Claire E. Altman
The Pennsylvania State University
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Family Instability and Weight Gain among Elementary Students

Abstract
Using four waves of the Early Childhood Longitudinal Study-Kindergarten Cohort (ECLS-K), a nationally representative survey of US school children, I examined the relationship between family structure and instability and body mass index (BMI). Using ordinary least squares regression, I found that children in step parent families have significantly lower percentile BMI scores than those in two parent households. Stable family structures may not result in negative BMI outcomes for kids. In contrast, using fixed effects modeling I found that family instability, especially changes towards a single parent family, is related to significant weight gain over the course of elementary school.

Introduction

Numerous studies of family structure have noted the increasing instability of American families in the late 20th century and the early 21st century. The instability is a result of several concurrent processes including changing age of marriage, increasing cohabitation rates, non-marital births, and single parenthood, and declines in marriage rates. The age at first marriage has increased steadily since the 1960s due to the postponement of marriage; by 2002, the median age of first marriage for women was slightly over 25 and almost 27 for men (Cherlin 2005). Further contributing to family instability is the eschewing of marriage as a form of family formation in favor of cohabitation. Bumpass and Lu (2000) estimate in 1995, 45 percent of women have ever cohabited; this represents an increase of 12 percent since 1987. Research also confirms that cohabiting unions are a less stable relationship form than marriage (Bumpass and Lu 2000). Due to delayed marriage and increased cohabitation, non-marital births currently account for approximately 17 percent of births in the US (Andersson 2002).

Contributing to family structure instability is the high rate of union dissolution followed by a period of single parenthood, and then parental re-partnering. Approximately 40 percent of children by age 15 will experience a union dissolution (Andersson 2002). US children can, on average, expect to spend between 18 to 22 percent (roughly 2.7 years) of their childhood years (ages 0-14) with a single parent, most likely their mother (Andersson 2002; Heuveline, Timberlake, and Furstenberg 2003). Yet, in only a matter of a few years after a union dissolution, parents remarry. Estimates show that 47 percent of parents are remarried three years after a union dissolution and over 75 percent remarry ten years after the union dissolution (Andersson 2002).

The literature on family instability indicates that residing in a family structure other than a two parent family is the reality facing children in the US today. Children spend the duration of their childhood years outside of a two parent family and transitioning between family types. Half of all US children experience living outside of a two parent family by age 15 (Andersson 2002). Therefore, children in the US are facing family instability. Family instability does not just refer to a single transition, but implies multiple transitions in family structure. Prior research has shown that children who experience multiple transitions face worse developmental outcomes than children in stable two parent families or children in stable single parent families (Fomby

and Cherlin 2007). Furthermore, children have the most advantageous outcomes when residing with their two biological parents (Heuveline, Timberlake, and Furstenberg 2003).

This paper will use nationally representative data from the Early Childhood Longitudinal Study-Kindergarten cohort to analyze physical health outcomes for children in various family structures. The primary goal is to establish if there is a significant relationship between family structure and instability and weight status. The literature to date has only studied obesity outcomes for children in two parent families compared to those in single parent families and ignores family instability. A second goal of the paper is to determine if the association between family structure and instability and body mass index varies according to race/ethnicity. Minority children are more likely to be overweight and to experience marital disruption; yet, no prior study to my knowledge has studied race/ethnic variation in weight status according to family structure and instability.

Background

Research on family instability primarily focuses on behavioral, emotional, cognitive, educational, and future family formation outcomes for children. Causality between family structure and childhood outcomes has not been established, but is strongly suggested (Amato 2005). The consensus from the literature is that children residing in any family structure other than a two parent family have negative outcomes and children facing multiple family structure transitions have the worst outcomes.

Behavioral and Emotional Outcomes

Analyzing data on children ranging from 4 to 10 years in age, researchers find that children who reside outside of a two parent family and experience family instability are more likely to have problem behaviors. Children, especially boys, who reside in a single parent family or have recently experienced a divorce, are more likely to have problem internalizing and externalizing behaviors (Martinez and Forgatch 2002; Carlson and Corcoran 2001). Cavanagh and Huston (2006) found that among first graders, those in an unstable family had significantly higher problems with externalizing behaviors and disruptions with peers and teachers. Similarly among four to seven year olds, family transitions are significantly associated with increasing emotional and problem behaviors even when controlling for maternal characteristics and family socioeconomic status (Ram and Hou 2003).

Cognitive and Educational Outcomes

Research has shown a strong association between family instability and academic test scores and educational attainment. Children who undergo family transitions have significantly lower math and reading standardized test scores compared to children who remain in two parent families after controlling for demographic and maternal characteristics and socioeconomic status (Carlson and Corcoran 2001; Ram and Hou 2003; Martinez and Forgatch 2002; Sun and Li 2002). Pong and Ju found (2000) found that children who experienced a marital disruption are more likely to drop out of school compared to children in a two parent family. Additionally, children who reside in any family type other than a two parent family have lower educational attainment measured by continuous years of schooling, high school graduation, college attendance and graduation (Ginther and Pollak 2004).

Future Family Formation

Changes in family structure and family instability during childhood have long lasting implications. Thus, the effects of a family structure change on a child are seen in the short term on behavioral and educational outcomes and often in the family formation that the child undertakes later in life. Children who experienced a divorce are more likely to cohabit and to

have a non-marital birth by the age of 23 compared to children whose parents did not divorce (Cherlin, Kiernan, and Chase-Lansdale 1995). Moreover, children who face family instability are at a significantly higher risk of a pre-marital birth (Wu and Martinson 1993).

Physical Health Outcomes

One of the primary limitations of research on the outcomes of family instability on children is that it often ignores the physical well-being of children. There are a limited number of articles known to date examine the relationship between the physical health of children and family structure and instability. Using NHIS data, Mauldon (1990) finds that children of divorced parents are more likely to report the onset of an illness or general health problems compared to children who do not experience a union dissolution even controlling for confounding covariates. The results using another nationally representative data set, the NLSY, reveal that elementary school age children in a single parent household are more likely to be obese (BMI greater than or equal to the 95th percentile) in a six year follow up compared to children who remained in an intact family; however, family structure and instability were not the focus of the research (Strauss and Knight 1999).

Given the lack of evidence on the association between weight and family structure and instability, this paper aims to provide empirical evidence of the relationship between family instability and physical health using body mass index (BMI) as an indicator of physical well-being for children.

Body Mass Index among Children

The rise in obesity among children and the increase in family instability occurred at approximately the same time in the mid to late 20th century. Since the 1970s, the prevalence of obesity among children in the United States has steadily increased. Approximately 4 percent of elementary school age children in the early 1970s were considered obese (BMI at or above the 95th percentile). By the late 1980s, the percentage increased to 11.3 percent (Ogden, Flegal, Carroll, and Johnson 2002). This continued to increase to a peak of 17 percent by 2003-2006(Ogden, Carroll, Flegal 2008). Children who are obese are at risk for a multitude of health risks including hypertension, cardiovascular disease, and diabetes that might remain into adulthood (Deckelbaum & Williams 2001a; Dietz 1998; Strauss and Pollock 2003). Overweight and obese children have poor academic outcomes and mental health (Datar, Strum, and Magnabosco 2004; Strauss and Pollack 2003).

The risk of obesity does not affect all children equally; minority children are at a higher risk of being overweight or obese than are non-Hispanic white children. For example, Black and Mexican American elementary aged children have the highest odds of overweight status. Between the late 1980s and 2000 the prevalence of overweight status increased by 10 percentage points for Mexican American and Black children (Ogden, Flegal, Carroll, and Johnson 2002). Mexican American *boys* and Black *girls* are at particularly high risk of being overweight.

The minority children who experience the greatest risk of overweight status are also children who typically come from low socioeconomic status families. Low socioeconomic status families often live in areas of a city that are residentially segregated and isolated from lack adequate green space, sidewalks, opportunities for physical activity, perceive their neighborhood as less safe, and have less access to grocery stores or high quality, nutritious foods which all may negatively influence weight status. In addition to being low SES, minority children face high rates of family instability. Recent estimates suggest that 32 percent of first marriages among white women end in divorce but for Hispanic and black women the percentages are 34 and 47, respectively (Bramlett and Mosher 2002).

Theoretical Framework

The literature proposes several theoretical frameworks to explain the relationship between family structure and childhood outcomes. The theoretical concepts have not been empirically tested for BMI outcomes for children, but previous literature points to their relevance in explaining physical health outcomes. It is not the particular family structure that children live under that influence outcomes, but the experience of multiple stressful family transitions. The authors hypothesize that children living in a stable, single parent family fare better than children who transition to a step parent family (Fomby and Cherlin 2007).

Multiple transitions harm children by subjecting them to a stressful home environment constantly in flux with regards to parenting strategies, household membership, household location and family socioeconomic status. When a step parent or cohabiting partner enters the child's household it is a stressful situation especially for children. Coleman et al. (2000) concludes based on a review of empirical research that children experience a great deal of stress with the addition of a new parent figure. Others argue that multiple transitions reduce the amount of attention and involvement that parents can allocate towards their children. For example, multiple family structure transitions are associated with a decline in parental involvement in the education of their children (Sun 2001). Parents may reduce their involvement in physical activity with their child.

Marital disruptions and transitions often shift the economic resources available in a household. Mothers may return to work or work longer hours after a marital disruption. Children may lose health insurance in the wake of a marital disruption. With fewer economic resources and reduced time for childrearing, parents involved in marital transitions may pay less attention to the health and diet of their child and resort to less nutritious, processed convenient foods. Finally, multiple transitions may have a cumulative effect for children's outcomes. Empirical research has shown the accumulation of negative effects on childhood outcomes with each family structure transition (Wu 1996; Wu and Martinson 1992; Osborne and McLanahan Working paper).

In regards to the instability hypothesis, this paper will test if children who transition between family types will be more likely to gain weight over time. It is hypothesize that the transitions will be significantly associated with BMI even when controlling for parental involvement, prior health status, and family socioeconomic position.

Data

The analysis will use the Early Childhood Longitudinal Study Kindergarten (ECLS-K) cohort of 1998-1999 for this study. ECLS-K was conducted by the National Center for Education Statistics and followed a nationally representative sample of children from kindergarten through eighth grade (1998-1999 through 2006-2007) with an initial sample size over 21,000. The study gathered data from the schools, parents and the children and included an oversample of Asian and Hispanic children.

The ECLS-K uses a dual-frame multistage sampling strategy. The first stage consisted of selecting roughly 100 Primary Sampling Units (PSUs) based on counties or groups of counties, followed by the selection of 1,000 public and private schools within the PSUs. During the final stage, approximately 23 kindergarteners were selected from each school. The children were followed in the fall and spring of kindergarten, spring of first grade, spring of third grade, and spring of fifth grade. The ECLS-K survey team made efforts to follow movers between waves to reduce the attrition. However, by the fifth grade the kindergarten sample is reduced by half. The analytical sample size for this data analysis is 4,856 children with valid BMI measures in

kindergarten, 1st grade, 3rd grade and 5th grade. Listwise deletion is used to deal with missing data. An alternative strategy to handle the missing data may be a more efficient method that reduces the amount of cases lost due to missing values on one item.

Measures

Dependent Variable

To incorporate the outcome of interest, childhood body mass index (BMI), the study will use a standardized measure of obesity especially designed to measure children's weight status. The children were weighed and measured during the spring of kindergarten, first, third, and fifth grade. The ECLS-K staff assessed children's height and weight at each wave of data collection and recorded them using a Shorr Board and a digital scale. Prior research on childhood obesity has established body mass index as the preferred method of measuring overweight status for children. Center for Disease Control's growth charts are used to calculate age and sex specific percentile BMI scores and rankings for children (Kuczmarski, Ogden, & Guo, 2002). Percentile BMI compares children today against a standard population of children taken from U.S. surveys and vital statistics from the 1970s and the 1980s (Kuczmarski, Ogden, & Guo, 2002), a time period before the rapid increase in weight status among children. The Center for Disease Control's guidelines classify children with BMIs greater than or equal to 95th percentile for their gender-specific BMI-for-age as obese, and those with BMI greater than or equal to 85th percentile to less than or equal to 94th percentile as overweight.

As children age from kindergarten to fifth grade, percentile BMI steadily rises as expected. Yet the analysis will determine if the weight gain a child experiences is over and above an expected amount for the child's age and sex. For the analytical sample, in kindergarten the mean percentile BMI score is 60.15 (sd=28.79), in first grade the mean is 60.40 (sd=28.54), in third grade the mean percentile BMI is 63.28 (sd=29.07) and by fifth grade the mean BMI is 64.99 (sd=29.46).

Independent Variables

Parental marital status is coded into single parent family, step parent family, other family type with a two parent family as the reference category. The other family type includes all other alternative family living arrangements. Information on whether the parent is cohabiting is not directly obtainable in the data. The percentage of children living in single parent and step parent families increases as children age. In kindergarten and in first grade about 15 percent of children lived in single parent families, 17 percent by third grade, and 18 percent by fifth grade. About 5.6 percent of kindergartners, 7 percent of first graders, 8 percnet of third graders, and 9 percent of fifth graders live in step families. The percentage of children living in other family types averaged about 3 percent over the course of elementary school. The number of children living in two parent families declines as children age. Over three quarters of the sample lives in a two parent family in kindergarten; by fifth grade just over 70 percent remain in a two parent family.

The socioeconomic status of the child's household is composite measure of the father and mother's occupation and education and the household income created by ECLS-K survey team. The information for the measure is taken from the parent's interview in the fall or spring of their child's kindergarten year. Occupations are coded based on the 1989 General Social Survey (GSS) prestige scores. Missing values are imputed using hot deck methodology (Tourangeau 2006). It will be used as a continuous variable.

The family SES declines over time. In kindergarten the mean of the SES is 0.15 (sd=0.79). In first grade, the mean is 0.12 (sd=0.80); the mean of SES in third and fifth grade is 0.09 (sd=.80). There is no clear indication of the reason for the SES decline over time.

Control Variables

The control variables fall into several categories. The first includes demographic information about the child. Female is dummy coded to control for the different gender effects on BMI. The sample is split evenly between girls and boys. Five race/ethnicity categories used to distinguish between non-Hispanic blacks, non-Hispanic whites, Asians, Hispanics and Other races. Children of other races include including Pacific Islanders, Native American and Alaska natives and children of more than one race. Non-Hispanic whites are the reference group. Of the analytical sample, 71.5 percent are white, 9 percent are black, 10 percent are Hispanic, 4 percent are Asian, and 5.5% are other races. The nativity status of a child is controlled for denoting children of immigrants versus natives. Fifteen percent of the sample is a child of an immigrant.

The second set of control variables pertain to health condition and behaviors. Parents were asked to rate the health of their child from excellent (1) to poor (5). In general, elementary aged children are healthy. The mean of the health indicator was approximately 1.6 with a standard deviation around 0.8 for children in all four waves of the data. Parents reported the number of minutes per weekday their child watched television. Kindergarteners, first, and third graders, on average, watch 120 minutes of television on a weekday (sd=78); by fifth grade, children watch 124 minutes of TV per weekday (sd=74).

The final set of controls is related to the home environment. Mother's full time employment is coded to indicate that a child's mother works full time versus any other amount of hours worked. As the children age the percentage of mothers who work full time increases. In kindergarten 45 percent of mothers work full time, 48 percent in first grade, and 50 percent by third and fifth grade. Family meal frequency and family meals together at breakfast and dinner are coded from 0 to 7 to indicate how many times in a given week families eat together and regularly for each meal. Families typically eat breakfast and dinner regularly and together between four and five times each week regardless of the grade of the child.

Methods

To test the stated hypothesis on family instability and family structure, this study will use ordinary least squares, a lagged dependent variable regression, and fixed effect models. In a lagged dependent variable regression model, the OLS framework is used but a prior measure of the dependent variable, percentile BMI, is included in the prediction equation. The aim of the model is to minimize the sum of the squared residuals to find the best linear unbiased estimator. For the question at hand the lagged model is:

$$y_{BMI\ 5th}=\beta_0+ \beta_1 X(\text{SES K}) + \boldsymbol{\beta_2 X(\text{Demographic K})} + \boldsymbol{\beta_3 X(\text{Health K})} + \boldsymbol{\beta_4 X(\text{Family Structure K})} + \beta_1 X(\text{BMI K}) + E$$

Fifth grade percentile body mass index is predicted by socioeconomic status of the parents in kindergarten, a vector of demographic characteristics including race/ethnicity and gender of the child, a vector of health status variables for the child measured in kindergarten, family structure measured in kindergarten and the percentile BMI of the child in kindergarten. By including the prior measure of BMI the model controls from pre-schooling, home, and other unmeasured factors that may be related to weight status.

The fixed effects model departs from the previously discussed method that models change between individuals; instead, fixed effects assess change within an individual over time using the individual as their own control. The formula for an individual i in time t is given by:

$$y_{it} = \mu_t + \beta x_{it} + \varepsilon_{it}$$

where $= \mu_t$ is a time varying intercept for time t, βx_{it} is a vector of time varying coefficients for individual i in time t and ε_{it} represents random disturbance. For the analysis in this paper, the time varying coefficients include measures of family level socioeconomic status, the number of minutes per weekday spent watching television, mother's full time employment status, regularity and frequency of family meals, family structure, and health status of the child which are used to predict y_{it}, or change in percentile BMI from kindergarten to fifth grade. The utility of a fixed effects model is that it allows a researcher to assess within person variation over time or for the question at hand, the within person growth over time in BMI related to family instability. Each individual serves as their own control potentially removing omitted variable bias.

The analytic strategy for the paper is to first run a series of nested ordinary least squares regression models predicting percentile BMI in the 5th grade. The first model will include demographic variables such as race/ethnicity, child of an immigrant status, gender and family structure indicators, health behaviors and controls for family meal frequency and togetherness. Socioeconomic status and maternal employment status will be added to the third model. The final model is a lagged dependent variable model that includes a prior measure of BMI.

To estimate within person change in BMI and to evaluate whether changes in family structure is associated with higher BMI, a fixed effects model using only time-varying predictors will be used. The time varying predictors include family structure, health behaviors, family meal togetherness and frequency, family SES and maternal employment. In the final fixed effects model all of the aforementioned time varying covariates will be used along with interaction terms between demographic characteristics and time.

Results

The results of the nested regression model are presented in Table 2. Model 1 includes demographic characteristics, indicators of family structure, health behaviors and family meal characteristics. The race/ethnic results support findings from previous research; Hispanic, Black and children of immigrants have significantly higher percentile BMI scores compared to whites and natives. Asians and females have lower percentile BMI scores than whites and males.

Children residing in step parent families have significantly lower percentile BMI scores than children in two parent families. This result contrasts the finding of higher BMI for children in a family structure other than a two parent family found by Strauss and Knight (1999). Children residing in a single parent or other family type do not have percentile BMI scores that are significantly different than those of children in two parent families. Parental involvement in family meals, especially eating breakfast with their child significantly reduces a child's percentile BMI. Eating meals together may indicate parental supervision over a child's diet and general parental attentiveness.

Family level SES and maternal employment are added in Model 2. With each unit increase in SES, percentile BMI is significantly reduced by 4.27 percentage points. As expected given prior literature, there is a negative relationship between SES and BMI for children. Wealthier children have healthier weight statuses. Children whose mother works full time experience an increase in percentile BMI of almost 3 percentage points holding constant all else including SES, family structure and race/ethnicity.

The inclusion of socioeconomic status does not eliminate the race/ethnic variation in weight status; blacks still have significantly higher percentile BMI scores than whites, Asians and females have lower percentile BMIs. Nor does the inclusion of socioeconomic status mediate

the significant and negative association between living in a step parent family and percentile BMI.

Model 3, the lagged dependent variable model, includes percentile BMI in kindergarten which significantly predicts BMI in the 5th grade. Those with higher BMIs in kindergarten, have higher BMIs in 5th grade. Regardless of prior BMI or SES, children in step parent families have significantly lower BMI scores than those in two parent families. This finding is unexpected in light of prior research that children of divorce have worse developmental outcomes. Yet the result highlights what Fomby and Cherlin (2007) suggest: children residing in a stable family structure, even if it is not a two parent family, may be protected from the harmful influence of family disruptions.

Initially, both fixed and random effects models were estimated. The Hausman test was run to determine which effects model to use; the results provided a significant p-value suggesting the use of a fixed effects model. The fixed effects results are shown in Table 3. Only time varying coefficients are included in the model. The estimated effect for SES indicates that an increase in family SES lowers percentile BMI over time for each individual. Children in families who make gains in socioeconomic status over time experience declines in weight status from kindergarten to fifth grade. Changes towards any of the family structures, other than a two parent families, raise percentile BMI over the course of elementary school, net of other fixed effects. These results indicate that family instability over time is significantly related to poor weight status outcomes for elementary age children. Transitioning from a two parent family to any other family type is associated with weight gain for children over time. Children who transition to a step parent family experience the most weight gain over time compared to children who remain in two parent families over time.

When a child's mother changes from not working full time to working full time a, the children significantly gain weight over time. A change in maternal full time employment is associated with about a 0.7 percentage point gain in BMI for children. Similar to the results of the OLS model, mother's full time employment raises percentile BMI above each individual's percentile BMI in kindergarten.

Meals together and regularly do not work in expected directions or together. As the number of times per week a family eats breakfast together increases over time, the weight status of elementary aged children is significantly reduced. When a family eats dinner more regularly over time, children experience reductions in weight status. Families may be engaging over time in more breakfast meals together and dinner more regularly often as a reactive strategy to combat the increasing weight status of their child.

The final fixed effects model show in Table 4 includes interactions between time and time invariant characteristics. In the previous model the time variable indicated the mean effect of time for all individuals. With the inclusion of the demographic interactions the mean effect of time can be determined for individuals in particular groups. All of the demographic groups except for Asians and females have significant gains in percentile BMI over time. As in the prior table, a transition towards a single parent family is associated with increases in percentile BMI over time.

Discussion & Conclusion

Previous research on the family instability has focused on behavioral, cognitive, and educational outcomes and ignored physical health outcomes for children. Children in any family type other than a two parent family have poorer outcomes. Recent empirical research suggests that the negative outcomes children experience are the result of family instability due to multiple

family disruptions and the subsequent stress and decline in familial and economic resources. This analysis tests whether the family instability hypothesis is empirically supported in analysis of weight gain over time for elementary school aged children.

Additionally, this paper contributes to the existing literature in important ways. First, the analysis examines a relatively unexplored topic— the relationship between family structure and BMI for elementary age children. Prior analysis by Strauss and Knight (1999) only compared obesity outcomes for children in single parent families to those in two parent families. This study compares BMI outcomes for children in multiple family types, single, step, and other to two parent families.

Secondly, this analysis models the relationship between family structure transitions and BMI over time for children using fixed effect methodology. Fixed effects models estimate within person change in BMI over time. The strength of this method is that each person is their own control removing potential bias from unobserved variable bias. Only time varying processes influence the BMI outcomes for children in these models.

The results from the full linear regression model in Table 1 propose that residing in a stable step parent family may not be as harmful to children as previously suggested and may be health protective for the weight status of elementary school aged children. Children in a stable step parent family may have additional parental oversight, involvement and additional economic and familial resources. As Fomby and Cherlin (2007) indicate the family structure type may not be the mechanism driving negative outcomes for children in step families; instead family instability drives the negative outcomes.

While residing in a single parent family or other type of family was not found to have a significantly different effect on BMI than residing in a two parent family, it seems possible that stability in one of the alternative family types may not provide the same type or amount of health protective benefits to children's weight status as residing in a house with two adults. The idea that a stable family structure, regardless of family type, does not drive negative childhood outcomes may only be pertinent when other aspects of a child's life are stable such as the family income and residence.

The results of the fixed effects models stand in sharp contrast to the OLS regression results. In the OLS regressions the family types have negative coefficients indicating family structures, regardless of the type, do not harm children. However, family instability has negative implications for children's BMI outcomes. Family instability and multiple family disruptions are associated with weight gain over time for children. Multiple transitions may push children from a normal weight status to overweight. Furthermore, children in family types other than two parent families have most likely experienced multiple family structure transitions including a divorce and then the re-partnering of their parent. The stress of the transitions is evident in the accumulation of excess weight over time.

The results presented here have pertinent policy and health implications as the prevalence of family instability and obesity continues to rise. Family instability is strongly related to behavioral, cognitive, emotional, educational and also physical health outcomes. Children who grow up in unstable homes are more likely to have unstable families themselves (Cherlin, Kiernan, and Chase-Lansdale 1995) and to remain overweight. Programs and policies cannot reach inside homes or mandate family stability for children. However, schools, community outreach programs, extracurricular activity groups, and religious organizations can promote healthy behaviors and lifestyles to children. These groups and institutions can provide some,

likely not all, of the stability needed for positive development and outcomes that a family may be unable to provide.

Continued work on family instability and weight status should be to continue disentangling the process of family instability especially for various race/ethnic groups to explore differential weight gain from kindergarten to fifth grade. Given prior research it is likely that demographic groups of interest in this paper have different slopes in the fixed effects models; therefore, future analysis should employ interactions between the demographic groups and family structures. Further analysis should expand on the findings presented regarding family instability and body mass index. Family instability has a potentially large influence on the physical well-being of children now that could remain with them into adulthood. Growth curve modeling may be a useful methodology to utilize to capture weight gain over time among specific demographic groups.

The analysis has several pertinent limitations. Additional measures of SES should be create and tested to ensure measurement stability over time and allow for further testing of the economic deprivation hypothesis. Sampling weights need to be implemented to control for clustering in schools and the proper weighting of the oversample of black and Hispanic children. Additional data exploration is needed to understand the differential attrition rates over time for minority groups versus whites. It is probable that minorities of low SES have higher attrition rates and experience more family instability than those of higher SES or whites. Finally, further analysis needs to establish that the weight gain over time for kids is related to family instability and that the results are not just picking up a period of rapid growth for children.

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Table 1. Descriptive Statistics (N=4856)

	Mean	Std. Dev
Percentile BMI Kindergarten	60.15	28.79
Percentile BMI 1st grade	60.40	28.54
Percentile BMI 3rd grade	63.28	29.07
Percentile BMI 5th grade	64.99	29.46
SES K	0.15	0.79
SES 1	0.12	0.79
SES 3	0.09	0.79
SES 5	0.09	0.79
TV min/weekday K	120.43	78.11
TV min/weekday 1	120.43	78.11
TV min/weekday 3	119.64	76.92
TV min/weekday 5	124.78	73.87
Health K	1.63	0.79
Health 1	1.57	0.75
Health 3	1.61	0.78
Health 5	1.66	0.82
Black	0.09	0.29
Hispanic	0.10	0.30
Asian	0.04	0.19
Other	0.06	0.23
Child of an Immigrant	0.15	0.36
Female	0.50	0.50
Single K	0.15	0.36
Single 1	0.15	0.36
Single 3	0.17	0.37
Single 5	0.18	0.38
Step K	0.06	0.23
Step 1	0.07	0.25
Step 3	0.08	0.27
Step 5	0.09	0.28
Other Family Type K	0.03	0.16
Other Family Type 1	0.03	0.17
Other Family Type 3	0.03	0.17
Other Family Type 5	0.03	0.16
Two Parent Family K	0.76	0.42
Two Parent Family 1	0.75	0.43
Two Parent Family 3	0.73	0.45
Two Parent Family 5	0.71	0.45
Mother's Full Time Employment K	0.45	0.50

Mother's Full Time Employment 1	0.48	0.50
Mother's Full Time Employment 3	0.50	0.50
Mother's Full Time Employment 5	0.51	0.50
Breakfast Regularly K	5.64	1.69
Breakfast Regularly 1	5.57	1.58
Breakfast Regularly 3	5.33	1.64
Breakfast Regularly 5	5.21	1.63
Breakfast Together K	4.62	2.45
Breakfast Together 1	4.56	2.43
Breakfast Together 3	4.28	2.43
Breakfast Together 5	3.72	2.44
Dinner Regularly K	5.45	1.83
Dinner Regularly 1	5.35	1.83
Dinner Regularly 3	5.21	1.94
Dinner Regularly 5	4.92	2.01
Dinner Together K	5.70	1.74
Dinner Together 1	5.68	1.72
Dinner Together 3	5.66	1.67
Dinner Together 5	5.42	1.75

Table 2. Nested OLS Regression Predicting Percentile BMI in 5th Grade (N=4856)

	Model 1		Model 2		Model 3	
	B	SE(B)	B	SE(B)	B	SE(B)
Constant	68.14 ***	2.38	69.40 ***	2.44	28.64 ***	2.02
Black	4.70 **	1.61	3.31 *	1.61	1.80	1.25
Hispanic	2.84 *	1.44	2.16	1.43	0.37	1.11
Asian	-9.03 ***	2.41	-7.90 ***	2.41	-2.65	1.87
Other	1.63	1.86	1.24	1.85	2.97 *	1.43
Child of an Immigrant	3.08 *	1.30	1.89	1.31	1.63	1.01
Female	-2.41 **	0.84	-2.48 **	0.83	-1.47 *	0.64
Single Parent Family K	1.59	1.25	-0.38	1.27	-0.34	0.98
Step Parent Family K	-3.39 †	1.84	-5.24 **	1.84	-4.23 **	1.43
Other Family Type K	3.03	2.59	2.00	2.58	0.89	2.00
TV min/weekday K	0.02 ***	0.01	0.01 **	0.01	0.01 **	0.00
Health K	0.64	0.54	0.03	0.55	0.48	0.42
Breakfast Regularly K	-0.20	0.27	-0.13	0.27	-0.17	0.21
Breakfast Together K	-1.15 ***	0.19	-0.90 ***	0.19	-0.52 ***	0.15
Dinner Regularly K	-0.10	0.27	-0.08	0.27	-0.05	0.21
Dinner Together k	0.05	0.27	-0.11	0.27	-0.04	0.21
Mother's Full Time Employment			2.90 ***	0.85	0.99	0.66
SES K			-4.27 ***	0.60	-3.05 ***	0.46
Percentile BMI K					0.64 ***	0.01

*p<0.05; **p<0.01; ***p<0.001

†p<0.10

Table 3. Fixed Effects Model Predicting Percentile BMI (Obs=44763)

	B	SE(B)
Constant	62.81 ***	0.61
Single Parent Family	2.56 ***	0.49
Step Parent Family	3.05 ***	0.69
Other Family Type	1.93 *	0.95
TV min/weekday	0.00	0.00
Health	-0.07	0.14
Breakfast Regularly	0.01	0.06
Breakfast Together	-0.23 ***	0.05
Dinner Regularly	-0.15 *	0.06
Dinner Together	0.10	0.07
Mother's Full Time Employment	0.68 **	0.26
SES	-0.75 *	0.36

*p<0.05; **p<0.01; ***p<0.001

†p<0.10

Table 4. Fixed Effects with Time Interactions Predicting Percentile BMI (Obs=44763)

	B		SE(B)
Constant	57.83	***	0.64
Single Parent Family	1.30	**	0.49
Step Parent Family	0.74		0.69
Other Family Type	1.04		0.94
TV min/weekday	0.00		0.00
Health	-0.10		0.14
Breakfast Regularly	0.12	†	0.06
Breakfast Together	-0.08	†	0.05
Dinner Regularly	-0.05		0.06
Dinner Together	0.12	†	0.07
Mother's Full Time Employment	0.18		0.26
SES	0.07		0.35
Time	1.61	***	0.11
Time*Female	-0.68	***	0.14
Time*Black	1.27	***	0.22
Time*Hispanic	0.43	†	0.22
Time*Asian	-0.04		0.35
Time*Other	1.42	***	0.30
Time*Child of an Immigrant	0.74	***	0.19

*p<0.05; **p<0.01; ***p<0.001

†p<0.10