2014 Annual Meeting of the Population Association of America
Submission, Cavanagh, Smith, and Crosnoe

FAMILY STRUCTURE, PARENTS' PARTNER INSTABILITY, AND WEIGHT GAINS AND LOSSES FROM CHILDHOOD INTO ADOLESCENCE

Shannon E. Cavanagh
Chelsea Smith
Robert Crosnoe

University of Texas at Austin

Word Count: 6,273 (abstract and text), 1,563 (references)
2 Tables, 2 Figures

Abstract

Families are a primary context of physical development and therefore receive ample attention in health research and interventions targeting unhealthy aspects of body size in the early life course. Given recent growth in the diversity in family composition and in the prevalence of child overweight, this study explores associations of family structure and instability with increases and decreases in BMI, with special attention to how these associations vary from early childhood into adolescence. With longitudinal data from the NICHD Study of Early Child Care and Youth Development (n = 1,215), first difference models revealed that experiencing family instability and living in a single parent family were associated with weight gain in early adolescence. Living in a single parent family was also associated with weight loss in early childhood. These results suggest that the time following family transitions might be an ideal intervention point to promote healthy weight, especially among adolescents.

Families are a primary context of physical development. From childhood into adolescence, parents organize and regulate nutrition, physical activity, and the general health maintenance of their children (Fiese and Jones 2012; Ramey, Ramey, and Lanzi 2006). Consequently, they receive ample attention in health research and interventions targeting obesity, underweight, and other unhealthy aspects of body size in the early life course (Fiese and Jones 2012; Ramey et al. 2006; Stice, Shaw, and Marti 2006). Increasingly, this interest in the role of families in young people's weight has recognized the growing diversity in the composition of U.S. families. For example, evidence suggests that children and youth are at greater risk for being overweight when they live in single parent households and/or experience a dissolution in their parents' partnerships (Augustine and Kimbro 2013; Schmeer 2012). The potential significance of family composition for the (un)healthy weights of children is notable. After all, family composition is a target of child-focused policy. Moreover, family composition shapes the intra-familial processes that are proximate influences on the development of children but that are also difficult to manipulate externally on a larger scale (Furstenberg 2007; McLanahan 2004).

As such, this apparent link between family composition and body mass index (BMI) in the early stages of the life course needs to be carefully unpacked. We attempt just that here. First, although obesity garners most of the attention, other aspects of unhealthy body size may be related to family composition and need to be considered. Importantly, the family-based mechanisms (e.g., economic distress, disrupted routines) and individual responses to family composition and partner instability (e.g., maternal depression, child's internalizing behaviors) assumed to underlie the weight gains associated with "alternative" family structures apply equally well to weight loss, with both changes in body size a physical manifestation of experiences at home (Augustine and Kimbro 2013). Second, family composition has both static

and dynamic elements—the context in which a young person lives at any one time (family structure) and the recency with which partner transitions have occurred (partner instability). Each element comes with its own circumstances and dynamics relevant to weight changes (Cavanagh and Huston 2006). Third, just as fluctuations in weight are best understood as developmental phenomena that reflect evolving transactions between the child and environment, the interplay of family composition and body size is unlikely to be consistent in direction and magnitude over developmental time (O'Brien et al. 2007). As children grow up and transition into adolescence, they gain more control over their eating, activities, and general behavior and experience family life in new and different ways, dampening the potential for a direct role of parenting in body size even as the changing dynamics of family structure and instability may be more acutely felt (Crosnoe 2012). Together, these three angles point to the value of an ecologically-oriented developmental approach to family context and body size in childhood and adolescence, an approach emphasizing the continuity and change in both as well as the links between them.

In this spirit, this study explores the associations between family structure and partner instability on one hand and increases and declines in BMI on the other, with special attention to how these associations vary from early childhood into adolescence. To do so, we apply a within-child modeling framework that powerfully addresses the impact of stable factors selecting children into their family structures and provides evidence of whether family factors are linked with changes in child weight. These analyses are conducted with data from the NICHD Study of Early Child Care and Youth Development (SECCYD), which followed a birth cohort of children in multiple states to age 15. This research adds a key health issue to the rich literature on the developmental implications of family structure and partner instability while injecting a policy-relevant aspect of family context into the rich literature on child and adolescent weight.

Family Composition and Body Size

Changes in the composition and stability of American families and rising levels of obesity are two trends garnering attention from researchers, policymakers, and the media. First, the structure of U.S. families has undergone dramatic changes over the past 60 years. In 1950, nearly all children were born into nuclear families with two biological parents and full siblings, and about three quarters remained in them through adolescence (Furstenberg 2007). Today, family structure histories are far more complex due to declines in marriage and remarriage and increases in non-marital births, multi-partner fertility, cohabitation, and divorce (Cherlin 2009; Cavanagh 2008; Cancian, Meyer, and Cook 2011). Scholars measure this complexity with indicators of *family structure* (a snapshot of household composition) and *partner instability* (tracking the movements of parents' partners in and out of the home). Although both dimensions are linked to intra-family dynamics and are expected to matter to changes in children's weight, each taps into unique aspects of family complexity that are important to consider. Structure captures the economic and social resources, including time, which parents draw upon to organize their children's everyday lives, including their weight-related experiences and activities. Instability captures recent changes in household composition and the concomitant disruption in parenting, household routine, and children's behavior that can matter to children's weight.

Second, U.S. childhood obesity rates have more than doubled over the past 30 years (Ogden, et al. 2012). In the short term, overweight in the early life course is associated with increased risk for prediabetes, heart disease, and joint problems (Freedman et al. 2007; Dietz 2004). Moreover, due to persistent stigma of obesity in the U.S., overweight children are at greater risk of depression, social exclusion, and poorer school outcomes (Mustillo, Hendrix, and Schafer 2012; Crosnoe 2007; Brownell et al. 2005; Janssen et al. 2004). In the long-term, early

overweight is linked with adult overweight as well as increased risk of heart disease, diabetes, infertility, some cancers, and socio-emotional problems (Carr and Jaffee 2012; Freedman et al. 2007; Serdula et al. 1993). Overweight is not the only unhealthy weight issue of the early life course. Although rates of underweight are not rising, a substantial population of underweight youth still exists. They too face risks in both physical health (e.g., osteoporosis, compromised immune functioning) and socioemotional development (e.g., low academic progress) (Capogrossi and You 2012; Heninger and Luze 2010; Wendt and Kinsey 2009).

Taken together, these population trends represent significant changes in the future prospects of U.S. children. To understand how and why these trends intersect, we must consider the ways each dimension of both family composition (i.e., family structure, partner instability) and each dimension of child weight (i.e., weight gain and loss) are connected to each other.

Linking Family Composition to Body Size

An underlying assumption of this study is that all parents value good health for their children and seek to promote it. They do so by purchasing food, setting up routines around food and meals, and managing children's leisure activities (e.g., sports, media viewing, play) (Lindsay, Sussner, Kim, and Gortmaker 2006; Lareau 2002; Bianchi 2000). In other words, the mundane aspects of life, which require money and time, contribute to children's physical development and are at least nominally under parental control. Yet, parental control only goes so far, and children's eating and physical activity may fluctuate according to the ups and downs of their lives, including their emotional states and social functioning (Garasky et al. 2009). In these ways, family structure and partner instability may be related to children's weight by constraining the capabilities of parents to support their children's daily routines and by evoking in children attitudes, feelings, and behaviors that compromise their own development.

Of course, before discussing these potential mechanisms, we need to consider the alternate explanation, which is that any observed link between family context and children's weight changes is going to reflect some endogeneity—the factors that select children into concurrent or historical patterns of family composition may also influence their weight. After all, adults who choose to marry and to remain married are not representative of all U.S. adults (Cherlin 2010; Fomby and Cherlin 2008). Instead, they possess socially and economically advantageous characteristics that they pass on to their children through genetic and/or environmental means. For example, those who are stably married tend to have more education and, therefore, better access to information about healthy food and nutrition (Grunert et al. 2012). Thus, the apparent benefits of parents' marital statuses and stability are, in part, attributable to who decides to and is able to marry and stay married, rather than to the institution of marriage itself.

Yet, the argument of this study is that links between aspects of family composition and children's weight may not be solely attributable to selection. Instead, they could also reflect what parents and children do in the contexts of specific family structures and partner instability.

Beginning with parents, not residing in a stable married two biological parent household is associated with disruptions to and stresses on intra-family dynamics that can hamper a parent's ability to promote their child's health on a daily basis. For example, children in single parent families tend to eat fewer meals with parents than other children (Bradley et al. 2001). Single parents are also more likely to prepare meals from packaged or prepared foods (Zick and McCullough 1996) and spend less money on fruits and vegetables than married couples (Ziol-Guest, DeLeire, and Kalil 2006). Here, the absence of a second partner coupled with a greater likelihood of irregular work hours for the resident parent can translate into less money and time

to ensure healthier food options for children (Schmeer 2012). Similarly, relationships among members of stepparent and even cohabiting biological parent families tend to be more ambivalent and less regulated by norms of obligation than those in married two biological parent families, differences that can be significant to the organization of the household and the routines that contribute to children's health development (Sweeney 2010; Brown and Manning 2009).

Parents' partner instability can also affect the regulation of children's health (Hetherington, Bridges, and Insabella 1998). Ample evidence suggests that this period is a time of disrupted routines and relationships as family members adjust to their new circumstances (Fiese and Winter 2010; Osborne and McLanahan 2007). Given the links between household routines and children's health in general (Spagnola and Fiese 2007), these disruptions could be a channel through which children experiencing family change gain or lose weight. Similarly, maternal mental health may also mediate the link between each dimension of family composition and child weight. Maternal depression can contribute to changes in children's weight (McCurdy et al. 2010) and is associated with residing outside of married parent families and partner instability (Meadows et al. 2008). Mothers who are more depressed many be less able to manage their children's diet or less aware when higher or lower than expected weight gains occur. We also consider changes in income-to-needs as a potential mediator. Family structure and partner instability are associated with a family's economic security and stability (McLanahan and Percheski 2008). Moreover, limited or unstable income can limit resident parents' ability to purchases things (e.g., healthy foods, extracurricular activities, green spaces) associated with health (Grow et al. 2010; Lopez 2007). At the same time, limited resources can introduce stress that diminishes parenting behaviors and parent-child closeness in ways that matter to health (Middlemiss 2003).

Finally, the number of children in the household may also matter. Both the introduction and exit of children in the home can complicate household routines. More specifically, an increase in children brought on by new partnerships can impact family budgets and affect food purchases or the distribution of food within the home. At the same time, fewer children can reduce the likelihood of regular, organized family meals and affect children's growth. In other words, fewer children may make eating out (where portions are larger) more feasible than when the number of children in the home is higher (Jeffery et al. 2006).

Turning to children's responses, experiences of family structure and instability can evoke anxiety in children, and alterations in diet and activity might reflect active or passive coping (Garasky et al. 2009; Gundersen et al. 2008). Residing in a single parent or stepparent family or experiencing a recent exit or entrance of a parent's partner can be negatively experienced by children, as they miss the non-resident parent, resent a new parent figure, and are discomfited by change (Amato 2010). Importantly, children can also be affected by the distress that a resident parent or others in the home feel within a particular set of family circumstances (Amato 2005). Stress and anxiety may be alleviated by eating (or failing to eat) and engaging (or failing to engage) in activities that are associated with weight, through physiological and cognitive responses or through increased feelings of control (Garasky et al. 2009).

Taken together, family structure and partner instability can shape parenting behaviors and parental resources in ways that impact the regulation of children's weight, and they can also shape children's own responses in ways that could lead to weight gain or weight loss. Thus, we expect that living in family structures other than those headed by two married parents at any one time and experiencing instability in parents' partnerships over time will both be related to changes in child weight across the early life course, above and beyond many important sources

of selection into specific family contexts. Examining these associations—and exploring the role of parent and child mechanisms of mediation in them—is the primary goal of this study.

Of the focal dimensions of family composition, partner instability is likely more strongly associated with changes in children's weight than family structure. Net of instability, any family structure may be a state of equilibrium. For example, even though residing in a single parent household may be linked with lower income, inconsistent rules around food, and other potential health risks, families often reach a new "normal" and adjust to current household composition in ways that may mitigate these risks in time (Hetherington et al. 1998). Instability denotes more recent disruption and, as such, could evoke more acute reactions among all involved.

Changes in Weight and the Issue of Timing

Both the experience of family composition and physical development are dynamic and also defined by critical periods. First, family structure and partner instability may not be equally salient in all windows of time. For example, some evidence suggests that family structure disruptions in early childhood are associated with a host of developmental risks in childhood and beyond (Cavanagh and Huston 2008; Fomby and Bostick 2013). Yet, other evidence points to the significance of concurrent transitions, so that recency matters most (Cavanagh 2008). Second, BMI typically increases rapidly from birth to age 1, declines to a low point at about ages 5 to 7, and then increases thereafter, especially during early adolescence (Adair 2008; 2007).

Thus, timing is important to understanding how a child will experience life in a specific family context and how her or his body size changes. An argument of this study is that timing is also important to understanding how family composition and body size are connected. The aforementioned mechanisms by which family structure and partner instability might affect child

weight (i.e., family income, parental regulation, maternal depression, child responses) may become more or less significant at different development stages.

To begin, parents' management of the everyday tasks and routines of children declines as children age (Pettit et al. 2007). Children become more independent and are better able to take care of themselves, including feeding themselves, as they move into middle childhood and adolescence. Thus, children's weight maybe less affected by disruptions in household routines or composition or the distress among resident parents as children can be more responsible for themselves. At the same time, although the stress that children feel about family structure or partner instability may remain constant across their lives, the ways in which young people cope with this stress may change as they age and gain more autonomy (Compas et al. 2001). For example, as food becomes increasingly under young people's control, eating may become a more prominent way of coping. Thus, the two mechanisms may be working in opposite directions, with one declining in importance and the other increasing in importance over time

Exploring such age-related variation in the associations between family composition and children's weight is our secondary aim. The expectations are that parenting will do more to mediate the focal associations in early childhood (ages 2 to 5) than in middle childhood (grade 1 to grade 5) or early adolescence (grade 6 to age 15) and that children's responses will do more in adolescence. Given the developmental gradient of weight, we expect that weight loss will be more common in early childhood, weight gain more common in adolescence.

Methods

Data

The SECCYD has followed a sample of children from birth through adolescence. Although designed to explore the role of early care arrangements in children's development, it eventually grew into a more general study of the contexts and processes of the early life course (NICHD ECCRN 2005). Families were recruited from hospitals in which mothers had just given birth around Little Rock, AR; Irvine, CA; Lawrence, KS; Boston, MA; Philadelphia, PA; Pittsburgh, PA; Charlottesville, VA; Morganton, NC; Seattle, WA; and Madison, WI. Mothers had to be over 18 and conversant in English; infants had to be healthy singletons; and families could not be planning to move. Although the sample (N = 1,364) was not nationally representative, it was geographically, demographically, and socioeconomically diverse, with 24% non-white children, 11% mothers without a high school education, and 41% families with incomes below 200% of the federal poverty line for their household size.

Major data collections occurred at roughly two-year intervals from 1 month through the start of elementary school, then in first, third, fifth, and sixth grades, and then at age 15, with smaller-scale data collections in between these major assessment points. Multiple methodologies (e.g., direct assessments, surveys, observations) targeted children and parents in the home and laboratory. Our analytical sample included 1,215 children with available data on their BMI and family structure during at least one study wave, totaling to 3,176 observations. The Stata suite of *mi* commands estimated the 5% of the remaining data that were missing (StataCorp 2011).

Measures

Average *BMI* was measured during the three focal developmental stages: early childhood (24, 36, and 54 months), middle childhood (grades 1, 3, and 5) and early adolescence (6th grade and age 15). Children's weight and height were measured during laboratory visits and used to calculate children's BMI with the equation: BMI = weight (kg) / height^2 (m^2).

Family composition was assessed through two sets of measures. First, measures of *family structure* were based on interviews at 24 months, 1st grade, and 6th grade—the start of each developmental stage considered here—in which the mother (typically) completed a household roster listing each household member and that person's relationship to her and the study child. Structure was classified into five categories: 1) two married biological parents; 2) two cohabiting biological parents; 3) married biological parent and stepparent; 4) biological parent and cohabiting partner; 5) lone biological parent (Cavanagh and Huston 2006; 2008). Second, *partner instability* is based on the full set of family structure reports from 24 months to age 15 from telephone interviews (at 27, 30, 33, 42, 46, 50, 60, 66 months, fall and spring of kindergarten, fall of grade 1, fall and spring of grade 2, grade 4, and grade 6) and home interviews (at 24, 36, 54 months, spring of grade 1, grade 3, and grade 5). From these data, three binary variables indicated any partner transition in each developmental period. For example, a child who experienced any partner instability between 24 months and 33 months was coded as 1; all others were coded as 0.

Each of the potential parent/child mediators was measured similar to our measurement of BMI, calculated as averages during each of the three developmental periods. *Family income-to-needs* was calculated by dividing total family income by the federal poverty threshold for family size in that year. A 20-item scale gauged *maternal depression* according to the Center for Epidemiological Studies Depression Scale (Radloff 1977).The Home Observation of Measurement of the Environment (HOME) inventory score consisted of 60 dichotomous items measuring the quality and quantity of support, stimulation, and structure provided to children in their homes, gauging overall *home environment*. Finally, we drew on the Child Behavior Checklist (see Achenbach 1991) from mothers' reports on the frequency with which they

observed *children's internalizing symptoms* (e.g., withdrawn, somatic complaints, anxious/depressed) on a 0-2 Likert scale. Once the measure in question was created for every data collection point, we took the average of the year-specific measures during each period.

Plan of Analyses

Primary analyses involved first difference models estimated with the fixed effects procedure in Stata (see Allison 2005). The goal was to estimate associations between family structure and partner instability one on hand and BMI on the other. To address selection beyond observable covariates, the within-child approach of the fixed effects procedure accounted for unobservable confounds that were stably associated with family composition and BMI. Thus, it compared children to themselves (i.e., Is BMI higher or lower during times when a child lived in one family structure vs. living in another structure? Is BMI higher or lower during times when a child experienced a family structure transition vs. times of stability?). As such, it contrasts with traditional regression techniques that estimate between-child associations (i.e., Is BMI higher or lower for a child in one family context vs. a child in another family context? Is BMI higher or lower for a child who has experienced a family structure transition vs. a child who has not?).

The base model included only family structure and partner instability measures and developmental period as predictors of children's BMI. The family structure indicators captured family structure status at the beginning of that period, whereas the partner instability indicator captured any change during that developmental period. The next models added interaction terms between developmental period and the family composition variables to examine whether the association between family composition and BMI varied across the three periods. The final models added various proxy and direct indicators of the hypothesized mechanisms (income-to-needs, maternal depression, HOME score, number of children in the home, internalizing

behaviors) to examine the degree to which their inclusion attenuated previously observed associations between family composition and BMI in general and across periods.

Results

Table 1 provides a breakdown of the SECCYD on the key variables in this study. As expected, children's BMI increased across the early life course, with the average BMI for early adolescents significantly greater than their average BMI in early and middle childhood. Family complexity also increased across the early life course. At 24 months, 77% of children were residing with married biological parents, 6% resided with cohabiting biological parents, 14% resided in a single parent family, and 3% resided in a stepparent family. By early adolescence, children were less likely to reside with both biological parents (62% married, 3% cohabiting) and more likely to reside with a stepparent (15%) than when they were younger. Early adolescents were also less likely to live with a single parent (19%) than when they were younger. Consistent with these family structure changes, about a third of the sample experienced at least one parental partner transition between ages 2 and 15—23% during only one developmental period, with roughly equal proportions in early childhood, middle childhood, and early adolescence. Another 8% experienced parents' partner instability during two developmental stages, and 3% experienced change in all developmental stages.

[Table 1 About Here]

The focal mediators were also dynamic. Income-to-needs rose with age. Maternal depression was lower during middle childhood than in other developmental stages. Homes were rated as higher-quality during early childhood than in both middle childhood and early adolescence. The number of children in the home during early childhood was lower than during

middle childhood or early adolescence. Finally, young people exhibited lower levels of internalizing behavior as they moved through childhood.

Linking Family Composition to Changes in BMI

The first difference models in Table 2 explored within-child associations between dimensions of family composition and children's BMI, controlling for stable effects of time-invariant confounds. Beginning with Model 1, parents' partner instability was not associated with changes in BMI. As for family structure status, young people residing in stepparent families were somewhat more likely to report higher BMIs than when they lived in other family forms. Consistent with the descriptive analyses, developmental stage was linked with BMI scores. Young people in early adolescence had significantly higher BMIs than they did in early or middle childhood.

[Table 2 About Here]

The next set of models interacted indicators of family composition and developmental period, considering whether associations between family composition and changes in weight operate differently across developmental periods. Findings from Model 2 suggest that parents' partner instability operated differently across periods, with both main effects and the interaction term for partner instability and early childhood statistically significant. As illustrated in Figure 1, these findings suggest that parents' partner instability had little connection with young people's changes in BMI in early childhood but was linked with increases in their BMI in early adolescence. Turning to family structure (Model 3), significant interaction terms were identified for children residing in single parent households. As illustrated in Figure 2, residing in single parent families appeared to operate differently in different developmental periods. Those who

resided in single parent families weighed *less* during early childhood, but they demonstrated sharper *increases* in weight during later developmental periods.

[Figures 1-2 About Here]

To explore mediation, Model 4 included a set of time-varying covariates that tapped factors that might illuminate the links among partner instability, developmental period, and child weight. Beginning with parent/household characteristics, the income-to-needs ratio was negatively associated with changes in children's BMI. In other words, in periods in which income-to-needs was higher, children weighed less than in other periods with less money. The number of children in the household was modestly linked with changes in BMI. As the number of children in the household increased, children had lower scores when they lived with more children. No other potential parent/household mediators predicted BMI. Turning to child mediators, internalizing behaviors were positively associated with BMI, net of stable confounds. Once these parent and child factors were taken into account, the partner instability x developmental period interaction was attenuated and no longer significant at conventional levels. Separate models (available on request) suggested that the time-varying income-to-needs largely explained this attenuation.

Finally, Model 5 explored potential mediators of the association among family structure, developmental period, and child weight. Again, income-to-needs and children's internalizing behaviors were significantly associated with children's BMI, net of all stable confounds. Yet, their inclusion led to little attenuation of the previously observed (Model 3) interaction between single parent family structure and developmental period. Thus, unlike for parents' partner instability, no evidence of mediation was revealed for family structure.

Conclusion

Children's weight is an important marker of physical development. As has been well-documented, children's and adolescents' weights and risks for obesity have increased dramatically over the last past 30 years in the U.S., leading to much public discussion, research, and public health intervention on the obesity "pandemic" (Ogden et al. 2012). Although the most recent estimates suggest that these increases in unhealthy weight are stabilizing, understanding the social factors that shape changes in weight—including underweight—remain an important task, given the stakes involved. In this study, we looked to timely dimensions of the family context—another arena of social life that has become increasingly complex over the past half century and triggered much debate—to better understand how and why U.S. children are able to maintain healthy weight or not and to take research-based action to promote this goal.

First, although the direct "effects" of family composition on changes in child weight in the SECCYD were modest, they were meaningful in terms of variation by developmental period and comparisons across dimensions of the family context. Beginning with partner instability among parents, a recent entry or exit of a parent's partner was associated with greater increases in a young person's BMI in in early adolescence (and, to a lesser extent, middle childhood) than in early childhood. Similarly, residing in a single parent family was associated with weight gains in different ways as children aged. Children weighed *less* in times of their lives when they lived in single parent families than in times when they lived in married two parent families, but only if their time in single parent families occurred in early childhood. When that time came during middle childhood or early adolescence, they weighed more when living in single parent families (compared to when they lived in married two-parent families). In other words, parent or child

reactions to the experience of living in a single parent family led to weight loss among young children but weight gain among older children.

Taken together, these findings suggest that family composition and stability become more salient as young people move out of childhood and into adolescence but only in terms of weight gain and not weight loss. Although past evidence has consistently pointed to the long reach of early family structure and instability for a host of social, emotional, and academic outcomes (e.g., Fomby and Bostick 2011; Ryan and Claessens 2010), the results of this study suggest that family changes matter more to a key aspect of physical health when young people are gaining more autonomy and control over their bodies *and* as the body and its presentation become more central to their identity development. Overeating and other unhealthy states (e.g., being sedentary) may be ways that young people cope with their family circumstances. Conversely, the early childhood weight loss pattern suggests that diet and food intake may be of concern in developmental periods in which children are most dependent on parents and other adults for routine health maintenance.

We had anticipated that parents' partner instability would be more strongly associated with changes in children's weight than family structure, but the findings, including the pseudo R^2 values in the first difference models, suggest that both dimensions of family composition mattered similarly to changes in children's BMI over time. We should reiterate, however, that we were not measuring obesity or underweight, as defined by the Centers for Disease Control and Prevention or other professional health organizations. Rather, our analyses measured increases and decreases in BMI score, a dynamic component of weight that is relevant to body size but likely captures reactions to certain family circumstances more than overall states.

Second, of the time-varying factors considered as potential mediators of observed associations between family composition and children's BMI, both income-to-needs and children's internalizing behaviors significantly predicted increases in BMI. This former pattern suggests that limited resources likely affected the way parents used money to support children's health, potentially purchasing cheaper, less healthy food options for children. The latter pattern suggests that weight gain was associated with higher levels of internalizing behavior such as depression or anxiety, consistent with previous research on the link between depression and overweight (Stunkard, Faith, and Allison 2003). Once taken into account, these factors (especially income-to-needs) appeared to mediate the links among parents' partner instability, children's BMI, and developmental period. In other words, a recent change (or multiple changes) in partner status may have changed income levels in a way that was linked with child weight.

Interestingly, none of the potential mediators had any appreciable effect on the corresponding associations for family structure. This difference suggests that, although both aspects of family composition matter to children's weight, family structure and partner instability captured distinct dimensions of the family environment. Partner instability, net of current family structure status, likely tapped the uncertainty in a family system following the movement of a partner (or parent) in or out of a household. This uncertainty could reduce household income, disrupt household routines, and affect individuals in the home in ways that mattered to children's weight in the short term. Family structure, on the other hand, did not operate through these dimensions of the home environment. Recall that, by using first difference models, we controlled for stable characteristics like persistent poverty (or wealth) or personality traits of children and parents. Thus, residing in single parent family likely comes with a fairly consistent set of

circumstances that either support healthy weight or not—the experience matters itself, not adapting to a new experience.

These findings suggest that the time following transitions might be an ideal intervention point. Schools are one possible location for policy intervention aimed at helping families promote healthy child weight, especially as it may fluctuate under various family compositions. The changes in household income brought on by family instability could mean that families are unable to afford after-school activities, such as sports, that encourage physical activity among early adolescents. Young people may need to get jobs or work more hours to contribute to the household, or parents may become unable to afford team fees or sports equipment. Strengthening sports programs to be available for older students of all income levels is one approach could address the connection between weight gain and family change among early adolescents by allowing them to continue participating even if their financial resources shift. Interventions should also target children in single parent families, although the type of intervention should differ by age given our finding that, relative to residing with biological married parents, children weighed *less* when they resided in single parent households in early childhood but weighed *more* when they resided in such households in early adolescence. Policies and programs that focus on nutrition for young children in single parent families and those that involve physical activity for adolescents could address this disparity. Possible interventions include more nutritious and satisfying school lunches for preschoolers and improved physical education and exercise regimens for middle school and high school students.

Although this study considered the role of timing in the link between family composition and weight gain or loss, it is not without limitations. First, the use of fixed-effects models controlled for time-invariant confounds associated with both family composition and weight but

did not control for possible time-varying confounds. Moreover, this analytical strategy partially controlled for unobserved heterogeneity at the within-child level but meant that we could not examine unchanging mediators that could be relevant to between-child differences. For example, experiences of family structure and instability may matter differently to weight gains and losses for boys versus girls, as the literatures on family instability and overweight suggest (Cavanagh and Huston 2008; Osborne and McLanahan 2007; Dietz 2004). Second, our results are not generalizable to the entire U.S. population because the SECCYD is not nationally representative. Nonetheless, our sample is drawn from numerous states across the country and is relatively race/ethnically and socioeconomically diverse. A great strength of the SECCYD data, however, is that they span from birth through age 15 and cover a wide variety of topics in-depth. In this study, we utilized data from eight time points across three developmental stages. Finally, although it was assessed by a nurse in a laboratory setting, thus ensuring more accurate measurement than self-reports, BMI score is not the best measure of body size or composition. Prentice and Jebb (2001), for example, illustrate the measure's shortcomings with a scenario of a professional football player whose BMI classifies him as nearly very severely obese despite his body fat content being less than 20 percent. Despite these drawbacks, BMI is widely accepted and used in medical and social science research, especially age- and sex-adjusted scores for children as were used in this study. We also use BMI as an indicator of weight gains and losses, not necessarily over/underweight, to underscore how changes in one aspect of children's lives (family composition) could affect changes in another (weight).

The lives of children in the U.S. look very different than they did 40 years ago, especially in terms of their body size and family experiences. In this study, we investigated how experiencing change in these two dimensions—family composition and weight—may by

interconnected, and whether this link varies across developmental periods. Although recent family instability was associated with weight gain in early adolescence, this effect occurred through changes in household income. Living with a single parent also led to weight gain in early adolescence, yet the experience of living in a single parent household led to weight loss among young children. Given the rising prevalence of overweight and obesity, these findings suggest a need for greater support in promoting child health for low-income families experiencing instability and for single parent families, especially as children reach adolescence and gain more control over their eating and exercise behaviors.

References

Achenbach, Thomas M. 1991. *Integrative Guide to the 1991 CBCL/4-18, YSR, and TRF Profiles*. Burlington, VT: University of Vermont, Department of Psychology.

Adair, Linda S. 2008. "Child and Adolescent Obesity: Epidemiology and Developmental Perspectives." *Physiology & Behavior* 92:8-16.

Adair, Linda S. 2007. "Size at Birth and Growth Trajectories to Young Adulthood." *American Journal of Human Biology* 19:327-337.

Allison, Paul. 2005. *Fixed Effects Regression Methods for Longitudinal Data*. Cary, NC: SAS Institute.

Amato, Paul. 2010. "Research on Divorce: Continuing Trends and New Developments." *Journal of Marriage and Family* 72:650-666.

Augustine, Jennifer M. and Rachel T. Kimbro. 2013. "Family Structure and Obesity among U.S. Children." *Journal of Applied Research on Children* 4.

Amato, Paul. 2005. "The Impact of Family Formation Change on the Cognitive, Social, and Emotional Well-being of the Next Generation." *Future of Children* 15:75-96.

Bianchi, Suzanne M. 2000. "Maternal Employment and Time with Children: Dramatic Change or Surprising Continuity? *Demography* 37:401-414.

Bradley, Robert H., Robert F. Corwyn, Harriette Pipes McAdoo, and Cynthia García Coll. 2001. "The Home Environments of Children in the United States Part I: Variations by Age, Ethnicity, and Poverty Status." *Child Development* 72:1844-1867.

Brown, Susan L. and Wendy D. Manning. 2009. "Family Boundary Ambiguity and the Measurement of Family Structure: The Significance of Cohabitation." *Demography* 46:85-101.

Brownell, Kelly D., Rebecca M. Puhl, Marlene B. Schwartz, and Leslie Rudd. 2005. *Weight Bias: Nature, Consequences, and Remedies*. New York: Guilford.

Cancian, Maria, Daniel R. Meyer, and Steven T. Cook. 2011. "The Evolution of Family Complexity from the Perspective of Nonmarital Children." *Demography* 48:957-982.

Capogrossi, Kristen and Wen You. 2012. "Do School Lunch Programs Influence Child Weight? A Treatment Effect Analysis." Presented at the Annual Meeting of the Agricultural and Applied Economics Association, August 12-14, Seattle, Washington.

Carr, Deborah and Karen Jaffe. 2012. "The Psychological Consequences of Weight Change Trajectories: Evidence from Quantitative and Qualitative Data." *Economics and Human Biology* 10:419-430.

Cavanagh, Shannon E. 2008. "Family Structure History and Adolescent Adjustment." *Journal of Family Issues* 29:944-980.

Cavanagh, Shannon E. and Aletha C. Huston. 2008. "The Timing of Family Instability and Children's Social Development." *Journal of Marriage and Family* 70:1258-1269.

Cavanagh, Shannon E. and Aletha C. Huston. 2006. "Family Instability and Children's Early Problem Behavior." *Social Forces* 85:551-581.

Cherlin, Andrew J. 2010. "Demographic Trends in the United States: A Review of Research in the 2000s." *Journal of Marriage and Family* 72:1-17.

Cherlin, Andrew J. 2009. *The Marriage Go Round*. New York: Random House.

Compas, Bruce E., Jennifer K. Connor-Smith, Heidi Saltzman, Alexandria Harding Thomsen, and Martha E. Wadsworth. 2001. "Coping with Stress during Childhood and Adolescence: Problems, Progress, and Potential in Theory and Research." *Psychological Bulletin* 127:87.

Crosnoe, Robert. 2012. “Obesity, Family Instability, and Socioemotional Health in Adolescence.” *Economics and Human Biology* 10:375-384.

Crosnoe, Robert. 2007. “Gender, Obesity, and Education.” *Sociology of Education* 80:241-260.

Dietz, William H. 2004. “Overweight in Childhood and Adolescence.” *New England Journal of Medicine* 350:855-857.

Fiese, Barbara H. and Blake L. Jones. 2012. “Food and Family: A Socio-ecological Perspective for Child Development.” *Advances in Child Development and Behavior* 42:307-337.

Fiese, Barbara H. and Marcia A. Winter. 2010. “The Dynamics of Family Chaos and its Relation to Children’s Socioemotional Well-being.” Pp. 49-66 in *Chaos and Its Influence on Children’s Development: An Ecological Perspective*, edited by Gary W. Evans and Theodore D. Wachs. Washington, DC: American Psychological Association.

Fomby, Paula and Stacey J. Bosick. 2013. “Family Instability and the Transition to Adulthood.” *Journal of Marriage and Family* 75:1266-1287.

Fomby, Paula and Andrew J. Cherlin. 2008. “Family Instability and Child Well-being.” *American Sociological Review* 72:181-204.

Freedman, David S., Zuguo Mei, Sathanur R. Srinivasan, Gerald S. Berenson, and William H. Dietz. 2007. “Cardiovascular Risk Factors and Excess Adiposity among Overweight Children and Adolescents: The Bogalusa Heart Study.” *Journal of Pediatrics* 150:12–17.e2.

Furstenberg, Frank F. 2007. “Should Government Promote Marriage?” *Journal of Policy Analysis and Management* 26:956-960.

Garasky, Steven, Susan D. Stewart, Craig Gundersen, Brenda J. Johman, and Joey C. Eisenmann. 2009. “Family Stressors and Child Obesity.” *Social Science Research* 38:755-766.

Grow, H. Mollie Greves, Andrea J. Cook, David E. Arterburn, Brian E. Saelens, Adam Drewnowski, and Paula Lozano. 2010. “Child Obesity Associated with Social Disadvantage of Children’s Neighborhoods.” *Social Science & Medicine* 71:584-591.

Grunert, Klaus G., Josephine Wills, Laura Fernández Celemín, Liisa Lähteenmäki, Joachim Scholderer, and Stefan Storcksdieck genannt Bonsmann. 2012. “Socio-demographic and Attitudinal Determinants of Nutrition Knowledge of Food Shoppers in Six European Countries.” *Food Quality and Preference* 26:166-177.

Gundersen, Craig, Brenda J. Lohman, Steven Garasky, Susan Stewart, and Joey Eisenmann. 2008. “Food Security, Maternal Stressors, and Overweight among Low-income US Children: Results from the National Health and Nutrition Examination Survey (1999-2002).” *Pediatrics* 122:e529-e540.

Henninger, William R. and Gayle J. Luze. 2010. "Differences in Parental Perceptions of the Socio-emotional Development of Underweight, Overweight, and Typically Weighted Children in a Low-income Sample." *Journal of Child Health Care* 14.3:250-260.

Hetherington, E. Mavis, Margaret Bridges, and Glendessa M. Insabella. 1998. “What Matters? What Does Not? Five Perspectives on the Association between Marital Transitions and Children’s Adjustment.” *American Psychologist* 53:167-184.

Janssen, Ian, Wendy M. Craig, William F. Boyce, and William Pickett, W. 2004. “Associations Between Overweight and Obesity with Bullying Behaviors in School-age Children.” *Pediatrics* 113:1187-1193.

Jeffery, Robert W., Judy Baxter, Maureen McGuire, and Jennifer Linde. 2006. “Are Fast Food Restaurants an Environmental Risk Factor for Obesity?” *International Journal of Behavioral Nutrition and Physical Activity* 3:2.

Lareau, Annette. 2002. “Invisible Inequality: Social Class and Childrearing in Black and White Families.” *American Sociological Review* 67:747-776.

Lindsay, Ana C., Katarina M. Sussner, Juhee Kim, and Steven Lawrence Gortmaker. 2006. “The Role of Parents in Preventing Childhood Obesity.” *The Future of Children* 16:169-186.

Lopez, Russ P. 2007. “Neighborhood Risk Factors for Obesity.” *Obesity* 15:2111-2119.

McCurdy, Karen, Kathleen S. Gorman, and Elizabeth Metallinos-Katsaras. 2010. “From Poverty to Food Insecurity and Child Overweight: A Family Stress Approach.” *Child Development Perspectives* 4:144-151.

McLanahan, Sara. 2004. “Diverging Destinies: How Children are Faring Under the Second Demographic Transition.” *Demography* 41:607-627.

McLanahan, Sara and Christine Percheski. 2008. “Family Structure and the Reproduction of Inequalities.” *Annual Review of Sociology* 34:257-276.

Meadows, Sarah O., Sara S. McLanahan, and Jeanne Brooks-Gunn. 2008. “Stability and Change in Family Structure and Maternal Health Trajectories.” American Sociological Review 73:314-334.

Middlemiss, Wendy. 2003. “Poverty, Stress, and Support: Patterns of Parenting Behaviour among Lower Income Black and Lower Income White Mothers.” *Infant and Child Development* 12:293-300.

Mustillo, Sarah A., Kimber L. Hendrix, and Markus H. Schafer. 2012. “Trajectories of Body Mass and Self-concept in Black and White Girls: The Lingering Effects of Stigma.” *Journal of Health and Social Behavior* 53:2-16.

NICHD Early Child Care Network. 2005. *Child Care and Child Development: Results from NICHD’s Study of Early Child Care and Youth Development*. New York: Guilford Press.

O'Brien, Marion, Philip R. Nader, Renate M. Houts, Robert Bradley, Sarah L. Friedman, Jay Belsky, and Elizabeth Susman. 2007. “The Ecology of Childhood Overweight: A 12-year Longitudinal Analysis.” *International Journal of Obesity* 31:1469-1478.

Ogden, Cynthia L., Margaret D. Carroll, Brian K. Kit, and Katherine M. Flegal. 2012. “Prevalence of Obesity and Trends in Body Mass Index among US Children and Adolescents, 1999-2010.” *The Journal of the American Medical Association* 307:483-490.

Osborne, Cynthia and Sara McLanahan. 2007. “Partnership Instability and Child Well-Being.” *Journal of Marriage and Family* 69:1065-1083.

Pettit, Gregory S., Margaret K. Keiley, Robert D. Laird, John E. Bates, and Kenneth A. Dodge. 2007. "Predicting the Developmental Course of Mother-reported Monitoring Across Childhood and Adolescence from Early Proactive Parenting, Child Temperament, and Parents' Worries." *Journal of Family Psychology* 21:206.

Prentice, Andrew M. and Susan A. Jebb. 2001. “Beyond Body Mass Index.” *Obesity Reviews* 2:141-147.

Radloff, Lenore S. 1977. “The CES-D Scale: A Self-Report Depression Scale for Research in the General Population.” *Applied Psychological Measurement* 1:385-401.

Ramey, Craig T., Sharon Landesman Ramey, and Robin Gaines Lanzi. 2006. “Children’s Health and Education.” Pp. 864-892 in *The Handbook of Child Psychology*, edited by Irving E. Sigel and K. Ann Renninger. Hoboken, NJ: Wiley and Sons.

Ryan, Rebecca M. and Amy Claessens. 2012. “Associations between Family Structure Changes and Children’s Behavior Problems: The Moderating Effects of Timing and Marital Birth.” *Developmental Psychology* 49:1219-1231.

Serdula, Mary K., Donna Ivery, Ralph J. Coates, David S. Freedman, David F. Williamson, and Tim Byers. 1993. “Do Obese Children Become Obese Adults?” *Preventive Medicine* 22:167–177.

Schmeer, Kammi K. 2012. “Family Structure and Obesity in Early Childhood.” *Social Science Research* 41: 820-832.

Spagnola, Mary and Barbara H. Fiese. 2007. “Family Routines and Rituals: A Context for Development in the Lives of Young Children.” *Infants & Young Children* 20:284-299.

StataCorp. 2011. *Stata Statistical Software: Release 12*. College Station, TX: StataCorp LP.

Stice, Eric, Heather Shaw, and C. Nathan Marti. 2006. “A Meta-analytic Review of Obesity Prevention Programs for Children and Adolescents: The Skinny on Interventions that Work.” *Psychological Bulletin* 132:667.

Stunkard, Albert J., Myles S. Faith, and Kelly C. Allison. 2003. “Depression and Obesity.” *Biological Psychiatry* 54:330-337.

Sweeney, Megan M. 2010. “Remarriage and Stepfamilies: Strategic Sites for Family Scholarship in the 21st Century.” *Journal of Marriage and Family* 72:667-684.

Wendt, Minh and Jean Kinsey. 2009. “Childhood Overweight and School Outcomes.” Presented at the Annual Meeting of the Agricultural and Applied Economics Association, July 26-28, Milwaukee, WI.

Zick, Cathleen D., Jane McCullough, and Ken R. Smith. 1996. “Trade-offs between Purchased Services and Time in Single-parent and Two-parent Families.” *Journal of Consumer Affairs* 30:1-23.

Ziol-Guest, Kathleen M., Thomas DeLeire, and Ariel Kalil. 2006. “The Allocation of Food Expenditure in Married- and Single-parent Families.” *Journal of Consumer Affairs* 40:347-371.

Table 1. Descriptive Statistics of Study Variables for Sample, by Developmental Period

	M (SD)			
	Overall	Early Childhood	Middle Childhood	Early Adolescence
BMI Score	18.67	16.34 [a, b]	18.35 [a]	21.91
	(4.19)	(1.45)	(3.64)	(4.92)
Any Family Change	0.37	0.13 [b]	0.18	0.15
	(0.36)	(0.34)	(0.38)	(0.36)
Family Structure				
Married bio	0.70	0.77 [a, b]	0.68 [a]	0.62
	(0.46)	(0.42)	(0.47)	(0.49)
Cohab bio	0.05	0.06 [a, b]	0.04	0.03
	(0.21)	(0.24)	(0.20)	(0.18)
Step (married or cohab)	0.08	0.03 [a, b]	0.09 [a]	0.15
	(0.28)	(0.16)	(0.28)	(0.35)
Single parent	0.17	0.14 [a, b]	0.19	0.19
	(0.38)	(0.35)	(0.39)	(0.40)
Income-to-Needs Ratio	4.18	3.62 [a, b]	4.21 [a]	4.83
	(3.66)	(2.84)	(3.29)	(4.69)
Number of Kids in Household	2.31	2.13 [a, b]	2.41	2.41
	(0.97)	(0.95)	(0.93)	(1.00)
Maternal Depression	9.28	9.46 [b]	8.67 [a]	9.73
	(7.44)	(7.19)	(7.18)	(8.00)
HOME Score	40.91	43.51 [a, b]	41.58 [a]	36.78
	(6.32)	(6.12)	(5.60)	(5.18)
Internalizing Behavior Problems	48.55	49.75 [a, b]	48.43 [a]	47.20
	(8.51)	(7.88)	(8.47)	(9.07)
Observations	3,176	1,169	1,060	947

Note: *t*-tests indicated significant differences at the $p < .05$ level in variables between developmental period: [a] Significantly different from early adolescence; [b] Significantly different from middle childhood.

Table 2. Fixed Effects Linear Regression Models Predicting BMI Score

	β Coefficient (SE)				
	(1)	(2)	(3)	(4)	(5)
Any Family Change During Period	0.254	0.722**	0.321†	0.655*	0.297
	(0.179)	(0.263)	(0.180)	(0.265)	(0.185)
Family Structure (Ref: Married Bio)					
Cohab bio	0.128	0.140	0.678	0.119	0.599
	(0.422)	(0.422)	(0.636)	(0.421)	(0.634)
Step (married or cohab)	0.549†	0.365	0.556†	0.390	0.542†
	(0.284)	(0.298)	(0.318)	(0.297)	(0.318)
Single parent	0.266	0.179	1.095***	0.138	1.005***
	(0.231)	(0.235)	(0.275)	(0.235)	(0.275)
Developmental Period (Ref: Early Adolescence)					
Early childhood	-5.480***	-5.385***	-5.101***	-5.772***	-5.467***
	(0.111)	(0.120)	(0.129)	(0.172)	(0.177)
Middle childhood	-3.492***	-3.413***	-3.284***	-3.622***	-3.487***
	(0.105)	(0.117)	(0.128)	(0.141)	(0.153)
Family x Period Interactions					
Family change x early childhood		-0.814*		-0.704†	
		(0.403)		(0.405)	
Family change x middle childhood		-0.572†		-0.511	
		(0.330)		(0.329)	
Cohab bio family x early childhood			-1.107†		-1.024†
			(0.593)		(0.593)
Cohab bio family x middle childhood			-0.385		-0.334
			(0.578)		(0.578)
Step family x early childhood			-0.006		0.023
			(0.574)		(0.573)
Step family x middle childhood			-0.308		-0.289
			(0.364)		(0.363)
Single parent family x early childhood			-2.059***		-2.011***
			(0.324)		(0.324)
Single parent family x middle childhood			-0.921**		-0.859**
			(0.289)		(0.289)
Covariates					
Income-to-needs ratio				-0.089***	-0.083**
				(0.027)	(0.026)
Number of children in household				-0.180†	-0.152
				(0.096)	(0.095)
Maternal depression				-0.011	-0.007
				(0.011)	(0.011)
HOME score				0.022	0.019
				(0.015)	(0.015)
Internalizing behavior problems				0.025**	0.028**
				(0.010)	(0.009)
Constant	21.718***	21.690***	21.533***	20.720***	20.361***
	(0.115)	(0.116)	(0.122)	(0.807)	(0.808)
Pseudo R^2	0.303	0.304	0.305	0.323	0.324
Observations = 3,176; *n* respondents = 1,215					

Note: †p < .1, *p < .05, **p < .01, ***p < .001. Standard errors in parentheses.

Figure 1. BMI Score, by Family Change and Developmental Period

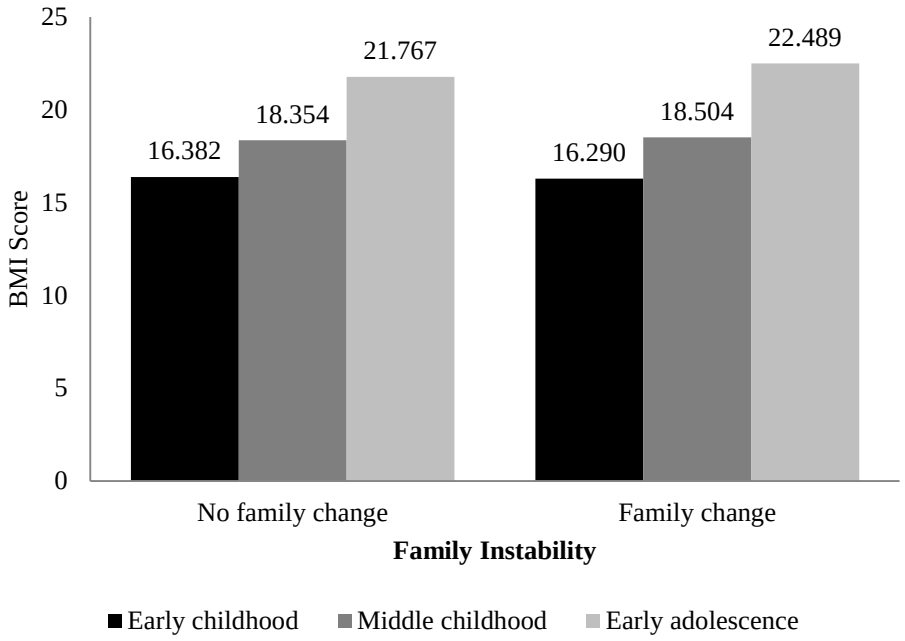

Figure 2. BMI Score, by Family Structure and Developmental Period