Increases in Income-Related Disparities in Early Elementary School Obesity, 1998–2014

Scott Latham, PhD; Jenna E. Finch, PhD; Sean Reardon, EdD; Jane Waldfogel, PhD

From the Education Research Section (S Latham), Princeton University, Princeton, NJ; Department of Psychology (JE Finch), University of Nebraska-Lincoln, Lincoln, Nebr; Center for Education Policy Analysis (S Reardon), Stanford University, Stanford, Calif; and Columbia University School of Social Work (J Waldfogel), Columbia University, New York, NY
The authors have no conflicts of interest to disclose.
Address correspondence to Scott Latham, PhD, Education Research Section, Princeton University, 288 Wallace Hall, Princeton, NJ 08540 (e-mail: slatham@princeton.edu).
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Abstract

Objective: Research shows that population-level rates of obesity, which rose dramatically from the 1970s through the mid-2000s, have since plateaued or even started to decline. However, overall improvements may mask differences in trends for different subgroups. For instance, obesity rates have continued to climb among low-income adolescents, leading to growing income-related gaps in obesity. By comparison, we know little about whether income-related disparities have also changed among elementary school children. To address this gap, we examined two cohorts of the Early Childhood Longitudinal Study − Kindergarten cohort, which followed children entering school in 1998 and 2010. We hypothesized that income-related disparities in obesity have also grown larger over time among young children.

Methods: We used data from nationally representative samples of children who entered kindergarten in 1998 and 2010. We documented rates of overweight and obesity from kindergarten through third grade, examined how rates differed for children from high- and low-income families, and tested whether income-related disparities changed over time.

Results: Rates of overweight and obesity were 2 to 5 percentage points higher in the later cohort, and overall increases masked substantial variation by income. Specifically, these increases were driven by children in lower-income households, resulting in substantially larger income-related disparities in overweight and obesity in the later cohort.

Conclusions: As we hypothesized, income-related disparities in young children's obesity grew between 1998 and 2014. This suggests that efforts to curb increasing rates of obesity may have been more successful for higher-income families. We discuss potential mechanisms that may account for increasing disparities.

Keywords: childhood obesity; elementary school; income inequality

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What's New?

From 1998 to 2014, obesity rates among low-income elementary school children increased, while rates among higher-income children did not. Consequently, we found that large income-related disparities in obesity were apparent in early elementary school, earlier in the life cycle than previously shown.

Obesity rates rose dramatically from the 1970s through the mid-2000s,[1,2] a phenomenon often referred to as an obesity "epidemic."[3,4] The speed and scope of this epidemic is such that the Centers for Disease Control and Prevention definition of obesity, which was designed to apply to just the top 5 percent of the population in the 1970s, applied to 17% of 2- to 19-year-olds in 2014.[2] This epidemic has had wide-ranging consequences, as obesity is linked to higher rates of diabetes, cardiovascular disease, cancer, and premature death, as well as poorer academic achievement, lower wages, and higher lifetime medical costs. It has also had important collective consequences, as higher rates of obesity are associated with reduced human capital, higher transportation costs, and added strain on the United States health care system.[4,5]

Weight problems often develop early. In 2016, about 14% of 2- to 5-year-olds and 18% of 6- to 11-year-olds in the United States were obese.[6] These children are likely to struggle with obesity for the rest of their lives, as young children who are overweight or obese tend to remain so, and individual diet and treatment approaches are generally unsuccessful at treating obesity in the long term.[7,8]

Obesity affects children of differing income levels unequally. Starting in early childhood, children from low-income households are more likely to be obese than those from higher-income households.[1,9] Low-income households generally have poorer access to healthy food, as they are less likely to be located near supermarkets and are less likely to own a car than higher-income households.[10] Even when households have access to healthy food, it is often more expensive than energy-dense foods such as grains, fats, and sweets.[11] Children in low-income households also live in more dangerous neighborhoods with fewer sidewalks and fewer playgrounds, which leads to fewer opportunities for exercise.[12,13]

Since low-income children are disproportionately likely to be obese, they also disproportionately deal with the stigma of obesity. Obesity is associated with lower rates of employment and wage penalties, as well as discrimination from medical professionals, educators, the media, family, and friends.[4,14] This stigma may be worsening over time, even as obesity becomes more common. For instance, the prevalence of weight discrimination increased from 1995 to 2004 beyond what would be expected based on changing rates of obesity alone.[15] This means the obesity epidemic has reinforced, and potentially exacerbated, existing socioeconomic inequalities.

Considerable public money and effort have been expended fighting the obesity epidemic, through policy proposals, public health campaigns, and community outreach.[8,16] Fortunately, recent data have provided hopeful signs that the epidemic may be abating. For instance, although rates of childhood obesity tripled from the early 1970s through the mid-2000s,[1] recent evidence suggests that they have since plateaued or even started to decline.[2,6,17]

Although these trends are encouraging, improvements in obesity rates may not be distributed equally. A few recent studies documented that obesity rates among low-income adolescents have continued to increase since 2000, even though rates among higher-income adolescents have remained relatively stable.[18–20] We know comparatively little about whether income-related disparities have also changed among elementary school children. One recent study reported higher obesity rates among low-income 7- to 11-year-olds using a cross-sectional sample collected from 2010 to 2015.[21] However, this study did not examine whether income-related disparities had changed over time. Another study found that obesity rates have continued to climb among low-income children under 4 years who participated in federally funded nutrition programs, but that study did not include any information about higher-income children.[22]

This paper fills this gap, using data from two iterations of the Early Childhood Longitudinal Study − Kindergarten Cohort. Using these nationally representative observational samples of early school-aged children, we sought to answer the following questions. First, how have income-related disparities in rates of overweight and obesity at kindergarten entry changed across the years 1998 to 2010? Second, do income-related disparities in rates of overweight and obesity change as children move through grades kindergarten through third grade? Finally, are these patterns different between the 1998 and 2010 cohorts? By examining these questions, we aimed to explore how income-related disparities in obesity rates have changed at kindergarten entry and how they develop as children move through elementary school.

METHODS

DATA

We used data from two iterations of the Early Childhood Longitudinal Study - Kindergarten Cohort (ECLS-K:1998 and ECLS-K:2010). These data were collected by the National Center for Education Statistics. The studies used stratified, multistage probability sampling designs to draw nationally representative samples of children entering kindergarten in the fall of 1998 and 2010, respectively. They collected data through surveys of parents, teachers, and school administrators, as well as direct assessments of children's weight and height. Both studies followed children as they progressed through school, and both collected data in the fall and spring of kindergarten, fall and spring of first grade, and spring of third grade. Notably, in both studies the fall first grade data collection included a random subsample of 30% of the full cohort. The original cohort contains data from 1998 to 2002 and the follow-up cohort spans 2010−2014.

Response rates were high across both ECLS-K cohorts, between 85% and 90% in the fall and spring of kindergarten year. Conditional on participating during the kindergarten year, response rates in fall first grade, spring first grade, and spring third grade in the 1998 cohort were 94%, 92%, and 86%, respectively. Analogous rates for the 2010 cohort were 91%, 91% and 84%.

SAMPLE

The ECLS-K 1998 and 2010 cohorts included 21,410 and 18,170 children, respectively. To examine a consistent set of children over time, we limited our sample to children who had height and weight measurements in the fall and spring of kindergarten, spring of first grade, and spring of third grade. Since the fall first grade data collection was a random subsample, we did not exclude children with missing height and weight measurements in fall first grade. This restriction omitted 10,150 and 7,380 observations in 1998 and 2010, respectively. Additionally, we limited our sample to first time kindergarteners, which excluded 1200 children in 1998 and 600 in 2010.

Our final samples contained 10,060 and 9980 children in the 1998 and 2010 cohorts, respectively. In Appendix Table A1 we examine how children in our sample compared to children who were excluded. Most notably, there was not a significant difference in obesity rates between these groups from fall of kindergarten through spring of first grade in either cohort.

MEASURES

OVERWEIGHT AND OBESITY

Following the 2000 CDC guidelines,[23] we classified children as overweight and obese based on body mass index (BMI; weight in kilograms divided by height in meters squared). We calculated children's BMI using height and weight measurements taken at each wave of data collection. All measurements were taken twice to ensure reliability.

Following CDC guidelines, we defined overweight and obesity as above the 85th and 95th BMI percentiles, respectively, for a child's age and sex. Notably, the reference population for the CDC benchmarks was a combination of five national samples spanning 1963−1994.[24] The BMI distribution has shifted over time, which explains

why well over 15% and 5% of children fell above benchmarks originally designed to represent the 85th and 95th percentiles of the weight distribution, respectively.

HOUSEHOLD INCOME

In both ECLS-K cohorts, annual household income was reported by children's parents or guardians in the spring of the kindergarten year. Income was reported as a continuous measure in 1998 and as an ordered categorical measure with 18 values in 2010. To construct a comparable measure across cohorts, we first converted the 1998 data into 2010 dollars, then binned this measure into a categorical variable with 18 even groups.

ANALYSIS

This study was determined to be exempt by the Stanford University Institutional Review Board. All analysis was conducted using Stata Version 15.[25] To allow for comparison of our data with other published estimates of childhood obesity, we estimated average rates of overweight and obesity for both cohorts at all available time points. All estimates were weighted to be nationally representative of children entering kindergarten in their respective years. We tested whether these rates changed significantly across cohorts.

We then estimated income-related disparities using a process designed to estimate disparities using noncontinuous data.[26] Starting with the binned categorical measure of income, we calculated obesity rates within each bin. Using these rates, we estimated a cubic regression to model the income-obesity gradient for each cohort at each time point. Next, we calculated the values of the estimated income gradients at the 10th and 90th income percentiles, to estimate rates of overweight and obesity at those respective income levels. In the formulas that follow, Y indicates an outcome of interest (ie, rate of overweight or obesity). Y_{10} indicates the value of that outcome among children from families at the 10th income percentile, and Y_{90} indicates the value among children at the 90th income percentile.

We examined both absolute and relative disparities, each of which contributes unique information about inequality across groups.[27] To measure *absolute* income-related disparities, we calculated the "10−90 gap" as follows:

$$1)\ 10{-}90\ \text{gap}(Y) = Y_{10} - Y_{90}$$

For this measure, a positive number indicated that children in the 10th income percentile were more likely to be overweight/obese than children in the 90th income percentile, and larger numbers indicate greater disparity.

To measure *relative* income-related disparities, we calculated the "10−90 risk ratio":

$$2)\ 10{-}90\ \textit{risk ratio}(Y) = \frac{Y_{10}}{Y_{90}}$$

For this measure, a value of 1 indicated no income-related disparity. A value larger than 1 indicated that low-income children were more likely to be overweight/obese than higher-income children and a value less than 1 indicated that higher-income children were more likely to be overweight/obese.

We calculated 10−90 gaps and 10−90 risk ratios for both cohorts at each time point, and tested whether these measures have changed significantly over time. In the 2010 cohort, about 12% of observations were missing income data. We conducted multiple imputation using chained equations to account for this (in the 1998 cohort, missing income data was imputed by NCES using a "hot deck" procedure).[28] Our imputation models included children's age, gender, and race/ethnicity, along with household information such as parental education, work status, and English-speaking status. Where available, we also included household income in spring of first and spring of third grade in our imputation models. Following recent guidance,[29] we constructed 20 imputed datasets, and included both independent and dependent variables in the imputation model, but we did not use imputed values for dependent variables in our analysis. The model was estimated using the *mi* command in Stata.

As income may reflect an incomplete picture of socioeconomic disparity, we also conducted this analysis using a composite measure of socioeconomic status that included parent/guardian education and occupation, as well as household income. The results of this analysis (available on request) were substantively quite similar to what we report here. We reported income-related disparities rather than socioeconomic status-related disparities because the former were more concrete and readily interpretable.

We also conducted sensitivity analyses to examine how and whether our results changed if we used data from all children at each time point (ie, a varying sample over time). These results (also available upon request) are substantively identical to the estimates presented here, which use a consistent sample over time.

RESULTS

Table 1 shows descriptive characteristics for our analytic samples in the 1998 and 2010 cohorts. Children in these samples differed most notably in terms of racial/ethnic composition, but also in terms of parental educational background and employment status. Compared with the 1998 cohort, the percent of white children *decreased* 9 percentage points from 62% to 53%, while the percentage of Hispanic children *increased* by 9 percentage points from 18% to 27%. Across cohorts, there was an 8-percentage-point increase in households where at least one parent held a bachelor's degree, up to 41 percent in 2010. Over the same period, the percentage of parents working full time decreased by 3 percentage points among mothers and 6 percentage points among fathers.

AVERAGE TRENDS IN OVERWEIGHT AND OBESITY

Table 2 shows overweight and obesity rates for both cohorts from the fall of kindergarten through the spring of third grade. Across the 12-year period, there was a statistically significant, roughly 3- to 5-point increase in the percentage of children who were overweight at every time point from fall kindergarten through spring first grade.

Table 1. Sample Characteristics for the 1998 and 2010 ECLS-K Cohorts

Variable	1998 Cohort	2010 Cohort
Age in fall of K (mo)	68.22	67.13**
Child is female	0.50	0.49
Child born preterm (<37 wk)	0.10	0.14**
Child race/ethnicity		
White	0.62	0.53**
Black	0.13	0.11*
Hispanic	0.18	0.27**
Asian	0.02	0.04**
Two parent household	0.79	0.79
At least 1 parent has bachelor's degree	0.33	0.41**
Mom works full time (if present)	0.46	0.43**
Dad works full time (if present)	0.91	0.85**
Non English-speaking household	0.21	0.28**
N	10,060	9980

Sample sizes rounded to the nearest 10. Estimates weighted to be nationally representative of children entering kindergarten in their respective cohorts.

*$P < .05$;

**$P < .001$.

There was also a significant 2- to 4-percentage-point increase in the percentage of children who were obese across the same grades. By contrast, in the spring of third grade, there was not a significant increase in either overweight or obesity rates.

CHANGES IN INCOME-RELATED DISPARITIES IN OVERWEIGHT AND OBESITY

Next, we examined how overweight and obesity varied by household income. Table 3 shows rates of overweight from kindergarten through third grade for children in households at the 10th and 90th income percentiles, along with the 10−90 gaps and 10−90 risk ratios. It is notable that there were significant increases in the rates of overweight children from 1998 to 2010 for low-income children at the 10th income percentile at each time point from fall kindergarten through spring of first grade. In contrast, rates of overweight among children at the 90th income percentile did not change significantly at any time point. Similar to estimates from the full sample (Table 2), there was not a significant increase from 1998 to 2010 in the percentage of children who were overweight in the spring of third grade for children at the 10th or 90th income percentiles.

As a result, we documented increases in both absolute and relative income-related disparities over time. By the time children arrived in kindergarten, there was already a substantial gap in overweight between the lowest and highest income children. Specifically, in 1998 over 30% of children at the 10th income percentile were overweight, compared with just 22% of children at the 90th percentile. The 10−90 gaps in overweight, which ranged between 3 and 12 percentage points in the 1998 cohort, grew to between 13 and 17 percentage points in the later cohort. These increases were statistically significant in the spring of kindergarten and the fall/spring of first grade. Similarly, 10−90 overweight risk ratios were larger in the 2010 cohort, and the increase was significant at each time point from spring of kindergarten through spring of third grade. Although increases in 10−90 overweight gaps and risk ratios were not significantly different from zero at all timepoints, the pattern of results strongly suggests that disparities have grown larger over time.

Table 4 shows rates of obesity at the 10th and 90th income percentiles, as well as 10−90 gaps and risk ratios, analogous to Table 3. The pattern of results for obesity strongly mirrored the pattern of results for rates of overweight discussed above. Specifically, large disparities in obesity had already developed by the time children arrived in kindergarten, and rates of obesity increased in the later cohort among children at the 10th income percentile, but not the 90th percentile. As a result, both 10−90 gaps and 10−90 risk ratios were significantly larger in the later cohort at 4 out of 5 time points considered (all but the spring of kindergarten).

Table 2. Percent Overweight and Obese in K-3, 1998 and 2010

	Overweight (%)			Obese (%)		
ECLS-K Wave	1998	2010	Change	1998	2010	Change
Fall K	27.0	30.0	3.0**	11.2	14.6	3.3**
	(0.6)	(0.6)	(0.8)	(0.4)	(0.4)	(0.6)
Spring K	26.4	29.3	2.9**	11.1	13.1	1.9*
	(0.6)	(0.6)	(0.8)	(0.4)	(0.4)	(0.6)
Fall 1st	27.2	32.3	5.1**	12.6	16.1	3.5*
	(1.1)	(1.0)	(1.4)	(0.8)	(0.8)	(1.1)
Spring 1st	26.7	30.0	3.3**	13.0	14.8	1.9*
	(0.6)	(0.6)	(0.8)	(0.4)	(0.4)	(0.6)
Spring 3rd	34.4	35.4	1.1	18.2	19.2	1.0
	(0.7)	(0.6)	(0.9)	(0.5)	(0.5)	(0.7)
N	10,060	9980		10,060	9980	

ECLS-K indicates Early Childhood Longitudinal Study - Kindergarten cohort.

Standard errors in parentheses. Fall first grade data were only collected for a random subsample of students (N = 3170 in 1998 and 3480 in 2010). Estimates weighted to be nationally representative of children entering kindergarten in their respective cohorts.

*$P < .01$;

**$P < .001$.

Table 3. Percent Overweight at the 10th and 90th Income Percentiles, 1998 and 2010

	10th Income Percentile			90th Income Percentile			10–90 Gap			10–90 Risk Ratio		
ECLS-K Wave	1998	2010	Change	1998	2010	Change	1998	2010	Change	1998	2010	Change
Fall K	30.4	35.2	4.8**	22.2	22.7	0.4	8.2	12.5	4.3	1.37	1.55	0.18
	(1.2)	(1.1)	(1.6)	(1.5)	(1.7)	(2.2)	(1.9)	(2.0)	(2.8)	(0.08)	(0.08)	(0.11)
Spring K	29.5	35.1	5.6***	21.8	20.7	−1.0	7.7	14.3	6.6*	1.35	1.69	0.34**
	(0.9)	(1.2)	(1.5)	(1.1)	(1.8)	(2.1)	(1.4)	(2.1)	(2.6)	(0.06)	(0.09)	(0.11)
Fall 1st	28.9	39.0	10.1***	26.1	25.9	−0.2	2.8	13.1	10.3*	1.11	1.51	0.40**
	(1.9)	(1.6)	(2.5)	(2.3)	(2.4)	(3.4)	(3.0)	(2.9)	(4.2)	(0.11)	(0.10)	(0.15)
Spring 1st	30.7	37.2	6.4***	21.5	21.7	0.2	9.2	15.4	6.2*	1.43	1.71	0.28*
	(1.0)	(1.2)	(1.5)	(1.2)	(1.8)	(2.2)	(1.5)	(2.2)	(2.6)	(0.06)	(0.09)	(0.11)
Spring 3rd	39.4	42.1	2.7	27.1	25.4	−1.8	12.3	16.7	4.5	1.45	1.66	0.21*
	(1.4)	(1.0)	(1.7)	(1.8)	(1.5)	(2.3)	(2.3)	(1.8)	(2.9)	(0.07)	(0.06)	(0.10)

ECLS-K indicates Early Childhood Longitudinal Study - Kindergarten cohort.

Standard errors in parentheses. Estimates weighted to be nationally representative of children entering kindergarten in their respective cohorts.

*$P < .05$;

**$P < .01$;

***$P < .001$.

In the fall of kindergarten, for instance, the gap in obesity rates between children in the 10th and 90th income percentile grew by over 5 percentage points from 6.4 to 11.5 percent from 1998 to 2010. In 1998, children at the 10th income percentile were 1.9 times more likely to be obese than were children in the 90th percentile. By 2010, the 10–90 risk ratio increased by 0.6 ($P < .05$; 95% CI: 0.2–1; Table 4), so that these children were 2.5 times more likely to be obese. These patterns were consistent across the fall and spring of first grade and the spring of third grade. In contrast, we did not find a significant increase in either relative or absolute disparities in the spring of kindergarten.

Figure 1 provides an illustration of how the relation between income and overweight/obesity changed between the two cohorts, using data from the fall of kindergarten. Specifically, it shows estimated income-overweight and income-obesity gradients that were used to calculate 10–90 gaps for both cohorts. The figure demonstrates that the 2010 rates of overweight and obesity were higher than the 1998 rates for children at the lower end of the income distribution, and unchanged among children near the top of the distribution. This demonstrates why income-related overweight and obesity gaps have gotten larger over time.

Figures 2 and 3 illustrate the estimated 10–90 obesity gaps and risk ratios over time. These figures demonstrate that income-related disparities in obesity were larger at every time point in the 2010 cohort than they were in the 1998 cohort, both in absolute and in relative terms. In both figures, we could not reject the null hypothesis that the trend lines for the two cohorts are parallel. This suggests that income-related disparities in obesity did not change as children moved through school.

DISCUSSION

Comparing two nationally representative samples of children who entered school in 1998 and 2010, we found that rates of overweight and obesity increased significantly. These increases were concentrated among children in lower-income households, as rates of overweight and

Table 4. Percent Obese at the 10th and 90th Income Percentiles, 1998 and 2010

	10th Income Percentile			90th Income Percentile			10–90 Gap			10–90 Risk Ratio		
ECLS-K Wave	1998	2010	Change	1998	2010	Change	1998	2010	Change	1998	2010	Change
Fall K	13.3	19.2	5.9***	7.0	7.7	0.8	6.4	11.5	5.1**	1.92	2.48	0.56*
	(0.7)	(0.9)	(1.1)	(0.8)	(1.3)	(1.6)	(1.1)	(1.6)	(1.9)	(0.13)	(0.18)	(0.22)
Spring K	13.6	16.7	3.0**	6.3	7.2	0.9	7.3	9.5	2.2	2.16	2.32	0.16
	(0.7)	(1.0)	(1.2)	(0.8)	(1.4)	(1.6)	(1.0)	(1.7)	(2.0)	(0.14)	(0.21)	(0.25)
Fall 1st	14.5	22.9	8.4***	8.6	9.8	1.2	5.9	13.1	7.2*	1.69	2.34	0.65*
	(1.3)	(1.2)	(1.8)	(1.6)	(1.8)	(2.5)	(2.1)	(2.2)	(3.0)	(0.21)	(0.19)	(0.29)
Spring 1st	15.8	19.2	3.4**	8.2	7.4	-0.8	7.6	11.8	4.2*	1.93	2.59	0.66**
	(0.6)	(0.9)	(1.0)	(0.7)	(1.3)	(1.5)	(0.9)	(1.6)	(1.8)	(0.09)	(0.18)	(0.21)
Spring 3rd	22.3	25.7	3.4*	11.6	10.3	-1.4	10.7	15.4	4.8*	1.92	2.50	0.59**
	(1.1)	(0.8)	(1.4)	(1.4)	(1.3)	(1.9)	(1.8)	(1.5)	(2.4)	(0.13)	(0.13)	(0.18)

ECLS-K indicates Early Childhood Longitudinal Study - Kindergarten cohort.

Standard errors in parentheses. Estimates weighted to be nationally representative of children entering kindergarten in their respective cohorts.

*$P < .05$;

**$P < .01$;

***$P < .001$.

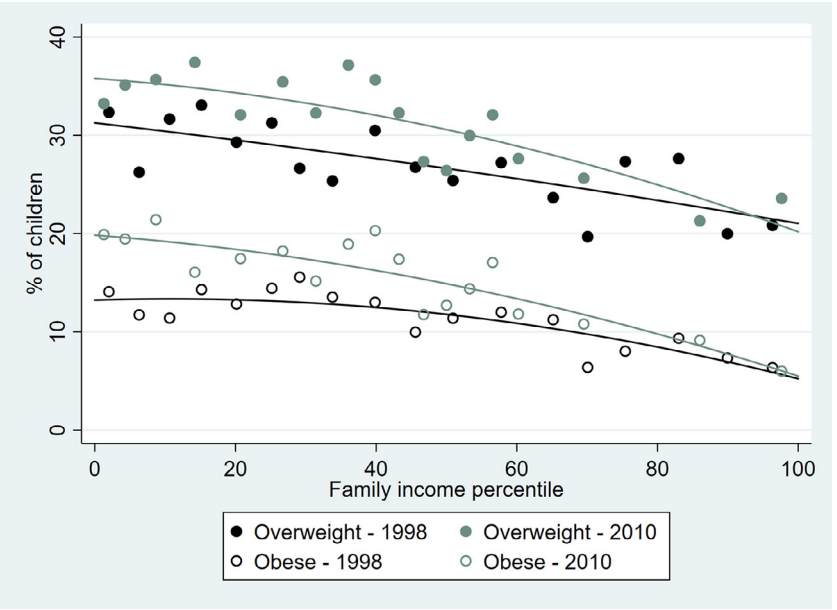

Figure 1. *Rates of overweight and obesity in the fall of the kindergarten year.*

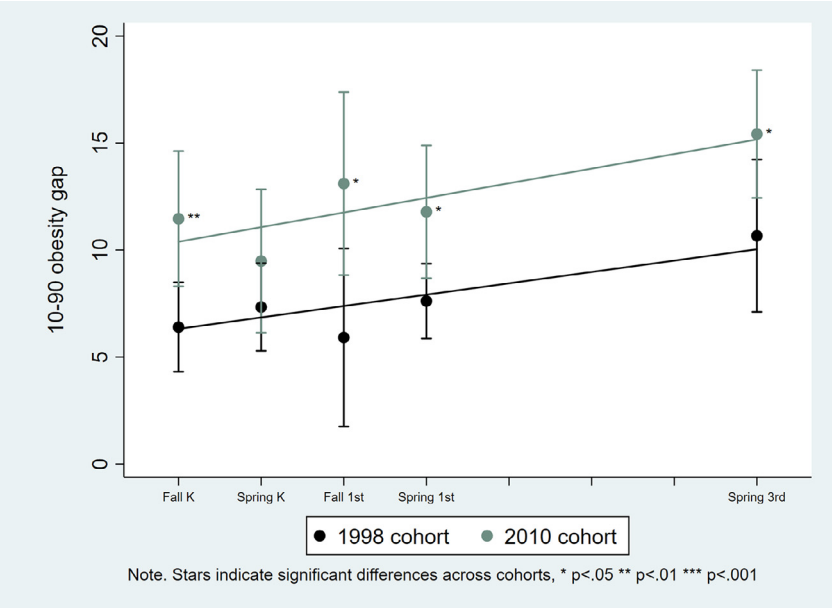

Figure 2. *10–90 obesity gaps across ECLS-K waves, 1998 and 2010 cohorts.*

obesity among the highest income children remained quite stable. As a result, income-related disparities in obesity grew larger across the 12-year period. Indeed, we found that income-based disparities in overweight and obesity were larger in the more recent cohort at every point of data collection. We also found that income-related disparities in weight had already developed by school entry, and did not change significantly as children moved from kindergarten through third grade. For this reason, large disparities continued to persist when these children were third graders in 2002 and 2014, respectively.

The overweight and obesity prevalence rates we find for children overall are consistent with other published estimates that use the original ECLS-K as well as the National Health and Nutrition Examination Survey.[30–32] Our results are also consistent with previous work that documented increases in income-related obesity disparities among adolescents.[18,20] However, our results highlight that increases in income-related disparities developed at a much earlier age than was previously known.

The fact that the obesity epidemic may have plateaued among higher-income children is good news. However, it is worrisome that rates of obesity have continued to increase among lower-income children, especially given that across the years examined here policymakers at all levels of government took steps aimed to combat the epidemic. At the federal level, the American Recovery and Reinvestment Act of 2009 included over $150 billion for health care. The Food, Conservation, and Energy Act of

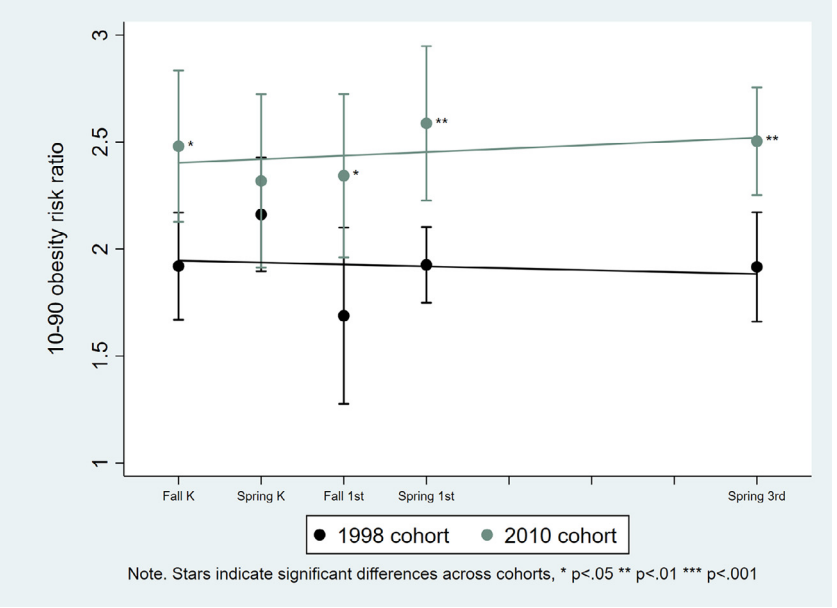

Figure 3. *10–90 obesity risk ratios across ECLS-K waves, 1998 and 2010 cohorts.*

2008 [the "Farm Bill"] for the first time included an allocation of nearly $2 billion for growing healthy foods including fruits, vegetables, and nuts. State and local governments passed a variety of legislation including menu calorie labeling, nutrition standards for publicly sold food, food/drink taxes, and subsidies for healthy food purchases.[33,34]

Why might these efforts have been more successful for children in higher-income families than in lower-income families? One possibility is that public health campaigns may be more effective among socially advantaged households. For instance, higher-income families may have better access to information and resources to put the information into practice. Research also suggests higher-income families may place more emphasis on health and on the desirability of thinness.[8] Low-income families, on the other hand, face barriers to reducing obesity that higher-income families may not face, such as decreased neighborhood safety and fewer opportunities for exercise.[10,13] The disparity in cost between healthy and unhealthy foods also appears to be growing, so that lower-income households face increasingly difficult choices between saving money and eating healthy food.[35]

This study has several important limitations. First, this analysis was descriptive and could not determine what caused the increase in income-related disparities over time. Second, the association between income and obesity is complex and differs by gender and by race/ethnicity. In this paper we chose to focus on the income-obesity gradient, but future research might consider whether the changes over time differ along other dimensions. Finally, since we relied on just two time points for this analysis, our results may have been affected by significant economic events that occurred in the intervening years. For example, the Great Recession of 2007 to 2009 disproportionately affected the poorest families in the country, and thus may have exacerbated disparities in obesity. However, a study that examined obesity among adolescents did not document an unusual spike across the years of the recession,[20] suggesting that it is likely not the primary cause of the changes we observed.

Conclusions

Our study documented that rates of overweight and obesity rose across 2 nationally representative cohorts of elementary school children spanning a 12-year period. We found that increases were concentrated among children from lower-income households, leading to an increase in income-related disparities in obesity. This suggests that efforts to slow the obesity epidemic have been more effective among economically advantaged families, and that low-income children face an even larger disadvantage than in past years. This heightened risk for obesity may preserve, and even exacerbate, socioeconomic inequality.

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Supplementary Data

Supplementary data related to this article can be found online at https://doi.org/10.1016/j.acap.2020.11.021.

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