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Wanwei Liang Date

URBAN-RURAL DIFFERENCE IN CHILDHOOD WEIGHT CHANGE IN THE UNITED STATE

By

WANWEI LIANG
MASTER OF SCIENCE IN PUBLIC HEALTH

DEPARTMENT OF EPIDEMIOLOGY

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By

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2021

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An abstract of
A thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University
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Abstract

Urban-Rural Difference In Childhood Weight Change In The United States

Objective

The increasing obesity rate among children has been observed in the United States in recent decades. However, less is known about the effect of locality on children's weight change utilizing a longitudinal cohort. This study assessed whether childhood weight change differs by locality in the US using a nationally representative sample of children.

Methods

We analyzed data on 7,403 children who enrolled in kindergarten during the 2010-11 school year from the Early Childhood Longitudinal Study-Kindergarten Class of 2011 (ECLS-K: 2011), a nationally representative sample of children at kindergarten age. This study used multinomial logistic regression models to predict children's weight change from fall kindergarten to spring fifth grade: consistently obese, consistently not obese, from obese to not obese, and from not obese to obese in different locality groups. Demographic and socioeconomic status variables were included in the models as covariates. All analyses were adjusted by survey weights to generate nationally representative estimates.

Results

The overall obesity increased from kindergarten to fifth grade among all locality groups, with rural areas showing the highest prevalence of obesity: 13.5% in kindergarten and 23.9% in fifth grade. Town areas followed with a prevalence of 13.1% in kindergarten and 21.6% in fifth grade, while the city had 13.5% in kindergarten and 21.5% in fifth grade. The suburb had the least prevalence in both kindergarten (11.7%) and fifth grade (19.9%). Children in rural areas exhibited higher odds of being consistently obese from kindergarten to fifth grade (OR = 1.35, 95% CI: 1.02-1.77) and becoming obese (OR = 1.42, 95% CI: 1.05-1.91) compared to their city peers. No significant difference was found in the association between locality and children's weight change among children living in suburban and town areas compared to the city.

Conclusions

There were differences in weight change from kindergarten to fifth grade among children in the city and rural areas. Children living in rural areas had higher odds of staying obese or transitioning to obese during the time from kindergarten to fifth grade compared to city areas. Additionally, they had slightly higher probabilities of becoming and staying obese than other locale groups.

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I. Introduction

Over recent decades, with the consistent improvement of living conditions and lifespan all over the world, some chronic diseases have prevailed and become one of the leading causes of mortalities. According to the World Health Organization (WHO), obesity is considered to be one side of the double burden of malnutrition, mainly in high-income countries [23]. Childhood obesity has also emerged as one of the most prevalent health conditions impacting children in the United States (US) over several decades. In the US, the obesity rate has doubled among adults and tripled among children in recent decades[10] and has become one of the leading public health problems. The Centers for Disease Control and Prevention (CDC) reported that the prevalence of childhood obesity was 19.7% among children aged 2 to 19, impacting around 14.7 million children in the United States between 2017 and 2020 [5].

Childhood obesity contributes to severe and long-term health problems, as research indicates that children being overweight could have a higher risk of obesity when they enter adulthood [3]. Childhood obesity is linked to various medical consequences and contributes to an increased risk for a variety of non-communicable diseases, including type-2 diabetes, hypertension, high cholesterol, orthopedic problems, liver diseases, and coronary heart diseases [24]. Additionally, being overweight and obese during childhood has an impact on children's emotional health, leading to negative stereotypes, discrimination, social marginalization, and bullying [16].

Many factors contribute to childhood obesity, including eating patterns, activity levels, sleep routines, social determinants, and urbanicity. According to Flattum[8], in the US, children living in rural areas have around 20 to 25% higher odds of being overweight or obese than those who live in urban areas. Moreover, the average obesity rate for children in rural areas exceeds the national average. Differences in diet, physical activities, socioeconomic status, neighborhood factors (e.g., community activity, neighborhood walkability, neighborhood safety), and availability of prevention programs between rural and urban areas contribute to the increased risk of childhood obesity [16].

While several studies have explored the association between urbanicity and childhood obesity, many focus on how urbanicity influences the association between obesity and other factors, such as food environment, walkability, and residential density. Some research examined the relationship directly between urbanicity and childhood obesity, whereas there were few using large longitudinal datasets including recent year data[32]. This study aims to assess whether the weight change from fall kindergarten to spring fifth grade differs by the locality in which children lived. The analysis will utilize data from the Early Childhood Longitudinal Study, Kindergarten Class of 2010-11 (ECLS-K: 2011), a longitudinal dataset conducted by the National Center for Education Statistics (NCES). This study followed nationally representative children selected from public and private schools followed from kindergarten year (2010-11 school year) to fifth grade (2015-16 school year).

II. Background and Literature Review

2-1. Risk Factors for Childhood Obesity

Childhood obesity is defined as an individual's weight being higher than being considered healthy for their height. The prevalence of obesity may be different among sex, race, and ethnicity. As a complicated disease, childhood obesity has many contributing factors, including eating and physical patterns, behavior, genetics, social determinants of health (SDOH), and psychological factors [5].

i. Children's Sex

Previous literature has reported that the prevalence of obesity is different between boys and girls, with a higher prevalence among boys than girls aged from 5 to 19 [27]. The difference in obesity prevalence may be the result of biological influences. Compared to boys, girls generally have greater fat mass and lower calorie needs [27]. Additionally, the difference in hormone levels in boys and girls contributes to the variance in body composition and accounts for the difference in obesity risk [35]. Sociocultural influence can be another driving part of the difference in obesity prevalence between boys and girls. During adolescence, because of the gender-based stereotypes of feminine identity, girls are more likely to have concern and anxiety regarding weight than boys [27].

ii. Race and Ethnicity

Differences in racial and ethnic groups are associated with the disparity in obesity prevalence. Some minority groups, including African American, American Indian, and Hispanic children, show a higher risk of obesity than white and Asian children[1]. Earlier evidence suggests that the risk factors for childhood obesity can be varied by children's race and ethnicity

[14]. The differences in socioeconomic factors across racial and ethnic groups could contribute to the different obesity prevalence. Additionally, the variety of factors contributing to early childhood obesity, such as maternal risks, infancy risks, and early childhood risks, could account for the BMI difference across racial and ethnic groups [14].

iii. Eating and Physical Patterns

Eating and physical activity patterns are among the most significant factors that might cause excess weight gain. As there has been an increase in the variety and popularity of fast food and processed food in recent years, they have become one of the most common options and staples in many children's diets in the US. Continuously consuming commercial fast-food products tends to bring children with a high number of calories with low nutritional values compared to the typical home setting, which will increase the risk of being overweight or obese[5]. Family dynamics and home environment also impact children's eating patterns. Children can share similar behaviors, such as eating habits and activities, with their family members [11]. Studies show that busy families, particularly those with two parents working full-time, could consume more foods and beverages that are high in calories as they are usually easier or take less time to prepare [16].

Additionally, many children spend less time doing outdoor activities due to the growing popularity of tablets, smartphones, and other electronic devices. The decrease in physical activity could contribute to the imbalance between calorie intake and output as children are less likely to burn extra calories they consume through activities, increasing the probability of overweight and obesity eventually [34].

iv. Genetic factors

Genetics is another major factor that contributes to obesity, with some studies showing that the body mass index (BMI) can be heritable at a range of between 40% to 70% in children [12]. There is also evidence that obesity can result from rare gene mutations [12]. However, genetic factors are only responsible for less than 5% of cases of childhood obesity [16]. Additionally, in most situations, obesity is considered to be a complex disease that requires both genetic and environmental factors.

v. Social determinants of health (SDOH)

Social determinants of health (SDOH) refer to the conditions of environments where people are born and live that can affect health, functioning, and life quality [6]. SDOH typically includes economic stability, education access and quality, health care access and quality, neighborhood and built environment, and social and community context, which play roles together in children's access to nutritious food options, availability of outdoor activity, and choice of a healthy lifestyle [6].

vi. Psychological factors

Psychological factors could also be responsible for childhood obesity. Some mental health problems, for example, anxiety and depression, can both be the reason and consequence of obesity [25]. Low self-esteem and poor self-worth may also be factors that contribute to weight gain and eating disorder symptoms [17]. On the other hand, overweight or obese children may encounter a higher risk of bullying compared to those at average weight, which may lead to the development of psychological problems, social deficits, unhealthy weight control, and eating disorders, resulting in even higher risk of overweight and obesity [13].

2-2. Differences in Obesity Patterns Contributed by Urbanicity

Urbanicity is closely related to the environment people live in, which could intricately shape an individual's lifestyle, dietary and physical habits, and health [30]. Living in urban areas provides various health benefits, such as more food choices, accessibility to education, workout facilities, and leisure activities, while it also brings risks that are specifically linked to the urban environment [30]. On the other hand, living in a rural environment may encounter fewer risk factors related to cardiovascular, respiratory diseases, and mental illness, but it could bring an increased risk of being overweight and obese [8]. Urbanicity can interplay with many factors contributing to obesity, including diet, physical activities, socioeconomic status, and neighborhood factors (e.g., commuting activity, neighborhood walkability, neighborhood safety) [9]. Therefore, in addition to the direct effect of overweight and obesity, urbanicity could result in inconsistency in the association between other factors and obesity.

i. Household socioeconomic status (SES)

Household socioeconomic status is measured based on family income, parents' educational attainment, and occupations [30]. Some evidence shows an association between family SES and childhood obesity. SES could impact children's health and weight status as a factor closely related to urban-rural distribution, neighborhood safety, dietary options, smoking, physical activities, and healthcare options [30]. While some literature shows no significant difference in the association between SES and childhood obesity among rural and urban areas, some found urbanicity plays a role in the association between parent education, one of the factors to measure family SES, and obesity [13]. According to Igel et al., better-educated parents were linked to a lower risk of obesity in urban areas, while no significant level was found in suburban (rural) areas [13].

ii. Food Environment

The food environment refers to how easily an individual can access various food, including availability, affordability, convenience, and desirability [33]. Urbanicity can be linked to the food environment as it has been identified as one of the most critical roles in building dietary habits and shaping eating behaviors [33]. According to research, rural areas tend to have fewer stores that sell high-quality products at reasonable prices and food or grocery delivery services than urban areas, resulting in a potential barrier for children living in rural areas to healthy food choices[8]. Children living in areas with fewer choices are more likely to have a lower diet quality index than those who can easily access food stores or shops, which results in a higher probability of being obese [9]. According to Wang, exposure to less fruit or vegetable could have an increased obesity risk among children living in both rural and urban areas [33].

iii. Built Environment

The built environment describes the physical environment in which individuals live and work, including homes, buildings, streets, open spaces, and infrastructure, which can directly influence the level of physical activities and walkability [32]. Children living in urban and rural areas could have different patterns of physical activities due to the different choices of activities, environmental considerations, and space. In urban areas, environmental factors such as air pollution levels, road traffic noise, and the availability of physical facilities can impact children's BMI. In a cluster analysis of high levels of air pollution, traffic, and noise, a significant association exists with the BMI level [7]. There is literal evidence proving that individuals living in more walkable areas tend to walk and use active transportation[31]. According to Stowe et al., youth residing in rural areas tend to have a lower BMI as walkability increases, while those in urban areas have an opposite trend as the increasing walkability also allows easier access to unhealthy food choices [31].

2-3. Conceptual Framework

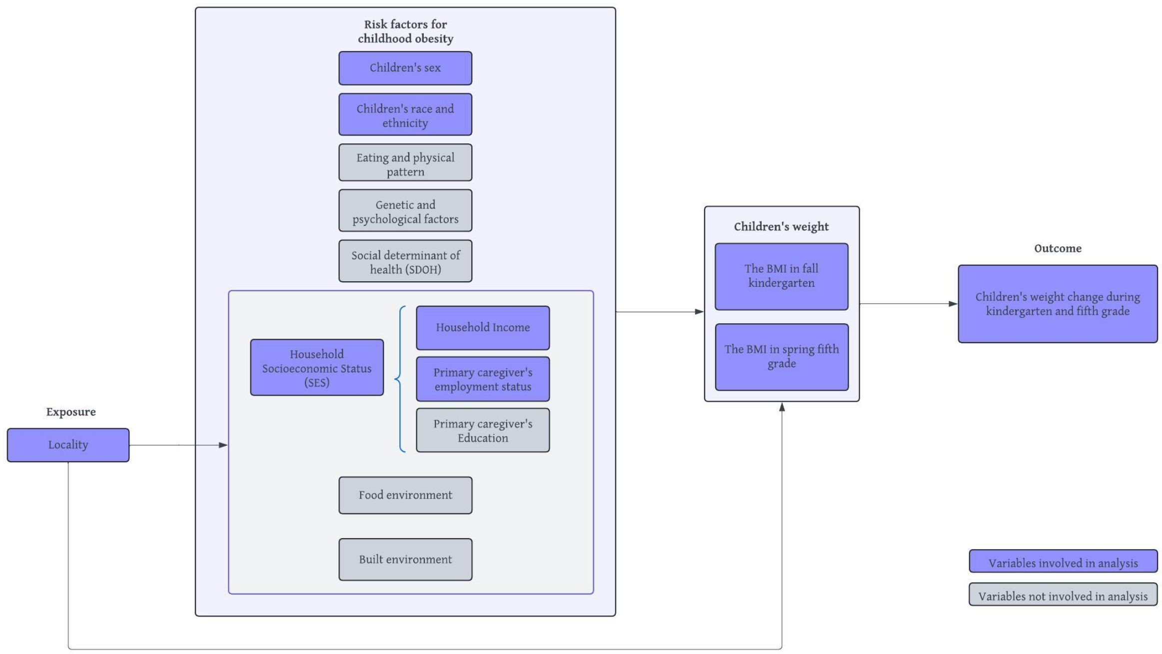
Based on the description of related factors on children's obesity and the design of the ECLS-K: 2011 dataset, this study aimed to evaluate the weight change of children from fall kindergarten to spring fifth grade, considering the locality of their school as a proxy of exposure variable. The covariates included children's race, sex, age, and socioeconomic status (SES). The subsequent section listed the rationale for choosing the variables listed in the conceptual framework.

This study considered the location of the school where the selected child enrolled as the proxy measure of the locality of residential areas. The school locality variables in spring fifth-grade collection were used to represent the urbanicity level of the environment children lived in from fall kindergarten to spring fifth grade. Urbanicity is linked to childhood obesity due to its close association with lifestyle, food environment, and built environment [26]. Moreover, urbanicity level affects the relationship between socioeconomic status and childhood obesity [13]. Based on the cross-sectional design of this study focusing on the fall kindergarten and spring fifth grade, primary caregivers' employment status and household income served as SES predictors in this study as they were available variables for socioeconomic status in the data collection round in kindergarten. Parental education, another relevant SES factor, was not considered in this analysis due to the unavailability of information until first grade.

Children's age is another factor considered relevant to children's weight, as older children are at higher risk of getting obesity [18]. Age is also used as a covariate to control for the possible difference in children's age at the data collection. Literature suggests that childhood obesity is associated with children's race and ethnicity, with higher prevalence among some racial and ethnic groups, such as American Indian, non-Hispanic black, and Hispanic children, when compared to white children [14]. Therefore, this study also included the race and ethnicity group of selected children as covariates. Additionally, children's sex can influence obesity prevalence due to biological influences [27]. Children's sex was also considered as a covariate in the study.

The children's weight change was defined by their BMI in fall kindergarten and their BMI in spring fifth grade. Children were categorized into two groups, with and without obesity, at both time points. The changes between groups when moving to spring fifth grade from fall kindergarten were put into four levels: children who were not obese at both time points, children who had obesity at both time points, children who transitioned into obese from not obese, and children who transited into not obese from obese, and used as the outcome variables in this study. The other risk factors mentioned in the conceptual framework, such as eating and physical patterns, genetic and psychological factors, and social determinants of health (SDOH), were not considered in the analysis as they were not the primary focus of this study. Food and built environment, other factors that may potentially contribute to childhood obesity, were not included in the analysis as they were not available in the dataset.

Representation of Conceptual Framework



III. Methods

3-1. Data Collection

The dataset used in this study is the Early Childhood Longitudinal Study-Kindergarten Class of 2011 (ECLS-K:2011) public-use dataset, which was conducted by the National Center for Education Statistics (NCES). This dataset contains information on a group of children enrolled in kindergarten during the 2010-11 school year and follows them through the 2015-16 school year. The description and design of data collection in the following sections referred to the ECLS-K manual by Mulligan et al. [22].

ECLS-K: 2011 collected data from a nationally representative sample of children at kindergarten age (i.e., five years old), enrolled in kindergarten or equivalent ungraded setting in the 2010-2011 school year. The children were selected using a multistage cluster sampling design via a three-stage process. In the first stage, the United States was divided into several primary sample units (PSUs). 90 PSUs were sampled with probability proportional to their population size of 5-year-old children within the PSU. In the second stage, public and private schools with kindergarten programs or educated children of kindergarten age were sampled within the selected subset of PSUs. In the last stage, children enrolled in kindergarten were sampled within each selected school.

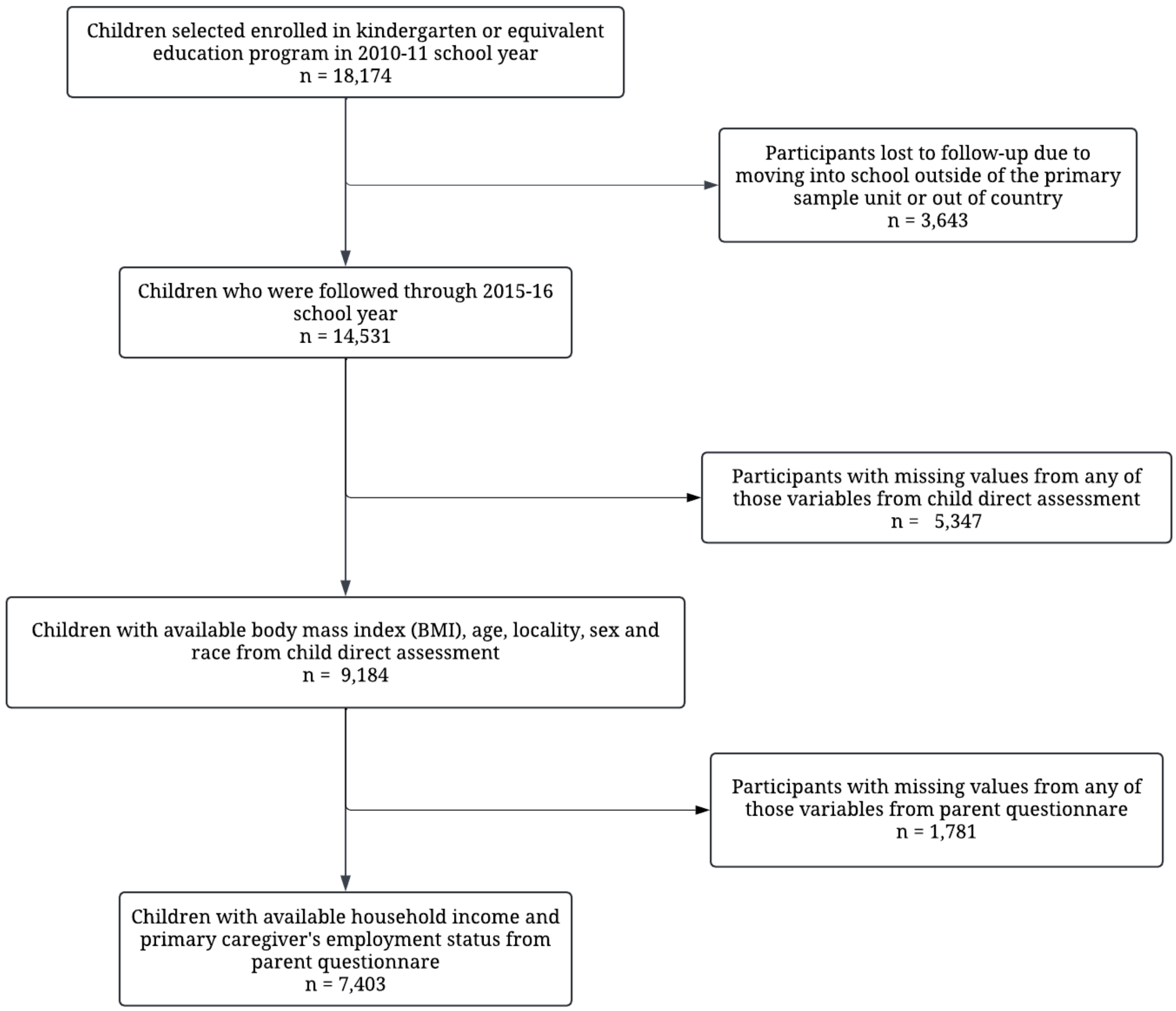
There was a total of nine waves of data collection from the 2010-11 school year through the 2015-16 school year. In the base-year data collection (kindergarten, 2010-11 school year), all sampled children in kindergarten (including those who were repeating kindergarten) were interviewed in the fall kindergarten data collection. In spring data collection in fifth grade, the entire sample of children who participated in base-year data collection were interviewed. The data were collected mainly from direct assessment of children and interviews with parents, teachers, school administrators, and healthcare providers. The direct assessment was conducted by trained field staff, while most parent interviews were conducted over the phone.

This study used two cross-sectional datasets: the child direct assessment and parent interviews from fall kindergarten, 2010-11 school year, and spring fifth grade, 2015-16 school year.

3-2. Study Population

ECLS-K: 2011 contains data from a US representative sample of children who enrolled in kindergarten or repeating kindergarten during the 2010-11 school year. The dataset used in this study consists of the sample of children who were interviewed in baseline data collection in the 2010-11 school year (n =18,174) and were followed to the last data collection in the 2015-2016 school year (n = 14,531). Several children lost to follow-up due to moving into school outside of the study primary sample unit or moving outside the country. Participants were not included in the study if there were missing body mass index (BMI), household income, and the parent’s employment status at baseline and BMI, age, locale, sex, and race in the fifth-grade data collection, resulting in the final sample size of 7,403. The flow of dataset processing is demonstrated in the following flowchart.

Data Cleaning Workflow and Final Sample Determination



3-3. Dependent Variable

The primary outcome of interest in this study is weight change, which was defined by the change in children's BMI between fall kindergarten and spring fifth grade. In the ECLS-K:2010-11 dataset, BMI was calculated based on the height and weight measured at each data collection round. To obtain accurate results of both height and weight, every child was measured twice, and the average of the two values was used as the composite value. Equation 1 was used to calculate the BMI of each child based on their unrounded values of weight and height.

Equation 1

$$BMI = \frac{weight\ in\ pounds}{height\ in\ inches} \times 703.0696261393$$

BMI below five standard deviations from the mean and above eight standard deviations from the mean for each wave were considered to be outliers and excluded due to the likelihood of being biologically implausible values [5]. A total of six observations were removed from this step. As children and adolescents grow, their height and weight may vary by age and sex dynamically. Therefore, children's obesity is expressed relative to other children of the same age and sex, which differs from adult obesity which only uses BMI value[4]. According to the CDC, children aged from 2 to 19 are categorized as obese when their BMI is above the 95th percentile for their sex and age[28]. Whether children were obese or not obese at each data collection wave was identified using the child's BMI percentile for their sex and age based on the 2000 CDC growth chart for the United States, which is the most updated growth chart available[28].

A binary variable indicating obesity status was created by assessing whether the child's BMI fell within the obesity range according to the CDC growth chart, both in the fall kindergarten and the spring fifth grade. Based on the obesity status in the fall kindergarten and the spring fifth grade, the weight change categories variable was created with four levels: consistently not obese (i.e., didn't have obesity at both waves), consistently obese (had obesity at both waves), negative weight change (i.e., changed from obese to not obese), and positive weight change (i.e., changed from not obese to obese).

3-4. Independent Variable

The primary exposure of interest in this study was the location where each child lived. The locality of the school they enrolled in was used as the proxy measure of the locality of residential areas. The location of the child's school was obtained from the Private School Universe Survey (PSS) for private schools and from the Common Core of Data (CCD) for public schools. The locality variable was categorized based on the 2006 National Center for Education Statistics (NCES) Locale Classification and Criteria[22]. In the dataset, the locale of each wave was coded as city (territory inside an urbanized area), suburb (territory outside a principal city and inside an urbanized area), town (territory inside an urban cluster and away from an urbanized area), and rural (Census-defined rural territory). In the analysis, the same categories of locality and the same coding were used.

3-5. Covariates

Demographic variables used in this analysis, consisting of child age, sex, and race, were involved as covariates in the statistical analysis. The child's age in months at each wave was calculated based on the date of child assessment at each data collection round and the child's date of birth. The child's sex and race were collected by parent interview at the baseline.

Race/ethnicity was recoded into five categories: non-Hispanic (NH) White, NH Black, NH Asian, Hispanic, and other (including NH Native Hawaiian or other Pacific Islander, NH Alaskan Native/American Indian, and two or more races specified).

In the ECLS-K dataset, the household income and the employment status of the primary caregiver were used as predictors of SES. Household income data was collected from parent interviews in fall kindergarten collection, with 18 categories ranging from $5,000 or less to $200,001 or more. Based on the Missouri Census Data Center [21]. The income was recategorized based on the distribution of households into five categories: “less than $15,000”, “$15,000 to $25,000”, “$25,000 to $50,000”, “$50,000 to $75,000”, and “$75,000 or more”.

The primary caregiver was defined as the first parent figure (Parent 1) in the household roster of the sampled child. In ECLS-K: 2011, if there was only one mother in the household, she was identified as Parent 1. Similarly, if there was only one father and no mother in the household, the father was identified as Parent 1. In cases where there were two fathers or two mothers in the household, one father or one mother was selected to be Parent 1 with the order: biological, adoptive, step, foster, and guardian. If neither a mother nor a father was identified, a female respondent or the male respondent’s partner or spouse was identified as parent 1. At the baseline data collection, the largest proportion of children had two biological or adoptive parents (76.7%), and the second largest proportion of children had only one biological or adoptive parent (16.8%). The rest of children had one biological/adoptive parent and one other parent/partner or guardians as both parents. The employment status was collected from parent interviews in spring kindergarten and defined by the number of hours parents worked in the past week. The variable was categorized into four groups: work more than 35 hours per week, work from 0 to 34 hours per week, currently looking for jobs, and not in the labor force. Due to the large number of missing, the missing employment status was also coded in a separate group and included in the analysis to avoid losing participants. Therefore, the final categories of employment were coded as “work more than 35 hours per week”, “work from 0 to 34 hours per week”, “currently looking for jobs”, “not in the labor force”, and “missing”.

The time elapsed between the fall kindergarten and spring fifth grade was calculated based on the year and month of the child direct assessment recorded for those two waves. The calculated time difference was recorded in months and was controlled in analysis to avoid the influence of time elapsed in changing weight categories.

3-6. Descriptive Methods

The weighted distribution of children’s socio-demographic characteristics and weight change by each locality group was illustrated in a table. The mean and standard deviation of each continuous variable were obtained. The prevalence of obesity in fall kindergarten and spring kindergarten by different localities, races, sexes, primary caregiver’s employment statuses, and household incomes, respectively, were calculated and illustrated via a bar graph. The proportion of each weight change level by locality group was visualized by a heat map.

3-7. Analytic Methods

The multinomial logistic regression was utilized to predict children’s weight change from kindergarten to fifth grade, with children who were not obese consistently in both the fall kindergarten and the spring fifth grade as reference groups. The general expression of the model used is visualized as Equation 2.

Equation 2[1]

$$\frac{p_J(x)}{p_j(x)} = e^{\beta_{0j}+\beta_{1j}X_1+\cdots+\beta_{pj}X_p}$$

In the first model, the weight change was included as the outcome, the locality of school in the spring of fifth grade was used as exposure, and children's sex and age were included. The second model added the children's race, the primary caregiver's employment, and the household income. The primary caregiver's employment and the household income are two variables that used as the representative variables for SES. The sample weight used in the analysis was the child base weight adjusted for non-response for child data from kindergarten (including fall and spring) and spring fifth grade, and parent data from fall or spring kindergarten. The predicted probabilities with adjustment for all covariates were calculated to demonstrate the overall probability of each weight change group by locality. All analyses were conducted by utilizing R (version 4.2.1, 2022) and StataSE (version 17.0, 2024).

[1] j = 1, …, J-1, J represents the levels of categorical variables Y (i.e., locality). X_1, X_2, … X_p represents the predictors used in the model.

IV. Results

4-1. Socio-demographic and weight status change

Table 1 presents the descriptive statistics for the overall sample (n = 7,403) and by locality. Most children were enrolled in schools located in suburban areas, followed by city and rural areas, whereas the fewest of them enrolled in schools located in town. Gender distribution across the sample was balanced, with a similar number of boys and girls in all locality groups. The mean ages in both fall kindergarten and spring fifth grade across different locality groups were similar, with minor fluctuation of a month to two months. Non-Hispanic white children constituted the majority of the sample (53.8%), followed by Hispanic, non-Hispanic Black or African American, and Asian. 5.7% of children were categorized as other races or ethnicity groups, including pacific islanders, American Indians, and Alaska natives. Most children lived with a primary caregiver employed for over 35 hours per week, while the second-largest proportion lived with a primary caregiver who was not in the labor force. The household income distribution indicated that most households earned more than $75,000 annually, followed by those earned between $25,000 and 50,000.

In fall kindergarten (2010-11), most children were underweight or normal-weight. In spring fifth grade (2015-16), they remained the largest compared to other weight groups. The percentage of children with obesity increased from 12.1 % in fall kindergarten to 19.8% in spring fifth grade. This pattern was consistent with the distribution of the weight change. From fall kindergarten to spring fifth grade, 76.4% of children remained not obese (i.e., underweight, normal-weight, and overweight). 10.5% of children experienced positive weight change as they became obese by the spring of fifth grade, while only 3.4% of children who were obese in kindergarten became not obese by the spring of fifth grade. Children living in city areas had the largest proportion of being consistently obese (10.0%), whereas those living in town areas had the smallest (7.6%). Additionally, children living in rural areas experienced the highest transition to being obese from not obese(12.8%), and children living in town areas had the most transition from being obese to not obese(3.7%).

4-2. The total prevalence of obesity in fall kindergarten and spring fifth grade

According to *Table 2*, the prevalence of obesity increased from fall kindergarten to spring fifth grade across all localities, sex, race, employment status, and household income levels. Rural areas exhibited the highest prevalence of obesity in both fall kindergarten (13.5%) and spring fifth grade (23.9%), followed by town, urban, and suburban areas. Male children had a higher prevalence of obesity than females in both fall kindergarten and spring fifth grade. Among all race and ethnicity groups, Hispanic children had the highest prevalence of obesity in fall kindergarten (16.8%). In comparison, non-Hispanic black or African American children had the highest prevalence in spring fifth grade (26.5%). Asian children had the lowest prevalence of obesity in both fall kindergarten (7.68%) and spring fifth grade (10.5%).

The prevalence of obesity was highest for children whose primary caregiver was looking for jobs in both fall kindergarten (14.4%) and spring fifth grade (25.1%). On the other hand, obesity was least prevalent among children with primary caregivers working from 0 to 34 hours. In fall kindergarten, children from households with an annual income of less than $15,000 had the highest prevalence of obesity, and the prevalence increased to 29.4% in the spring fifth grade. As the household income increased, the prevalence of obesity decreased at both time points. Children living in households with an annual income of more than $75,000 had the lowest prevalence of obesity, with a prevalence of 8.07% in fall kindergarten and 13.1% in spring kindergarten.

4-3. Comparing obesity and weight change in fall kindergarten with spring fifth grade

Figure 1 shows a bar graph illustrating the proportion of children with obesity in fall kindergarten and spring fifth grade by different localities. The proportion of children with obesity increased from fall kindergarten to spring fifth grade. Among the four locality groups, suburb areas exhibited the largest proportion of children with obesity, whereas town areas had the lowest proportion.

From the heat map demonstrated in *Figure 2,* most children maintained either underweight or normal weight from fall kindergarten to spring fifth grade. Around 10% to 20% of children in the underweight or normal weight category transited into the overweight category when moving to spring fifth grade. It's noteworthy that a small proportion of children categorized as obese in fall kindergarten transitioned to either overweight or underweight/normal weight, as most of them stayed obese in spring fifth grade.

5-4. Odds of being consistently obese or weight change compared to being consistently not obese

Models 1 and 2 in *Table 3* represent the odds ratios (ORs) of various weight changes compared to being consistently not obese by locality, sex, employment status of the primary caregiver, and household income, along with their respective 95% confidence interval. In Model 1a – 1c, where children's sex, age in fall kindergarten, and the time elapsed between kindergarten and fifth grade were controlled during analysis, none of the children living in suburbs, towns, or rural areas showed a significantly different odds of having consistently obesity, positive weight change, or negative weight change compared to those were consistently not obese. Male children exhibited higher odds of consistent obesity (OR = 1.56, 95% CI: 1.30 - 1.89) and negative weight change (OR = 1.69, 95% CI: 1.18 - 2.42) compared to females.

In Model 2a – 2c, where all the covariates (race/ethnicity, employment status of primary caregiver, and household income) were included in the analysis, children living in rural areas showed higher odds of being consistently obese compared to city areas (OR = 1.35, 95% CI: 1.02 - 1.77). Additionally, they also demonstrated higher odds of gaining obesity compared to city areas (OR = 1.42, 95% CI: 1.05 - 1.91). Among all weight change groups, the probabilities of staying not obese consistently from fall kindergarten to spring fifth grade were highest despite different locality groups (*Figure 3*). Children living in rural areas had a slightly increased probability of being consistently obese and gaining obesity compared to other locality groups, while the probabilities of being in other weight change were similar in all locality groups.

Male children had higher odds of consistently having obesity (OR = 1.57, 95% CI: 1.29 – 1.91) and changing from obese to not obese (OR = 1.64, 95% CI: 1.12, 2.41) after controlling for race and SES. Among different race and ethnicity groups, Hispanics (OR = 1.48, 95% CI = 1.14-1.89) and other races (OR = 1.61, 95% CI: 1.11-2.33) had higher odds of staying obese from fall kindergarten to spring fifth grade when compared to non-Hispanic white children. Non-Hispanic black or African American children were more likely to become obese (OR = 1.40, 95% CI: 1.01-1.95), while non-Hispanic Asian children had lower odds of positive becoming obese (OR = 0.430, 95% CI: 0.241-0.769), compared to non-Hispanic white children. The employment status of the primary caregiver influenced children's weight change. When living with caregivers who worked for 0 to 34 hours per week, children had lower odds of being consistently obese compared to those with caregivers who worked over 35 hours per week (OR = 0.684, 95% CI: 0.518, 0.903). Children living in the household that had an income of $50,000 to $75,000 also showed lower odds of being consistently obese (OR = 0.482, 95% CI: 0.342-0.658) or becoming obese (OR = 0.607, 95% CI: 0.415-0.887) when compared with children whose annual household income was less than \$15,000. As the household annual income was more than \$75,000, the odds of staying obese (OR = 0.358, 95% CI: 0.263-0.487) or becoming obese (OR = 0.446, 95% CI: 0.312-0.638) decreased further.

V. Discussion

This study used data from the Early Childhood Longitudinal Study (ECLS-K: 2011), a nationally representative sample of children enrolled in kindergarten or equivalent ungraded settings in the 2010-11 school year. In this study, we seek to determine the impact of residential location on children's weight change from fall kindergarten to spring fifth grade. Our findings reveal that there was a difference in the likelihood of children remaining obese or transitioning to obesity between rural and city areas. Specifically, children living in rural areas had 1.56 times higher odds of remaining obese compared to those in city areas. Additionally, they had 1.69 times higher odds of transitioning to obesity from not obese than their city peers.

There are several possible factors contributing to this finding. Children enrolled in schools in rural communities might face some challenges and barriers to accessing healthy food choices and recreational facilities[26]. Furthermore, our analysis reveals that rural areas had the highest proportion of primary caregivers who worked over 35 hours per week. The need for caregivers to work full-time may lead to limited supervision for healthy eating and physical activities among children, which may contribute to higher odds of getting obese or consistently having obesity[16].

Conversely, it is also important to note that no significant association ($p > 0.05$) was found between the locality of schools and weight change from fall kindergarten to spring kindergarten among children living in suburban and town areas compared to the city. Children living in suburban and town areas did not have significantly higher odds of being consistently obese or transitioning between being obese and not obese than in the city. This result suggests that the difference in weight change due to locality is more subtle in children living in suburban and town areas compared to urban areas. In the analysis, suburban and town areas were both defined as areas inside urban clusters, while rural areas were defined as areas located outside of urbanized areas according to the 2006 NCES Locale Classification and Criteria[22]. The proximity of suburbs and towns to urbanized areas may provide some access to healthier food choices, physical activities, and a better built environment compared to children in rural areas[8, 33]. As little evidence from previous studies shows the association between obesity and living in suburban or town areas, further understanding is needed to draw a firm conclusion.

Overall, the prevalence of childhood obesity in spring fifth grade increased from 12.8 to 20.9 in fall kindergarten. Overall, the prevalence of childhood obesity in spring fifth grade increased from 12.8 to 20.9 in fall kindergarten. Among four locality levels, children enrolled in schools in rural areas had the highest obesity prevalence in both fall kindergarten and spring fifth grade. Additionally, children in rural areas presented higher odds of being consistently obese and transitioning to obesity during the period from fall kindergarten to spring fifth grade compared to those in urban areas. On the other hand, children enrolled in schools located in suburban areas showed the lowest obesity prevalence in both fall kindergarten and spring fifth grade. However, there were no significantly higher odds of transitioning from obese to not obese compared to those living in the city.

Moreover, our study found that there was a difference in obesity prevalence by sex and race/ethnicity, which were consistent with the findings in previously published literature[14, 27]. Specifically, male children showed higher odds of being consistently obese during the time from fall kindergarten and spring fifth grade. They also had a higher obesity prevalence in both fall kindergarten and spring fifth grade. We also found higher odds of transitioning to non-obese status from obese in males compared to females from analysis. While not much evidence shows that boys tend to lose more weight than girls, some literature shows that men tend to lose more weight than women on diet intervention due to higher muscle-to-fat mass ratio, greater body size, and higher total energy expenditure[2]. Further study might be conducted to address factors affecting the different transition rates in children between sexes.

A significantly higher odds of being consistently obese was demonstrated in Hispanic and other race groups compared to their white peers. Additionally, NH black or African American children had a higher chance of changing to obesity from not obese than white children. Similarly, Hispanic children and NH black or African American children showed higher obesity prevalence in both fall kindergarten and spring fifth grade compared to other races or ethnicities. The results are consistent with the Early Childhood Longitudinal Study Birth Cohort, in which African American children had the highest prevalence, while Asian children had the lowest[14].

The socioeconomic status of the household is another significant factor influencing children's weight change. Children from households where primary caregivers work between 0 and 34 hours had lower odds of being consistently obese compared to those whose primary caregivers work over 35 hours per week, while no significant association was found in other employment status groups. There is evidence indicating there is a higher risk for children to become overweight if their mothers work more hours per week over the child's life[1]. However, previous evidence may not provide strong support for this finding, as only 78.1% of primary caregivers were identified as mothers in the dataset we utilized. Moreover, previous study indicates that the multifaceted nature of childhood obesity, implying various caregiving factors such as childcare quality and children's nutrition and energy expenditure, can also impact children's weight change[1]. Hence, the primary caregiver's work status may not have a singular effect on childhood obesity outcomes. Further research is warranted to comprehensively assess the interplay between work intensity and childhood weight problems.

Additionally, children from households with an annual income between $50,000 and $75,000 had significantly lower odds of staying obese consistently and becoming obese compared to those with an annual income of less than $15,000. This highlights the impact of household income on obesity prevalence, with higher income levels associated with lower odds of obesity among children. Similar results were shown in previous studies in states and the US, as children from low-income families both had a higher risk of being overweight or obese[15, 20].

5-1. Strengths and Limitations

This study contributes insights into the relationship between the locality and children's weight change from kindergarten to fifth grade. Different from focusing on the obese status at one single time point, this study examined the change in obese status from kindergarten to fifth grade and provided us some insight into the how locality would have an effect on children's weight over a four-year period. Another key strength of this study is that it used a large, nationally representative, longitudinal dataset, which provides robust and generalizable findings regarding childhood obesity. Additionally, as there was more existing evidence focused on childhood obesity from ECLS-K: 1998-99, the use of a more recent dataset covering the 2010-11 school year through the 2015-16 school year, ECLS-K: 2011, ensures the study's findings reflect more recent trends and patterns in weight change among children living in different locations.

It is important to acknowledge several limitations of this study. Firstly, the cross-sectional nature of this study focused on the data collected in fall kindergarten and spring fifth grade during analysis. Therefore, the study might not capture any weight changes that have happened between these two time points. For example, if a selected child became obese and became not obese again at any time between fall kindergarten and spring fifth grade, they would be marked as consistently not obese in this study. As a result, the findings may not represent the dynamic nature of childhood obesity trajectories over time. Similarly, the locality variable used in the analysis only accounts for the location of the school that children enrolled in during the spring fifth grade. The findings may not account for any change in locality if children relocated from schools in one locality group to another between waves. Further research incorporating longitudinal modeling strategies is recommended for a full presentation of patterns of childhood obesity. By conducting longitudinal studies, we may be able to examine the weight change over time and gain a more accurate understanding of how locality has a long-term effect on children's weight change.

Secondly, the assumption that the locality of schools where children enrolled in was the same as where children resided may introduce potential bias in the analysis. This assumption may not accurately represent the effect of residential locality on childhood obesity, as the proxy measures may not fully account for the difference between residential areas and school locations. Consequently, the findings may only provide a partial understanding of the impact of residential locality on childhood weight change. Given the secondary analysis design of this study, we did not have control over the data collection process. Therefore, in future research, a direct measurement of the locality where children reside could provide more precise information on the environmental factors, as well as enhance the validity of the findings.

Additionally, as mentioned in conceptual framework, some variables were not included in the analysis due to unavailability, including parental education, food and built environment. As they were not captured during the data collection, the study findings may not account for all the risk factor possibly contributed to childhood obesity. Future research should strive to incorporate these risk factors and provide more comprehensive understanding of the determinant of childhood obesity.

VI. Conclusion

Our study reveals that there is difference in weight change from kindergarten and fifth grade among children in city and rural areas. Specifically, we found children living in rural areas exhibit higher odds of being consistently obese and becoming obese during the period from kindergarten to fifth grade compared to their peers living in the city. Furthermore, our finding suggests that a slightly higher prevalence of obesity among children in rural areas relative to other locality groups. These finding indicate the potential relationship between locality on childhood obesity. Moreover, this study demonstrated the odds of staying consistently obese and becoming obese differ between sex, race, and the SES status of their households. These findings underscore the importance of environment factors such as locality in childhood obesity, while future research is recommended to explore the causality relationship between locality and obesity. Additionally, further studies could investigate the interaction between locality environment factors such as SES, food, and built environment, and how they influence childhood obesity.

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VIII. Tables and figures

Table 1. Survey-adjusted Socio-demographic Characteristics and Weight Changes (from 2010 to 2016) of the US Children in ECLS-K: 2011 (n = 3,087,273)[2]

	City, % n = 906,393	**Suburb, %** n = 1,243,800	**Town, %** n = 353,703	**Rural, %** n = 583,377	**Total, %** n = 3,087,273
Weight category in fall kindergarten					
Underweight	71.8	73.4	74.8	68.3	72.1
Overweight	15.0	15.1	12.8	16.7	15.1
Obese	13.2	11.5	12.4	15.0	12.8
Weight category in spring fifth grade					
Underweight	59.9	62.5	64.7	57.8	61.1
Overweight	19.0	18.2	16.0	18.1	18.2
Obese	21.1	19.3	19.3	24.1	20.7
Weight status change, kindergarten to fifth grade					
Consistently not obese	76.1	78.2	76.7	72.4	76.3
Consistently obese	10.4	9.0	8.4	11.5	9.8
Obese to not obese	2.8	2.5	4.0	3.5	2.9
Not obese to obese	10.7	10.3	10.9	12.6	11
Time elapsed between kindergarten and fifth grade (months)					
Mean (SD)	167.4 (3.0)	167.5 (3.0)	167.4 (2.9)	167.5 (2.7)	167.5 (2.9)
Sex					
Female	48.8	48.4	47.2	48.3	48.4
Male	51.2	51.6	52.8	51.7	51.6
Age in fall kindergarten (years)					
Mean (SD)	5.59 (0.36)	5.58 (0.37)	5.71 (0.38)	5.70 (0.38)	5.62 (0.37)
Age in spring fifth grade (years)					
Mean (SD)	11.05 (0.36)	11.05 (0.36)	11.17 (0.39)	11.16 (0.37)	11.08 (0.37)
Race/ethnicity					

[2] Note: The weight applied was adjusted for non-response associated with child assessment/child questionnaire data from both kindergarten rounds and spring fifth grade, as well as parent data from fall kindergarten and spring kindergarten. Source: ECLS-K:2011

White, NH	37.1	52.8	68.6	72.9	53.8
Black or African American, NH	17.4	10.8	10.5	9.0	12.3
Hispanic	33.1	26.3	13.6	9.3	23.7
Asian, NH	7.8	4.5	1.1	1.8	4.5
Other[3]	4.6	5.6	6.3	7.0	5.7
Employment status of primary caregiver					
Work ≥ 35 hours/week	36.9	38.7	41.8	42.8	39.3
Work 0-34 hours/week	18.4	20.1	20.6	16.9	19.0
Looking for jobs	7.4	4.6	5.0	5.6	5.7
Not in labor force	24.4	26.3	23.0	26.9	25.5
Missing	13.0	10.3	9.7	7.8	10.5
Household income					
Less than \$15,000	17.1	8.3	12.6	11.3	11.9
\$15,000 to \$25,000	19.5	12.5	13.9	13.1	14.8
\$25,000 to \$50,000	21.8	21.4	27.2	26.6	23.2
\$50,000 to \$75,000	13.7	17.8	20.8	19.5	17.3
More than \$75,000	27.8	40.0	25.5	29.5	32.8

[3] Other race includes NH Native Hawaiian or other Pacific Islander, NH Alaskan Native or American Indian, or two more races specified.

Table 2. Survey-adjusted Total Prevalence of Obesity in Fall Kindergarten and Spring Fifth Grade, by Locality, Sex, Race, Employment Status, and Household Income[4]

	Fall kindergarten (2010-11) Prevalence, % (95% CI)	**Spring fifth grade (2015-16)** Prevalence, % (95% CI)
Overall		
	12.8 (11.8, 13.7)	20.9 (19.6, 22.2)
Locality		
City	13.5 (11.8, 15.1)	21.5 (18.9, 24.0)
Suburb	11.7 (10.5, 13.0)	19.9 (18.3, 21.6)
Town	13.1 (10.0, 16.1)	21.6 (17.0, 26.1)
Rural	14.5 (12.0, 17.1)	23.9 (21.6, 26.2)
Sex		
Female	10.1 (8.91, 11.4)	19.4 (17.9, 21.0)
Male	15.3 (13.8, 16.8)	22.3 (20.5, 24.1)
Race/ethnicity		
White, NH	10.8 (9.40, 12.1)	17.8 (16.2, 19.3)
Black or African American, NH	14.7 (11.4, 18.0)	26.5 (23.0, 30.1)
Hispanic	16.8 (15.2, 18.3)	26.1 (23.1, 29.0)
Asian, NH	7.68 (5.12, 10.3)	10.5 (7.73, 13.3)
Other	14.1 (11.0, 17.3)	23.6 (17.9, 29.3)
Employment status of primary caregiver		
Work ≥ 35 hours/week	13.2 (11.8, 14.6)	21.4 (19.7, 23.1)
Work 0-34 hours/week	10.1 (8.07, 12.3)	17.3 (14.5, 20.2)
Looking for jobs	14.4 (11.1, 17.6)	25.1 (20.9, 29.3)
Not in labor force	11.5 (10.0, 13.1)	19.7 (17.6, 21.8)
Missing	18.3 (15.4, 21.2)	26.4 (22.5, 30.3)
Household income		
Less than $15,000	18.0 (15.4, 20.5)	29.4 (25.9, 32.9)
$15,000 to $25,000	16.2 (13.4, 18.9)	25.0 (22.0, 28.0)
$25,000 to $50,000	15.6 (13.5, 17.7)	25.2 (22.6, 27.9)
$50,000 to $75,000	10.8 (8.88, 12.8)	17.5 (14.4, 20.5)
More than $75,000	8.07 (6.67, 9.47)	13.1 (11.3, 14.9)

[4] Note: The weight applied was adjusted for non-response associated with child assessment/child questionnaire data from both kindergarten rounds and spring fifth grade, as well as parent data from fall kindergarten and spring kindergarten. Source: ECLS-K:2011

Table 3. Odds of Being Consistently Obese, Changed from Obese to Not Obese, and Changed from Not Obese to Obese among US Children from Fall Kindergarten (2010-11) to Spring Fifth Grade (2015-16)

	Weight change (ref: consistently not obese)					
	Consistently obese		Obese to not obese		Not obese to obese	
	Model 1a[5], OR (95% CI)	Model 2a[6] OR (95% CI)	Model 1b OR (95% CI)	Model 2b OR (95% CI)	Model 1c OR (95% CI)	Model 2c OR (95% CI)
Locality (ref: City)						
Suburb	0.842 (0.694, 1.02)	0.987 (0.798, 1.22)	0.851 (0.586, 1.24)	0.976 (0.639, 1.49)	0.965 (0.766, 1.22)	1.06 (0.817, 1.38)
Town	0.869 (0.516, 1.46)	0.872 (0.428, 1.77)	1.30 (0.738, 2.28)	1.48 (0.808, 2.71)	1.18 (0.905, 1.56)	1.10 (0.834, 1.46)
Rural	1.11 (0.857, 1.43)	1.35* (1.02, 1.77)	1.11 (0.654, 1.89)	1.42 (0.836, 2.42)	1.23 (0.936, 1.61)	1.42* (1.05, 1.91)
Sex (ref: Female)						
Male	1.56*** (1.30, 1.89)	1.57*** (1.29, 1.91)	1.69* (1.18, 2.42)	1.64** (1.12, 2.41)	0.986 (0.830, 1.17)	0.963 (0.818, 1.13)
Age in fall kindergarten	1.00 (0.982, 1.02)	1.00 (0.982, 1.03)	1.03 (0.986, 1.07)	1.01 (0.975, 1.06)	0.980 * (0.962, 0.997)	0.974 * (0.953, 0.995)
Time elapsed between kindergarten and fifth grade	0.985 (0.958, 1.01)	0.970* (0.944, 0.996)	0.989 (0.933, 1.05)	0.984 (0.926, 1.05)	0.995 (0.966, 1.02)	1.00 (0.972, 1.03)
Race/ethnicity (ref: White, NH)						
Black or African American, NH	-	1.31 (0.927, 1.84)	-	1.29 (0.55, 2.19)	-	1.40* (1.01, 1.95)
Hispanic	-	1.48* (1.14, 1.89)	-	1.16 (0.704, 1.91)	-	1.26 (0.961, 1.65)
Asian, NH	-	0.639 (0.393, 1.04)	-	0.642 (0.301, 1.37)	-	0.430* (0.241, 0.769)
Other	-	1.61** (1.11, 2.33)	-	0.608 (0.278, 1.33)	-	1.09 (0.696, 1.73)

Source: ECLS-K: 2011

[5] Model 1 a-c: Control for children's sex, age, time elapsed between waves.

[6] Model 2 a-c: Control for children's sex, age, race, time elapsed between waves, employment status of primary caregiver in the household, and the household income.

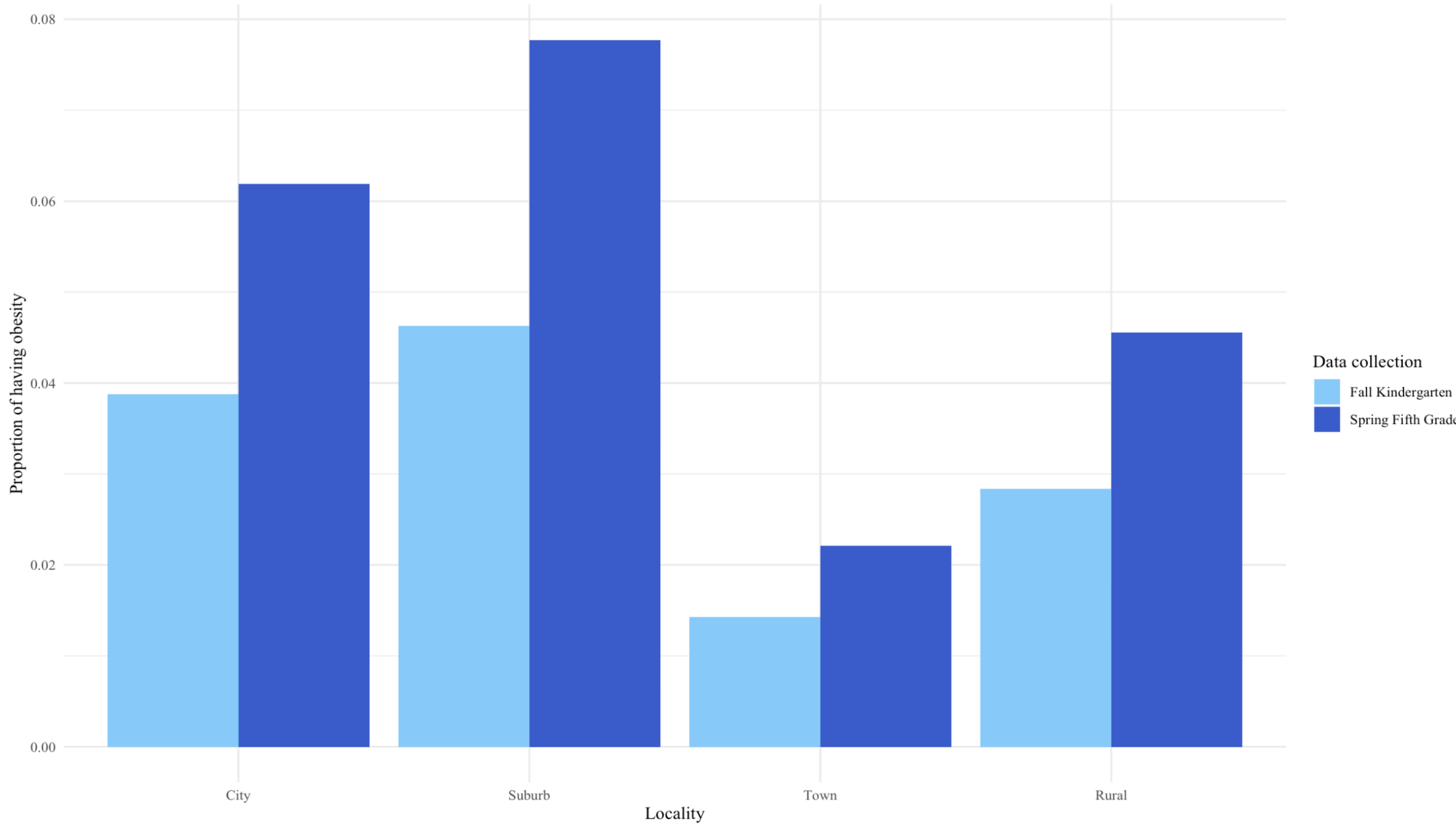
* Indicates a p-value < 0.05

** Indicates a p-value < 0.01

*** Indicates a p-value < 0.001

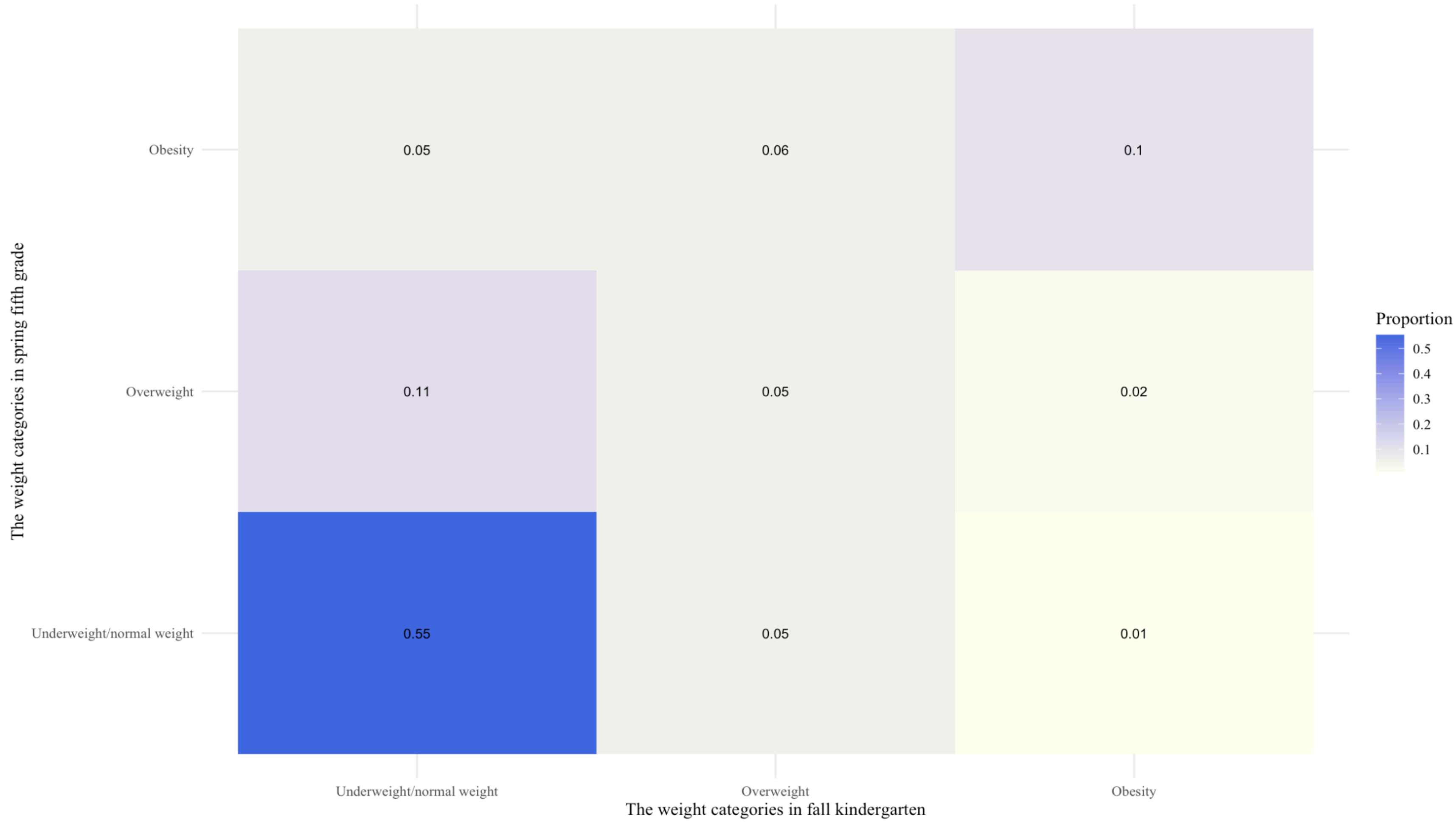
Employment status of primary caregiver (Ref: Work ≥ 35 hour/week)						
Work 0-34 hours/week	-	0.684** (0.518, 0.903)	-	0.759 (0.489, 1.18)	-	0.808 (0.597, 1.09)
Looking for jobs	-	0.754 (0.507, 1.12)	-	1.13 (0.622, 2.06)	-	1.01 (0.703, 1.44)
Not in labor force	-	0.738 (0.593, 1.59)	-	0.830 (0.516, 1.34)	-	0.946 (0.764, 1.17)
Missing	-	1.12 (0.793, 1.59)	-	1.42 (0.866, 2.34)	-	1.12 (0.765, 1.65)
Household income (Ref: Less than $15, 000)						
$15,000 to $25,000	-	0.752 (0.555, 1.02)	-	1.37 (0.686, 2.75)	-	0.840 (0.607, 1.16)
$25,000 to $50,000	-	0.793 (0.599, 1.05)	-	1.25 (0.673, 2.34)	-	0.901 (0.698, 1.16)
$50,000 to $75,000	-	0.482*** (0.352, 0.658)	-	0.958 (0.503, 1.82)	-	0.607 ** (0.415, 0.887)
More than $75,000	-	0.358*** (0.263, 0.487)	-	0.695 (0.384, 1.26)	-	0.446 *** (0.312, 0.638)

Figure 1. Survey-adjusted Comparison of the Proportion of Children with Obesity in Fall Kindergarten and Spring Fifth Grade by Locality[7]



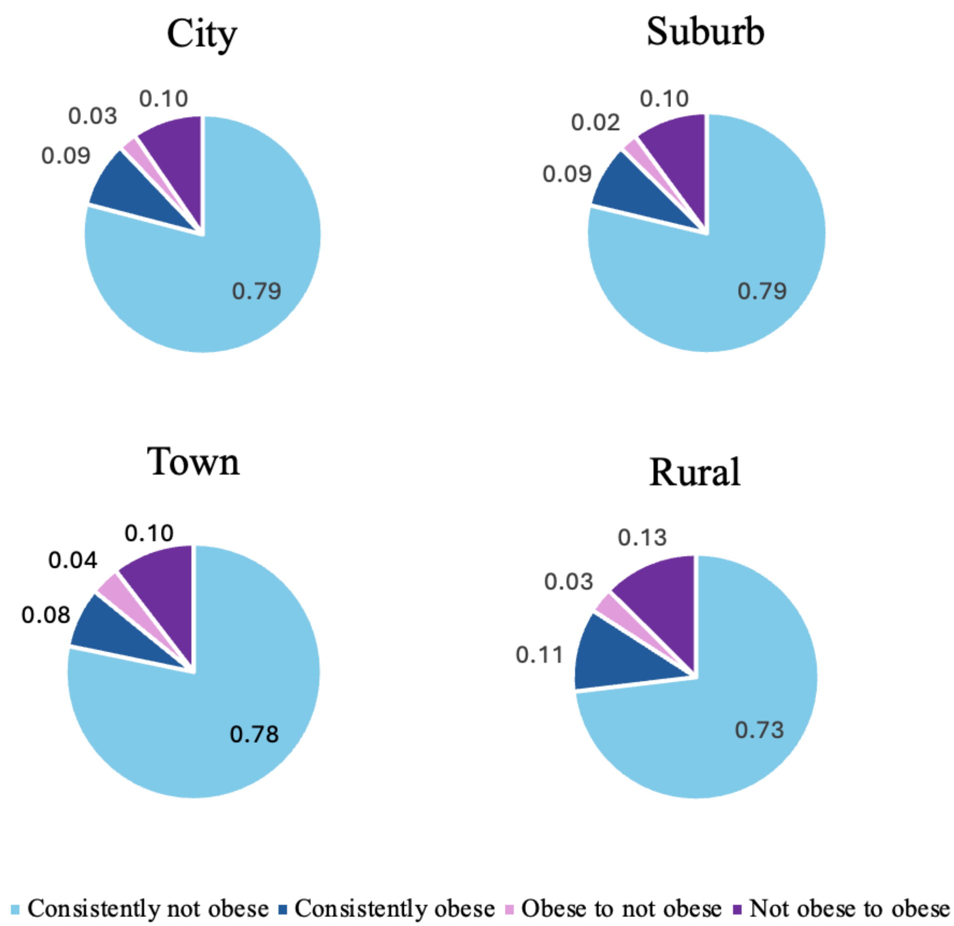
[7] Note: The proportion was calculated using the number of participants with obesity in each locality over the total number of participants in that locality group. Source: ECLS-K: 2011

Figure 2. Survey-adjusted Weight Category Transition from Fall Kindergarten to Spring Fifth Grade[8]



[8] Note: A heat map showing the transition of children's weight category from fall kindergarten to spring fifth grade. Source: ECLS-K: 2011

Figure 3. Adjusted Predicted Probability of Weight Change by Locality[9]



[9] Note: Predicted probabilities of each weight change group by city, suburb, town, and rural. The error bars shown in the figure represented the 95% confidence intervals. Source: ECLS-K: 2011

IX. Appendices

Table 1. Survey-unadjusted Socio-demographic Characteristics and Weight Changes (from 2010 to 2016) of the US Children in ECLS-K: 2011 (n = 7,403)[10]

	City, % n = 2,085	**Suburb, %** n = 3,219	**Town, %** n = 619	**Rural, %** n = 1,480	**Overall, %** n = 7,403
Weight category in fall kindergarten					
Underweight	72.1	73.6	75.0	7.7	72.7
Overweight	15.1	15.0	13.7	16.0	15.1
Obese	12.8	11.4	11.3	13.2	12.1
Weight category in spring fifth grade					
Underweight	61.2	64.0	66.7	60.1	62.7
Overweight	18.8	17.5	15.0	17.2	17.6
Obese	20.0	18.5	18.3	22.7	19.8
Weight status change, kindergarten to fifth grade					
Consistently not obese	77.2	79.0	78.0	73.9	77.4
Consistently obese	10.0	8.9	7.6	9.9	9.3
Obese to not obese	2.7	2.5	3.7	3.4	2.8
Not obese to obese	10.0	9.6	10.7	12.8	10.5
Time elapsed between kindergarten and fifth grade (months)					
Mean (SD)	167 (2.99)	168 (3.04)	167 (2.74)	167 (2.82)	167 (2.96)
Sex					
Female	50.1	48.1	48.0	48.2	48.7
Male	49.9	51.9	52.0	51.8	51.3
Age in fall kindergarten (years)					

[10] Source: ECLS-K:2011.

Mean (SD)	5.59 (0.362)	5.61 (0.359)	5.70 (0.376)	5.69 (0.366)	5.63 (0.366)
Age in spring fifth grade (years)					
Mean (SD)	11.0 (0.365)	11.1 (0.358)	11.2 (0.376)	11.2 (0.361)	11.1 (0.365)
Race/ethnicity [n(%)]					
White, NH	33.1	51.6	74.2	76.9	53.3
Black or African American, NH	12.5	7.9	4.8	6.1	8.6
Hispanic	36.4	26.9	3.7	9.9	25.1
Asian, NH	13.2	7.7	2.3	1.5	7.6
Other[11]	4.8	5.5	5.0	5.5	5.4
Employment status of primary caregiver					
Work ≥ 35 hours/week	35.1	37.0	42.8	43.6	38.3
Work 0-34 hours/week	18.5	20.8	21.6	18.8	19.8
Looking for jobs	6.3	4.3	4.5	4.7	5.0
Not in labor force	26.2	27.6	21.6	25.7	26.4
Missing	13.9	10.3	9.4	7.2	10.6
Household income					
Less than $15,000	17.5	8.9	9.9	9.9	11.6
$15,000 to $25,000	18.8	11.2	10.8	12.0	13.5
$25,000 to $50,000	20.5	18.8	24.7	24.1	20.8
$50,000 to $75,000	13.4	16.7	22.5	19.5	16.8
More than $75,000	29.8	44.3	32.1	34.5	37.2

[11] Other race includes NH Native Hawaiian or other Pacific Islander, NH Alaskan Native or American Indian, or two more races specified.