC from 50 states, the District of Columbia, and 5 US territories.

[b]Children with anthropometric data examined in March and April 2020 were excluded because of the COVID-19 pandemic.

TABLE 2

Trends in the Prevalence of Severe Obesity[a] Among Children Aged 2 to 4 Years Enrolled in WIC Program in Selected Years, 2010 to 2020

Characteristics	Crude Prevalence, % (95% CI)			APD,[b] % (95% CI)	
	2010	2016	2020[c]	2016 vs 2010	2020 vs 2016
Overall	2.12 (2.10 to 2.13)	1.84 (1.83 to 1.86)	2.03 (2.01 to 2.05)	−0.19 (−0.21 to −0.16)[d]	0.23 (0.21 to 0.26)[d]
Sex					
Male	2.06 (2.03 to 2.08)	1.75 (1.73 to 1.77)	1.95 (1.92 to 1.98)	−0.21 (−0.24 to −0.18)[d]	0.25 (0.21 to 0.28)[d]
Female	2.18 (2.16 to 2.20)	1.94 (1.92 to 1.96)	2.11 (2.08 to 2.15)	−0.16 (−0.19 to −0.13)[d]	0.22 (0.18 to 0.26)[d]
Age, y					
2	1.30 (1.28 to 1.32)	1.16 (1.14 to 1.18)	1.25 (1.23 to 1.28)	−0.10 (−0.13 to −0.07)[d]	0.11 (0.08 to 0.15)[d]
3	2.23 (2.20 to 2.26)	1.97 (1.95 to 2.00)	2.24 (2.20 to 2.27)	−0.22 (−0.26 to −0.18)[d]	0.28 (0.24 to 0.33)[d]
4	3.31 (3.27 to 3.35)	2.87 (2.83 to 2.91)	3.14 (3.09 to 3.20)	−0.32 (−0.38 to −0.27)[d]	0.35 (0.28 to 0.42)[d]
Race/ethnicity[e]					
American Indian/Alaska Native	2.66 (2.50 to 2.82)	2.41 (2.26 to 2.57)	2.36 (2.17 to 2.58)	−0.18 (−0.40 to 0.05)	−0.01 (−0.27 to 0.25)
Asian/Pacific Islander	1.51 (1.44 to 1.58)	1.14 (1.08 to 1.20)	1.43 (1.35 to 1.51)	−0.32 (−0.41 to −0.23)[d]	0.28 (0.19 to 0.38)[d]
Black, non-Hispanic	1.51 (1.48 to 1.54)	1.38 (1.35 to 1.41)	1.48 (1.44 to 1.52)	−0.09 (−0.13 to −0.05)[d]	0.13 (0.08 to 0.18)[d]
Hispanic	2.81 (2.78 to 2.83)	2.41 (2.38 to 2.44)	2.79 (2.76 to 2.83)	−0.31 (−0.34 to −0.27)[d]	0.41 (0.36 to 0.46)[d]
White, non-Hispanic	1.45 (1.42 to 1.47)	1.36 (1.34 to 1.39)	1.38 (1.35 to 1.42)	−0.05 (−0.08 to −0.01)[d]	0.03 (−0.01 to 0.07)
Household income, % FPL					
<50	2.18 (2.16 to 2.21)	1.90 (1.88 to 1.93)	2.11 (2.07 to 2.15)	−0.16 (−0.20 to −0.12)[d]	0.24 (0.19 to 0.29)[d]
50 to <100	2.27 (2.25 to 2.30)	1.97 (1.94 to 1.99)	2.19 (2.15 to 2.23)	−0.20 (−0.23 to −0.16)[d]	0.29 (0.24 to 0.34)[d]
100 to <150	2.02 (1.98 to 2.05)	1.66 (1.63 to 1.70)	1.88 (1.83 to 1.93)	−0.27 (−0.32 to −0.22)[d]	0.23 (0.18 to 0.29)[d]
≥150	1.66 (1.61 to 1.70)	1.45 (1.40 to 1.50)	1.72 (1.66 to 1.79)	−0.16 (−0.23 to −0.09)[d]	0.24 (0.16 to 0.32)[d]

[a]Defined as a BMI of 120% or more of the 95th percentile for age and sex on the CDC growth charts or BMI ≥35 kg/m.

[b]Represents 100 times the average marginal effect of year (2016 vs 2010, 2020 vs 2016) controlling for sex, age, and race/ethnicity. Children with missing information on race/ethnicity were excluded. A negative value indicates that the prevalence decreased.

[c] Children with anthropometric data examined in March and April 2020 were excluded because of the COVID-19 pandemic.

[d] Statistically significant difference at the 0.05 level based on logistic regression adjusting for age, sex, and race/ethnicity.

[e] Children with multiple race/ethnicity designations were assigned to the appropriate race/ethnicity category presented in the table.

TABLE 3

Prevalence of Severe Obesity[a] Among Children Aged 2 to 4 Years Enrolled in WIC Program, by US State or Territory, 2010 to 2020

WIC Agency	2010		2016		2020		2016 vs 2010	2020 vs 2016
	n	%[b] (95% CI)	*n*	%[b] (95% CI)	*n*	%[b] (95% CI)	APD,[c] % (95% CI)	APD,[c] % (95% CI)
State								
Alabama	45 743	2.12 (2.00 to 2.26)	42 671	2.25 (2.12 to 2.40)	29 284	2.10 (1.94 to 2.27)	0.10 (−0.09 to 0.29)	0.09 (−0.13, 0.31)
Alaska	10108	2.6 (2.31 to 2.93)	5983	2.36 (2.00 to 2.77)	3390	1.74 (1.35 to 2.24)	−0.29 (−0.78 to 0.20)	−0.59 (−1.18 to 0.0)[d]
Arizona	72 933	2.07 (1.97 to 2.17)	58 054	1.29 (1.20 to 1.39)	40182	1.41 (1.30 to 1.53)	−0.74 (−0.88 to −0.60)[d]	0.15 (0.0 to 0.29)
Arkansas	31 245	1.9 (1.76 to 2.06)	23 647	1.81 (1.64 to 1.98)	11 735	2.06 (1.82 to 2.34)	−0.07 (−0.30 to 0.16)	0.30 (−0.01 to 0.61)
California	583 008	2.73 (2.69 to 2.77)	495 095	2.26 (2.22 to 2.30)	202 526	2.77 (2.70 to 2.84)	−0.28 (−0.34 to −0.22)[d]	0.54 (0.45 to 0.62)[d]
Colorado	39 612	1.12 (1.02 to 1.22)	31 307	1.02 (0.92 to 1.14)	21 702	1.23 (1.10 to 1.39)	−0.10 (−0.25 to 0.05)	0.29 (0.10 to 0.48)[d]
Connecticut	22 988	2.32 (2.13 to 2.52)	18 748	1.84 (1.66 to 2.04)	13 271	2.19 (1.96 to 2.46)	−0.31 (−0.58 to −0.03)d	0.19 (−0.12 to 0.51)
Delaware	7650	2.81 (2.46 to 3.21)	6906	2.11 (1.8 to 2.48)	4610	2.32 (1.92 to 2.8)	−0.27 (−0.78 to 0.24)	0.19 (−0.36 to 0.73)
District of Columbia	5182	2.06 (1.71 to 2.49)	5181	1.41 (1.12 to 1.77)	3480	1.52 (1.17 to 1.99)	−0.45 (−0.95 to 0.05)	0.11 (−0.40 to 0.63)
Florida	194 924	1.83 (1.77 to 1.89)	193 749	1.61 (1.55 to 1.66)	125 469	1.74 (1.67 to 1.82)	−0.23 (−0.31 to −0.15)[d]	0.18 (0.08 to 0.27)[d]
Georgia	104959	1.76 (1.68 to 1.84)	78 023	1.55 (1.46 to 1.63)	42 661	1.85 (1.73 to 1.98)	−0.23 (−0.35 to −0.11)[d]	0.40 (0.24 to 0.56)[d]
Hawaii	14 504	1.29 (1.12 to 1.49)	11 589	1.33 (1.14 to 1.55)	8441	1.55 (1.31 to 1.84)	0.03 (−0.25 to 0.31)	0.37 (0.02 to 0.72)[d]
Idaho	18 704	1.29 (1.14 to 1.47)	14521	1.47 (1.29 to 1.68)	8859	1.47 (1.24 to 1.74)	0.16 (−0.09 to 0.41)	0.07 (−0.25 to 0.39)
Illinois	108 762	2.02 (1.94 to 2.10)	79 949	2.05 (1.96 to 2.15)	41 503	2.20 (2.07 to 2.35)	0.12 (−0.02 to 0.25)	0.22 (0.05 to 0.39)[d]
Indiana	63 220	2.07 (1.97 to 2.19)	55 955	1.54 (1.45 to 1.65)	35126	1.65 (1.52 to 1.79)	−0.24 (−0.39 to −0.09)[d]	−0.06 (−0.23 to 0.10)
Iowa	29 481	2.01 (1.86 to 2.18)	24 427	1.99 (1.82 to 2.17)	14447	1.88 (1.67 to 2.11)	0.02 (−0.22 to 0.26)	−0.12 (−0.40 to 0.16)
Kansas	30 458	1.69 (1.56 to 1.85)	24 306	1.52 (1.37 to 1.68)	15 555	1.64 (1.45 to 1.85)	−0.18 (−0.39 to 0.03)	0.22 (−0.04 to 0.47)
Kentucky	45 761	2.73 (2.58 to 2.88)	38 361	2.42 (2.28 to 2.58)	17 697	2.34 (2.13 to 2.57)	−0.30 (−0.52 to −0.09)[d]	−0.06 (−0.34 to 0.21)
Louisiana	48145	1.85 (1.74 to 1.98)	37 527	1.76 (1.63 to 1.90)	21 090	1.95 (1.77 to 2.14)	−0.15 (−0.33 to 0.03)	0.26 (0.02 to 0.49)[d]
Maine	10410	1.69 (1.46 to 1.96)	8233	1.63 (1.38 to 1.92)	4665	1.82 (1.48 to 2.25)	−0.07 (−0.44 to 0.30)	0.22 (−0.25 to 0.69)
Maryland	51 280	2.12 (2.00 to 2.25)	50 469	2.00 (1.88 to 2.12)	35 210	2.25 (2.10 to 2.41)	−0.03 (−0.21 to 0.14)	0.26 (0.06 to 0.46)[d]
Massachusetts	49178	2.16 (2.03 to 2.29)	41 740	2.07 (1.94 to 2.22)	28 562	2.36 (2.19 to 2.54)	−0.13 (−0.32 to 0.06)	0.23 (0.01 to 0.45)[d]

WIC Agency	2010		2016		2020		2016 vs 2010	2020 vs 2016
	n	%[b] (95% CI)	*n*	%[b] (95% CI)	*n*	%[b] (95% CI)	APD,[c] % (95% CI)	APD,[c] % (95% CI)
Michigan	85 293	1.67 (1.59 to 1.76)	84 387	1.40 (1.32 to 1.48)	61 119	1.61 (1.51 to 1.71)	−0.12 (−0.23 to 0.0)	0.21 (0.08 to 0.34)[d]
Minnesota	57 529	1.30 (1.21 to 1.40)	47 219	1.45 (1.35 to 1.56)	27 074	1.30 (1.18 to 1.45)	0.11 (−0.03 to 0.26)	−0.08 (−0.25 to 0.09)
Mississippi	36 519	2.07 (1.93 to 2.22)	28 493	2.39 (2.22 to 2.57)	19 685	2.15 (1.96 to 2.36)	0.26 (0.03 to 0.49)[d]	−0.18 (−0.45 to 0.09)
Missouri	50 575	1.58 (1.48 to 1.69)	43 404	1.42 (1.32 to 1.54)	22 856	1.50 (1.35 to 1.67)	−0.15 (−0.31 to 0.0)	0.12 (−0.07 to 0.32)
Montana	7194	1.60 (1.33 to 1.92)	6647	1.43 (1.17 to 1.74)	3621	1.16 (0.86 to 1.56)	−0.22 (−0.62 to 0.19)	−0.22 (−0.68 to 0.23)
Nebraska	15 622	1.86 (1.66 to 2.09)	13 807	2.14 (1.91 to 2.39)	7376	1.84 (1.56 to 2.18)	0.24 (−0.08 to 0.56)	−0.26 (−0.65 to 0.13)
Nevada	25 855	2.02 (1.85 to 2.19)	24 493	1.70 (1.55 to 1.87)	15 790	1.64 (1.45 to 1.85)	−0.23 (−0.47 to 0.0)	0.07 (−0.19 to 0.33)
New Hampshire	7263	1.65 (1.38 to 1.97)	6042	1.77 (1.47 to 2.14)	4402	2.02 (1.65 to 2.48)	0.08 (−0.36 to 0.52)	0.31 (−0.23 to 0.84)
New Jersey	59 000	2.45 (2.33 to 2.58)	53 917	2.09 (1.97 to 2.21)	42 528	2.28 (2.15 to 2.43)	−0.40 (−0.58 to −0.23)[d]	0.39 (0.20 to 0.58)[d]
New Mexico	21 968	1.86 (1.69 to 2.05)	18619	1.57 (1.40 to 1.76)	11 781	1.98 (1.74 to 2.25)	−0.27 (−0.52 to −0.01)[d]	0.33 (0.02 to 0.63)[d]
New York	186 760	2.10 (2.03 to 2.16)	182 401	1.66 (1.60 to 1.72)	103 959	1.95 (1.87 to 2.04)	−0.27 (−0.36 to −0.19)[d]	0.19 (0.09 to 0.29)[d]
North Carolina	89 798	1.85 (1.77 to 1.94)	97 286	1.83 (1.74 to 1.91)	57101	1.91 (1.8 to 2.03)	0.0 (−0.12 to 0.13)	0.17 (0.03 to 0.31)[d]
North Dakota	5484	1.53 (1.24 to 1.89)	4723	1.69 (1.36 to 2.10)	3072	1.89 (1.46 to 2.43)	0.14 (−0.35 to 0.64)	0.26 (−0.35 to 0.87)
Ohio	102 803	1.62 (1.55 to 1.70)	74 753	1.45 (1.37 to 1.54)	35 864	1.61 (1.49 to 1.75)	−0.17 (−0.28 to −0.05)[d]	0.18 (0.02 to 0.33)[d]
Oklahoma	37 849	1.75 (1.62 to 1.88)	34 486	1.68 (1.55 to 1.83)	19 665	1.64 (1.47 to 1.83)	−0.07 (−0.26 to 0.12)	−0.04 (−0.27 to 0.18)
Oregon	43 209	1.73 (1.61 to 1.85)	34 485	1.77 (1.63 to 1.91)	21 315	1.97 (1.79 to 2.17)	0.06 (−0.13 to 0.24)	0.27 (0.04 to 0.51)[d]
Pennsylvania	96 762	1.65 (1.57 to 1.73)	80 202	1.56 (1.48 to 1.65)	55 283	1.71 (1.61 to 1.82)	−0.02 (−0.14 to 0.1)	0.05 (−0.09 to 0.19)
Rhode Island	10 783	2.28 (2.02 to 2.58)	6984	1.93 (1.64 to 2.28)	4938	2.37 (1.98 to 2.83)	−0.36 (−0.79 to 0.07)	0.41 (−0.12 to 0.95)
South Carolina	39 785	1.65 (1.53 to 1.78)	32 399	1.56 (1.43 to 1.70)	16 461	1.75 (1.56 to 1.96)	0.04 (−0.14 to 0.23)	0.20 (−0.04 to 0.44)
South Dakota	7884	1.84 (1.57 to 2.16)	6771	1.76 (1.47 to 2.10)	4194	1.74 (1.39 to 2.18)	−0.14 (−0.58 to 0.29)	−0.11 (−0.61 to 0.39)
Tennessee	57153	2.12 (2.01 to 2.24)	51 157	2.01 (1.89 to 2.13)	30 061	2.09 (1.93 to 2.25)	−0.14 (−0.31 to 0.03)	0.20 (0.0 to 0.41)
Texas	361 823	2.33 (2.29 to 2.38)	268 787	2.02 (1.97 to 2.07)	180 615	2.40 (2.33 to 2.47)	−0.14 (−0.21 to −0.06)[d]	0.45 (0.36 to 0.54)[d]
Utah	26 045	1.22 (1.09 to 1.36)	21 599	0.97 (0.85 to 1.11)	11 707	1.17 (0.99 to 1.38)	−0.24 (−0.43 to −0.06)[d]	0.25 (0.01 to 0.49)[d]
Vermont	6964	1.71 (1.43 to 2.04)	5254	1.79 (1.46 to 2.18)	3904	1.74 (1.38 to 2.2)	0.06 (−0.41 to 0.54)	−0.04 (−0.59 to 0.50)
Virginia	48 920	2.72 (2.58 to 2.87)	47 376	1.99 (1.86 to 2.12)	28 038	2.16 (2.00 to 2.34)	−0.55 (−0.74 to −0.36)[d]	0.16 (−0.05 to 0.37)
Washington	78 336	1.81 (1.72 to 1.90)	69 870	1.74 (1.65 to 1.84)	43618	1.90 (1.78 to 2.03)	−0.09 (−0.22 to 0.05)	0.38 (0.22 to 0.55)[d]

WIC Agency	2010		2016		2020		2016 vs 2010	2020 vs 2016
	n	%[b] (95% CI)	*n*	%[b] (95% CI)	*n*	%[b] (95% CI)	APD,[c] % (95% CI)	APD,[c] % (95% CI)
West Virginia	17 669	2.33 (2.12 to 2.56)	14 222	2.52 (2.27 to 2.79)	7598	2.34 (2.03 to 2.71)	0.15 (−0.19 to 0.49)	−0.12 (−0.55 to 0.31)
Wisconsin	48 511	1.79 (1.68 to 1.92)	37116	1.79 (1.66 to 1.93)	26177	1.90 (1.74 to 2.08)	0.04 (−0.14 to 0.22)	0.26 (0.04 to 0.47)[d]
Wyoming	4413	0.95 (0.70 to 1.28)	3458	1.33 (1.00 to 1.77)	2007	1.74 (1.26 to 2.42)	0.34 (−0.13 to 0.82)	0.45 (−0.24 to 1.14)
Territory								
American Samoa	3221	1.55 (1.18 to 2.04)	2824	1.10 (0.77 to 1.55)	1421	1.76 (1.19 to 2.58)	−0.45 (−1.02 to 0.13)	0.62 (−0.16 to 1.39)
Guam	3248	1.45 (1.09 to 1.92)	2710	0.70 (0.45 to 1.09)	2234	0.81 (0.51 to 1.27)	−0.76 (−1.28 to, −0.24)[d]	0.11 (−0.38 to 0.59)
Northern Mariana Islands	2157	2.60 (2.00 to 3.36)	1418	0.63 (0.33 to 1.20)	1095	0.82 (0.43 to 1.55)	− 1.99 (−2.78 to −1.20)[d]	0.16 (−0.52 to 0.84)
Puerto Rico	70 699	3.09 (2.97 to 3.22)	63 251	1.90 (1.80 to 2.01)	40 056	2.14 (2.00 to 2.29)	−1.17 (−1.33 to −1.00)[d]	0.30 (0.12 to 0.48)[d]
Virgin Islands	2093	1.72 (1.24 to 2.37)	1593	1.76 (1.22 to 2.53)	667	1.65 (0.92 to 2.93)	0.03 (−0.82, 0.88)	−0.09 (−1.25 to 1.08)

[a]Defined as a BMI of 120% or more of the 95th percentile for age and sex on the CDC growth charts or BMI ≥35 kg/m.

[b]Crude prevalence of severe obesity.

[c]Represents 100 times the average marginal effect of year (2016 vs 2010, 2020 vs 2016) controlling for sex, age, and race or ethnicity. Children with missing information on race/ethnicity were excluded. A negative value indicates that the adjusted prevalence decreased.

[d]Statistically significant difference at the 0.05 level based on logistic regression adjusting for age, sex, and race/ethnicity.