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Family Structure and Obesity Among U.S. Children

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Child overweight and obesity in the U.S. is a significant public health issue. In 2008 nearly one-third of all U.S. children ages two to seventeen were obese or overweight[11]. For young children ages two to five, fully 21.2% were overweight (at or above the 85th%ile based on the CDC's sex-specific BMI-for-age growth charts), while 10.4% of preschoolers were obese (at or above the 95th%ile)[11].The prevalence of overweight and obesity among U.S. children has implications for children's future health and the health trajectory of the nation. For example, children who are overweight are more likely to grow up to be overweight or obese[1-3], to suffer health consequences both as children and later in life[4-6], and to experience social and behavioral difficulties[7,8]. Moreover, in 2009 the estimated annual healthcare costs in the U.S. related to obesity topped $145 billion[9], a figure which is expected to increase as obese children age and develop other health problems[10]. Thus, while recent data show that trends in children's overweight and obesity rates are stabilizing, obesity continues to be a substantial problem, including among younger preschool-aged children, and identifying the contributing factors to it an important goal.

By and large, scientists have identified nutrition and physical activity as the primary determinants of weight status for children[12]. Yet social factors have been shown to play an important role too. In examining this side of children's weight development, parents' socioeconomic status has emerged as a primary social predictor. In particular, obesity in the U.S. is more prevalent among children who are racial or ethnic minorities[11,13], and whose parents have less income and lower levels of education[13]. Differences in parenting styles[14], culture[15], exposure to stressors[16,17], and neighborhood context[18] have been presented as some of the main mechanisms connecting parents' socioeconomic status with children's risk of obesity.

Going beyond this well-developed area of research, however, another social factor and indicator of family socioeconomic background that may be associated with children's risk of obesity is family structure. Increasing family complexity over the past three decades in the United States means that more children are growing up in homes without two biological parents. Yet few studies have considered the role of different family structures in children's weight status, and among those that have, even fewer have constructed and assessed categories for family structure that represent the diversity among U.S. families today.

INCREASING COMPLEXITY OF CHILDREN'S LIVING ARRANGEMENTS

U.S. society has experienced significant changes in the family over the past several decades. Often referred to as the "second demographic transition,"[19] these changes include women marrying and having children at later ages, increases in women's labor force participation, and rises in rates of divorce, cohabitation, and non-marital fertility. One example of this historic trend is that the%age of births to unmarried women was 18.4% in 1980, increased to 33.2% in 2000, and is now over 40%[20]. As a result of this large-scale transition in women's union formation and fertility behavior, more children are being raised outside of a two-biological-parent, married context in a variety of new family forms.

For example, cohabitation between the biological parents has emerged as an increasingly common family form—a pattern which reflects changes in both fertility behavior (ie, having children outside marriage) and union formation (delaying marriage). Linked to trends in cohabitation is the rise in other family types, including married or unmarried step-parent families, single-mother families, and families headed by adult relatives, since cohabitation is often a less stable family form than marriage[21]. Indeed, a recent U.S. cohort study of children born in urban areas found that, among births to unmarried mothers, approximately two-thirds ended their relationship with the child's biological father by the time the child was five years old. Furthermore, more than half of these mothers had entered a new partnership.[22] Thus, while this example does not convey why each of the family structures we explore in this study—which includes cohabiting households with and without the presence of the biological father, married step-parent families, nevermarried single-mother families, and families headed by a divorced mother, relative, or just the child's father—have grown more common, it illustrates the complex reasons why families have in general become more diverse than they were in the past.

Turning to the literature linking family structure to other sources of child well-being, it is conceivable that family structure is associated with differences in family routines surrounding diet, children's physical activity, mothers' work, and families' time-use—all factors with well-documented implications for children's weight status. For example, in households with children headed by a single parent who must balance work, childcare, meals, and housework, children may spend more time engaged in sedentary behaviors, and eat less nutritious, non-family meals[18,23-25]. Likewise, step-families with blended children may experience complex routines which are more likely to result in less healthy meals and exercise patterns. Yet on the other hand, we might expect children in households with two parents, whether married, cohabiting, or step-parents, to have healthier routines simply due to having two adults to manage household routines. In addition, households that can rely upon two incomes, or those that have one working parent and one with a more flexible schedule, may have greater resources related to nutrition and physical activity and time to focus on the tasks required of parenthood. Thus, while we might expect to see differences in the likelihood of obesity based on the type of family in which children are living, it is unclear which family structures present the greatest obesity risks to children.

Despite this uncertainty in the literature on preschool children's obesity, there is still some preliminary evidence that family structure matters. A small but burgeoning literature on the link between family structure and child obesity has found that children in dual-parent or married households are less likely to be overweight or obese than children in single-parent (usually single-mother) households[13,24-33]. Moreover, these findings typically persist, even when socioeconomic characteristics are accounted for. Existing research, however, has not made much progress on separating out the effect of marriage from the presence of two parents (biological or step), identifying the prevalence of overweight children in other family types, such as relative-headed households, or conceptualizing what the mechanisms connecting family structure to child obesity might be. Rather, due primarily to data constraints, the majority of studies have focused just on two family structure categories (either married vs. single or two-parent vs. one). In contrast, this study investigates how preschool-aged children's risk of obesity varies across eight different family structures—(described below)—and compare it to their risk of obesity when raised in a married two-biological-parent household.

THE ROLE OF FAMILIES' SOCIOECONOMIC CIRCUMSTANCES

This study also considers an important factor that may complicate our investigation on the link between family structure and child obesity: the possibility that the association between family structure and child obesity is moderated by the characteristics of the child or the family. Indeed, previous studies have found that only girls raised in single-parent households (compared to two-parent households) have an elevated risk of obesity[34-36]. Other factors which may moderate the influence of family structure on child obesity are indicators of families' socioeconomic status, including mothers' education and poverty. In the U.S., children in households under the poverty line have more than twice the odds of obesity compared to children in households at 400% of the poverty line or above; and the family income disparity in child obesity is growing[13].

Children have also been shown to have lower BMIs in single-mother households where the mother has a high school degree (versus mothers with less than a high school education)[27].

Yet, while mothers' education and family poverty status present well-document risks to children's weight status, it is unknown whether these factors moderate the impact of family structure on child obesity. Nevertheless, guided by previous studies that find parents' socioeconomic characteristics to buffer children against problematic family structure circumstances disruptive to child learning, we have reason to expect such moderation[37]. As such, we expect family structure to differentiate children's risk of obesity more when the family is poor or headed by a less educated mother. We expect fewer family structure differences in children's risk of obesity for non-poor families or families with college-educated mothers. This step in the investigation explores the possibility that some family structures, for example households headed by unmarried and unpartnered mothers, may be more problematic—or perhaps even only problematic—when the family is disadvantaged.

SUMMARY OF STUDY

In this study we will will assess whether children are at greater risk of being obese if they are living outside of an intact family, identify the specific family types associated with this increased risk, and assess whether these patterns are similar across two different categories of household socioeconomic status. In doing so, we will also carefully account for a number of demographic, socioeconomic, and health-related factors that extant research suggests may be driving these associations yet are excluded from many studies on the topic. The results from this study will lay the foundation for future investigations of why these patterns exist and how they can potentially be altered.

METHODS

DATA AND SAMPLE

Data come from the Early Childhood Longitudinal Study – Birth Cohort (ECLS-B)[38]. The ECLS-B is a nationally representative study of U.S. children and their families designed to provide information on children's development. Data collection for the study began in 2001 when over 14,000 children were identified based on a clustered list frame sample of births registered in the National Center for Health Statistics vital statistics system. The final study sample included 10,400 children (74% of families contacted) whose parents participated in the first wave of the in-home interview when children were infants of approximately nine months. This sample included children from diverse socioeconomic and racial and ethnic backgrounds as well as an oversample of Asian, Pacific Islander, Alaska Native children, American Indian, twins, and low birth weight children.

Following the nine-month data collection, data were subsequently collected when the children were two years old, in preschool (approximately age four), and in kindergarten. At each wave, in-home interviews were conducted with the primary caregiver (in most instances the mother, but not always), which included computer-assisted personal interviewing (CAPI) and a self-administered questionnaire. Assessments of children's height and weight, and other measures of development (eg, cognitive functioning) were also conducted at each wave. Our analytic sample included the 8,250 children who completed the nine-month-old and preschool assessments. Among this sample 46% were race/ethnic minorities, 25% were poor, and 16% were headed by mothers without high school degrees.

MEASURES

Obesity During the preschool in-home data collection wave, children's heights and weights were measured by trained data collectors. To measure children's height, data collectors used a stadiometer. A digital bathroom scale was used to measure children's weight. Each height and weight measurement was taken twice. The children's height and weight measurements were then averaged for the recorded height and weight. This weight-for-height information was then used to calculate children's body mass index (BMI). Finally, using the CDC Growth Charts appropriate for the child's age[36], children at or above the 95th percentile were classified as obese. Children below the 95th percentile were sorted into a second category for non-obese children. We focus on obesity because it is related more strongly to health problems in adolescence and adulthood than child overweight[4] .

Family structure During the preschool data collection, the primary caregiver reported on her or his marital status, relationship to the child, and the other household members who lived in the home. Marital status at the time of the child's birth was ascertained from the child's birth certificate. Together, this information was used to sort families into eight mutually exclusive categories designed to account for both children's current family structure and the one they were born into. The first category captures two biological married parent families. This group includes the small number of families that were unmarried at the time of the child's birth. The second captures families headed by an un-partnered single mother who was unmarried at the time of the child's birth. The third consists of cohabiting two-biological-parent families. The fourth group designates married two parent step-families. The fifth category is for unmarried step-families. The sixth category captures mothers that were married at the time of the child's birth but subsequently divorced. The seventh includes households in which the child resides with the biological father but not biological mother, referred to here as father-headed families. The final category designates families whose primary caregiver is a relative (typically a grandparent). In addition, a small number of children did not fit into these categories, for example, because they were coresiding with a foster parent, non-relative caregiver, or adoptive parent. These children are grouped into a final category (*n* < 100). As explained below, this heterogeneous group of children is excluded from the analysis, but retained as part of the analysis sample.

Family characteristics Information on the sociodemographic characteristics of children and their families comes primarily from the child's birth certificate. These data include the child's gender (0 = *male*, 1 = *female*) and race (dummy coded as *White*, *Black*, *Hispanic*, and *Other*), the mother's age (measured continuously), and the child's parity (1= *first born*, 0=*higher order birth*). We also draw on the nine-month primary caregiver interview to determine whether the home language was English (coded as "0") or another language (assigned a value of "1") and the families' region of residence (indicated by dummy variables for West, Northeast, Midwest, and South). Lastly, we control for the number of children under age 18 in the household (measured continuously), as reported by the primary caregiver at the preschool data collection[25].

Given the persistent correlations between socioeconomic background, family structure, and child obesity, we also include several indicators of families' socioeconomic status that come from the preschool primary caregiver interview. Socioeconomic variables include the mothers' (or primary caregivers') education (dummy coded *as less than high school*, *high school degree*, *some college*, and *college degree*) and work status (*not working*, *part-time*, *full-time*), whether the father or romantic partner of the mother is college educated (1= *yes*, 0 = *no*) or employed (1 = *yes*, 0 = *no*), and if the family is poor (under 100% of the federal poverty line), near poor (100 – 185%) or not poor (over 185%)[10, 37]. Family poverty status is based on an income-to-needs ratio, which divides the primary caregiver reports of all sources of household income by the federal poverty threshold for that family size and year. The 185% cut-off was chosen because it marks the eligibility criteria for free and reduced lunch in many states[38].

Health-related measures To account for inherited and endogenous health-related factors among both mothers and children that may confound estimates of children's preschool height-for-weight measurement, we include several key measures that are typically absent in other studies. These include the mother's pre-pregnancy BMI (based on self-reports of her pre-pregnancy weight and height), whether her child had fair or poor general health (assigned a value of "1") around the time of birth (vs. good, very good, or excellent), and a count for the number of mother-reported pregnancy complications (eg, Gestational Diabetes). We also account for whether the pregnancy and delivery were paid for by Medicaid, whether the mother participated in WIC or smoked during her pregnancy, and if the child was ever breastfed[21,30]. This information comes from the nine-month parent interview. We also include an indicator for whether the child was born low birth weight (below 2500 grams) or high birth weight (about 4500 grams) based on data taken from the child's birth certificate[26, 39, 40].

Other relevant factors Finally, we consider two other factors. The first is the possibility that children with unmarried parents spend time in care arrangement associated with higher rates of obesity (eg, informal care), while children from more advantaged households experience care arrangements that can lower children's risk of obesity (ie, center care)[41]. Thus, we account for the child's primary care arrangement at preschool using dummy variables for *center*, *relative*, *group home*, and *exclusive care by the primary caregiver*. We also consider whether the family received food stamps within the past twelve months.

Analysis Plan

All analyses were conducted in Stata Version 12[39]. Descriptive calculations explore mean level differences for all study variables by family structure. Multivariate analyses uses binary logistic regression to predict a child's odds of being obese, given his or her family structure. Estimation of the multivariate models proceeded systematically. First, only family structure was entered into the model, with stably e married two-biological parent-families serving as the reference group. Then, controls for families' sociodemographic characteristics (eg, gender, child race) were added. Next, we accounted for parents' socioeconomic circumstances. We then added measures tapping different aspects of mother and child health outcomes (eg, general rating of health at birth) and behaviors (eg, breastfeeding). Finally, we accounted for children's primary care arrangement and food stamp receipt. This step-wise approach provides a more careful look at how the coefficients for family structure change when potentially confounding factors are added to the model.

To assess whether the associations between different family structure types and children's odds of obesity vary by families' socioeconomic circumstances, we then interact family structure with dichotomous measures for poverty (poor, not poor) and maternal education (college degree, no college degree). To aid in the interpretation of these interactions, we estimate the predicted probabilities of obesity for different combinations of family structure and our indicators of socioeconomic status (either poverty or maternal education).

The bivariate models apply the sampling weight W31C0, created by the National Center for Educational Statistics (NCES). This weight adjusts for differential nonresponse at the preschool wave, over time attrition, the initial sampling design (in which certain groups were oversampled) , and nonresponse[35]. The multivariate models employ Stata's *svy* command to handle both the sampling weights and adjust for the complex survey design in which children were clustered within primary sampling units. This approach provides corrected standard errors, which would otherwise be too low [42]. In addition, we use the *subpop* option to exclude from the analysis the small number of children not assigned to one of our eight family structure categories. This option is preferable to making sample restrictions, which, given the use of survey and sampling weights, could produce incorrect estimates of the standard errors.

To estimate item-level missing values, we use multiple imputation procedures in Stata using the *ice* command[43].The variables used in the imputation model include family structure, child obesity, and the full set of covariates. This approach produced five fully imputed data sets. Assuming the data are missing-at-random (MAR), this approach provides unbiased estimates that are superior to other conventional approaches to dealing with missing data, such as list-wise deletion[44]. Thus, we include the very few cases with item-level missing data on the dependent variable. Missingness on the dependent variable due to attrition was accounted for by the weights.

RESULTS

BIVARIATE MODELS

Bivariate associations between our eight categories of family structure and all of our study variables are presented in Table 1. We also report the weighted frequencies and raw *n*'s for the number of families in each family structure category at the bottom of the table. The raw *n*'s, however, were rounded to the nearest 50, following NCES licensing agreements. These raw numbers suggest that while the majority of families were headed by two married biological parents, followed by single mothers, there were sufficient numbers of families where an adult relative or father was the primary caregiver or the mother was in step or cohabiting union, to give us reason to explore the associations among such family types and child obesity. The ability to do so is an important innovation, given the increasing heterogeneity among families today.

Such family structures may also have implications for children's weight status. Indeed, children raised by two cohabiting biological parents had the highest rates of obesity (31%) followed by children coresiding with an adult relative (29%). Not surprisingly, children in married two-biological-parent households had some of the lowest obesity rates (17%), but children in father-headed households (15%) or married step-parent households also had lower obesity rates (15%). Children in divorced families (21%), cohabiting step-parent families (23%), and single-mother families (23%) had some of the highest rates of obesity in children (23%).

Importantly, the association between family structure and children's risk of obesity may also be confounded by the characteristics associated with different family structures. For example, mothers in the ECLS-B who were married to the biological father were typically older, more educated, and less likely to be poor or a racial/ethnic minority than other mothers in the sample. Unmarried mothers, including single mothers or mothers cohabiting with the child's father or a romantic partner, were typically younger, less educated, and more likely to be poor or a minority.

Such obesity risks may also be confounded with the child's early health outcomes, mothers' health behaviors, or her own health including her pre-pregnancy BMI and whether she experienced complications during the pregnancy. Taken together, this set of health-related measures does not immediately suggest a clear pattern by family structure. Still, some important findings emerged. For example, children living in single - mother families, father-headed families, or relative-headed families had the lowest likelihood of being breastfed during infancy. Alternately, women married to their child's biological father were the most likely to breastfeed.

MULTIVARIATE MODELS

Turning to the multivariate models, we begin by estimating the zero-order correlation between our eight categories of family structure and children's odds of obesity. These results appear in Table 2. Compared to children raised by two married biological parents, children in single-mother families (*or* = 1.45), cohabiting biological (*or* = 2.17), cohabiting step- (*or* = 1.40), and relative-headed families (*or* = 1.93) had greater odds of being obese (Model 1). Adding in controls for the sociodemographic characteristics of the family attenuated the association between single-mother families and child obesity to marginal significance (Model 2). The other significant coefficients remained significant and were roughly the same size as they were in Model 1. Among the added covariates, Hispanic children were 48% more likely to be obese than White children, and female children were 19% less likely to be obese than male children.

Model 3 added in families' socioeconomic characteristics. Accounting for these factors reduced the associations between obesity and living in a single-mother or cohabiting step-parent household to non-significance. Thus, it appears that much of these children's risk of obesity is driven by the socioeconomic characteristics of their parents. Yet living in a relative-headed household or with biological cohabiting parents still remained significantly associated with children's increased risk of obesity. Not surprisingly, children raised by college-educated mothers had a lower likelihood of being obese (compared to children whose mothers did not have high school degrees). Other indicators for family socioeconomic background, including father/partner education and employment, mothers' work status, and family poverty status were not significantly associated with child obesity once different family structures and family sociodemographic factors were taken into account.

Model 4 accounts for the possibility that children raised in certain family structures were more likely to be at greater, or perhaps, lesser risk of obesity given their health status at birth. Factors included low or high birth weight status, their mothers' pre- (ie, WIC recipient, prenatal care paid for by Medicaid, smoking) and postnatal health behaviors (breastfeeding), or their mothers' own health (pre-pregnancy BMI, pregnancy complications). The inclusion of these variables did not do much to diminish the increased risk of obesity for children raised in two-parent cohabiting biological parent households or relative-headed households compared to children in two-biological-parent married households.

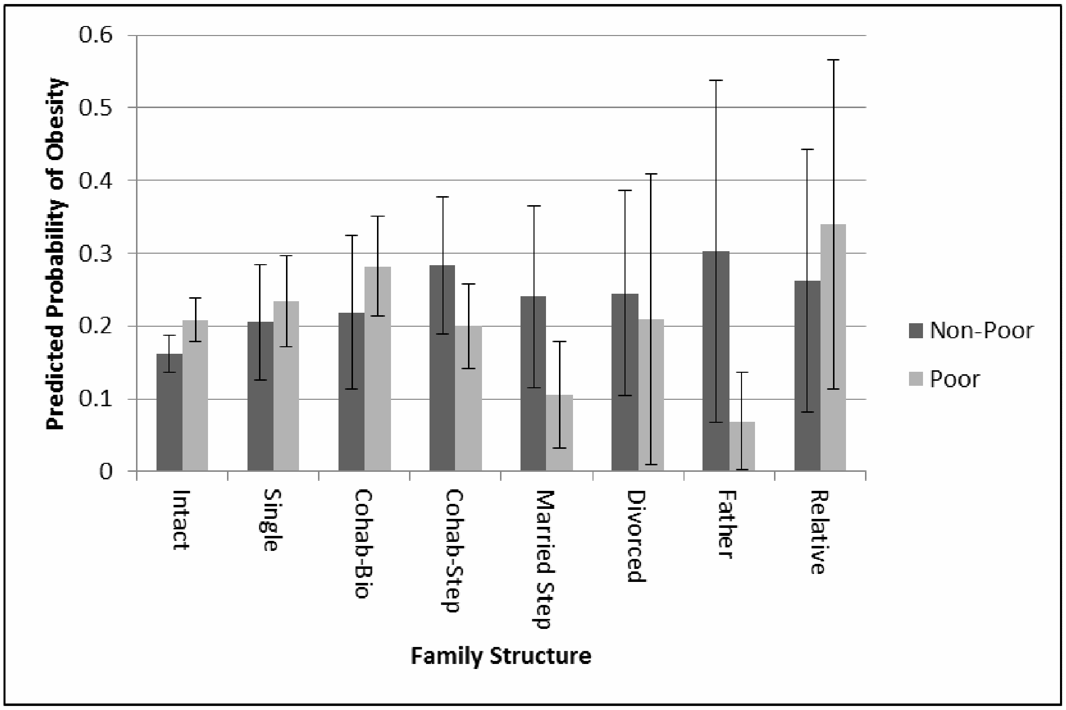
As a last step in building our model, we consider the importance of the child's primary care arrangement and whether the primary caregiver received food stamps. The coefficients for two-biological-parent cohabiting households and relative-headed households remained significant. Accounting for the full set of covariates, children raised by two unmarried biological parents had a 65% greater likelihood of being obese than children who were raised by married biological parents. Children living with a relative caregiver had more than twice the odds of obesity compared to similar children living with their married biological parents.

TESTING INTERACTIONS BETWEEN FAMILY SOCIOECONOMIC STATUS AND FAMILY STRUCTURE

A final analytical step was to test whether there was a greater risk of obesity for children raised outside intact families when their primary caregivers were less advantaged. Thus, we included interactions between family poverty and family structure, and as in a separate model, family structure and maternal education. For these models, we used a simplified dichotomous indicator of poverty and higher maternal education. For our poverty measure, we sorted children living below the federal poverty line into one group and children above it into another. For mothers' education, we distinguished families with a college-educated mother (or female caregiver) from those with a mother (or female caretaker) without a college degree. Table 3 presents the coefficient for the main effects and interactions. The covariates are not shown. To aid in the overall interpretation of these interactions, Figure 1 (below) presents the predicted probabilities of being obese for poor and non-poor children in our eight family structure categories.

Interacting poverty with family structure reveals an interesting pattern of results. Non-poor children living with married step-parents had a 67% higher risk of obesity compared to similar non-poor children raised by married biological parents. This is suggested by the significant main effect of married step-parent, in which non-poor and married biological parents serve as the reference category. Thus, married step-parent families presented some obesity risk to children, but only when their families were not poor. We also found evidence that poor children raised in married two-biological-parent families were at a 38% increased risk of obesity when their parents are poor, compared to children in similar family structures that were not poor. This is suggested by the significant coefficient for the poverty term. For other family types, poverty did not seem to increase children's risk of obesity. In fact, poor children living with a father, cohabiting step-parent, or married step-parent had lower odds of obesity (*or* = .12, .46, and .26 respectively) than children in non-poor married biological households.

Figure 1. Predicted Probability of Obesity by Family Structure and Poverty Status



Notes: Bars represent 95 % confidence interval.

Interacting maternal education with family structure reveals that children in two biological married parent households also had a lower likelihood of being obese if their mother had a college degree (because the findings from this model were generally more straightforward, we do not present predicted probabilities in this article, as we did above). This is suggested by the significant coefficient for mothers' education (*or* = .72, *SE* = .09, $p < .05$), in which no college degree serves as the reference category. This finding mirrored the pattern described above in which poor children from intact households had a greater risk of obesity than non-poor children from intact households. The significant main effect of living with unmarried biological parents (*or* = 1.65, *SE* = .30, $p < .01$) taken with the nonsignificant coefficient for its interaction with mothers education reveals that the increased risk of obesity associated with this family structure (refer to Model 5, Table 2) was generally concentrated among children of less educated mothers.

DISCUSSION

As family structures have grown more diverse and children's likelihood of living outside an intact family greater, family structure is now considered an important indicator of socioeconomic background. As such, family structure has been examined in relation to various child outcomes. Child obesity, however, has rarely been examined in the context of such research. Thus, the goal of our study was to document how children's risk of obesity varied across different types of family structures.

The results from our unadjusted models indicate that children in families headed by single mothers, cohabiting biological parents, cohabiting step-parents, and those headed by a relative all had higher odds of obesity compared to children in married-parent households. These findings correspond with evidence linking family structure to other domains of child development, where children in non-intact family structures have lower levels of achievement and more behavioral problems than children in married households[40]. They also reflect the current research on child obesity and family structure in which children in households headed by unmarried mothers have higher rates of obesity than children in households headed by married mothers[13,24-34] .

Yet in the fully-adjusted models that account for sociodemographic, socioeconomic, and relevant health factors, the only family structure differences in child obesity remaining were for cohabiting biological parents and relative-headed households, in comparison to married couple households. These two findings were somewhat surprising, given the findings from other studies mentioned above. Previous research, however, did not include households headed by a grandparent relative, who may have outmoded views of nutrition and less ability to promote children's physical activity (eg, playing together outdoors)[41]. Such studies also did not distinguish single-parent households from cohabiting households, which are often characterized by high levels of household stress and conflict[42,43]. Therefore, children with cohabiting biological parents may have higher rates of obesity because of the indirect cumulative impact of these factors. Such nontraditional households may also hold different parenting philosophies that ultimately increase children's obesity risk[44].

When we tested whether the relationships between our family structure categories and child obesity would change based on two SES measures – whether the family lives in poverty and whether the mother had a college degree, we had two main expectations. First, that socioeconomically advantaged children in nontraditional family types would have similar or only slightly elevated obesity risks compared to similar children in intact families, and second, that disadvantaged children in nontraditional family types would have greater obesity risks than similar children in intact families. In general, our results supported this expectation, but in not in the ways we anticipated.

First, poor children living in cohabiting stepfather, married stepfather, and single-father households had *lower* odds of obesity compared to non-poor children in married biological parent households. Essentially, such results underscore how even children in non-poor two-biological-married-parent families are at risk of obesity today. Indeed, the predicted probability that a child would be obese in such a context was not zero—it was .17 ($p<.001$). In improving the health of the nation, children from disadvantaged households deserve special attention. In addition, this pattern of results suggests that we should also continue to think more about what is contributing to obesity rates among more advantaged children (ie, non-poor children in intact households).

The need for this broader policy focus is further emphasized by the second finding based on our interaction models—non-poor children living in step-parent families had a higher risk of obesity compared to married couple households. Thus, in addition to children in cohabiting and relative-headed households, step-parent families present a risk to children's healthy weight status, but only when the family is not poor. This finding may reflect step-parent families' greater material resources (eg, access to computers) in tandem with household dynamics that are associated with such families (eg, less monitoring) and can result in sedentary behaviors among children[40].

Third, we find that the benefit of living in a married, biological-parent household is offset by living in poverty or when the mother is less educated. For example, children of poor married biological parents had a 38% increase in the odds of obesity compared to similar non-poor families. Given that our measure of poverty was not a significant predictor of children's obesity risk, this finding revealed that even children in the "optimal" family structure type (i.e., the type generally associated with the highest levels of child wellbeing) can also experience obesity risks when other sources of socioeconomic support are not in place. As such, this study advances current research (that simply controls for SES while estimating the link between family structure and obesity) by highlighting how marriage is not universally protective of children's obesity risk while reminding scholars we must study the social factors influencing child well-being at their intersection.

These findings, of course, must be considered in light of their limitations. First, it is possible that we did not control for the full range of confounding factors, despite our use of a uniquely rich set of controls.

Second, we focused primarily on family structure states, rather than family structure changes. Yet one recent study found that young children whose mothers experienced union dissolutions had worse weight status trajectories compared to children with stably married parents[45]. Thus, in future research we should consider the role of family structure change. Lastly, we did not consider mechanisms and their mediating role in the link between different family structures and children's obesity. Importantly, the results of this study highlight the need for future research to explore such mechanisms among cohabiting biological parent families, relative -headed families, and non-poor married step-parent families, in particular. Potential inquires could include relative caregivers' food choices, children's time use in step-parent families, and parenting conflict or philosophies among cohabiting households.

As a final word, our findings also have implications for policy, practitioners, and interventions aimed at reducing child obesity. Many of these implications have already been laid out above. Taken more broadly, however, they convey how information on children's health and nutrition must reach not only mothers, but the other caregivers (relatives, fathers, step-parents) with whom mothers and children regularly interact. It is also important to ensure that caregivers are in agreement about issues of nutrition and physical activity for children. Finally, schools, pediatricians, child care providers, and other important adults and institutions in the lives of children should recognize that family configurations can contribute to children's obesity risks.

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Table 1. Descriptive Statistics for All Study Variables by Family Structure (*n* = 8,250)

	Means (SD) and Percentages							
	Married	**Single**	**Cohabit Bio**	**Cohabit Step**	**Married Step**	**Divorced**	**Father**	**Relative**
Child Obesity								
Obese	17%	23%	31%	23%	15%	21%	15%	29%
Sociodemographic Variables								
Maternal age at birth	29.21 (5.57)	22.46 (5.03)	23.71 (5.37)	26.19 (6.34)	24.10 (5.58)	26.70 (5.86)	24.10 (5.58)	22.93 (5.21)
Child Female	49%	47%	41%	52%	54%	55%	48%	53%
Child first born	33%	52%	41%	33%	44%	40%	25%	29%
Child Black	6%	49%	16%	17%	11%	7%	13%	26%
Child Hispanic	14%	13%	31%	13%	3%	12%	8%	9%
Other race/ethnicity	13%	12%	27%	17%	10%	14%	21%	10%
Non-English speaking	20%	11%	43%	14%	5%	12%	8%	3%
Number of children	1.50 (1.08)	1.02 (1.14)	1.34 (1.10)	1.35 (1.16)	1.38 (1.06)	1.38 (1.26)	.91 (.99)	.94 (1.10)
Northeast region	18%	19%	11%	17%	14%	22%	9%	16%
South region	34%	40%	34%	39%	57%	40%	41%	45%
Midwest region	23%	22%	21%	20%	14%	17%	17%	26%
West region	25%	18%	34%	24%	14%	21%	33%	12%
Socioeconomic Variables								
Mother no high school	10%	24%	40%	19%	17%	20%	15%	15%
Mother high school	22%	42%	36%	34%	37%	35%	29%	36%
Mother some college	32%	30%	21%	36%	40%	23%	35%	32%
Mother college	36%	5%	4%	11%	5%	22%	13%	16%
Father college degree	35%	4%	2%	9%	4%	17%	6%	5%
Mother not working [a]	42%	37%	49%	29%	43%	48%	33%	47%
Mother part-time[a]	22%	17%	15%	17%	13%	13%	16%	13%
Mother full-time [a]	36%	46%	36%	54%	44%	39%	51%	40%
Father full-time [b]	91%	---	81%	29%	88%	---	70%	47%

Table 1 Continued. Descriptive Statistics for All Study Variables by Family Structure (n = 8,234)

	Means (SD) and%ages							
	Married	**Single**	**Cohabit Bio**	**Cohabit Step**	**Married Step**	**Divorced**	**Father**	**Relative**
Poor	13%	59%	50%	40%	27%	37%	32%	29%
Near poor	20%	22%	30%	29%	30%	24%	28%	22%
Not poor	68%	19%	20%	32%	43%	38%	40%	48%
Mother and Child Health Factors								
Maternal pre-pregnancy BMI	24.84 (5.41)	24.98 (6.10)	25.32 (5.64)	25.23 (5.97)	24.04 (5.51)	25.22 (6.12)	24.05 (5.39)	23.87 (5.10)
Maternal pregnancy complications	0.36 (0.63)	0.44 (0.66)	0.30 (0.58)	0.42 (0.66)	0.34 (0.40)	0.40 (0.65)	0.37 (0.69)	0.49 (0.66)
Child low birth weight	7%	11%	9%	9%	9%	11%	10%	13%
Child high birth weight	11%	6%	11%	7%	5%	5%	6%	5%
Child poor birth heath	2%	4%	4%	3%	1%	5%	1%	3%
Pregnancy paid for by Medicaid	19%	70%	64%	50%	53%	48%	54%	73%
Received WIC during pregnancy	27%	71%	76%	58%	69%	59%	56%	61%
Mother breastfed	77%	47%	65%	60%	64%	68%	43%	51%
Mother smoked during pregnancy	2%	3%	3%	7%	8%	2%	6%	12%
Other Relevant Factors								
Food stamp receipt	11%	61%	40%	50%	42%	44%	28%	41%
Center care	60%	60%	49%	56%	52%	56%	49%	58%
Relative care	11%	20%	16%	17%	18%	21%	28%	16%
In-home group care	8%	6%	7%	11%	9%	9%	9%	4%
No child care	21%	14%	28%	16%	20%	13%	14%	23%
Weighted%age	62%	12%	7%	11%	2%	2%	1%	1%
Raw n's [c]	5,250	1,000	500	850	200	200	100	100

Notes: Data are weighted using weight W13C0. Descriptive statistics for children in final family structure group containing adoptive, foster, and other families headed by non-relatives are not shown (n = 50). [a] Refers to mother or female primary caregiver. [b] Refers to father or other male caregiver in household. [c] Rounded to nearest 50th

Table 2. Logistic Regression Models Predicting Children's Obesity Odds (*n* = 8,250)

	Odds Ratios (Standard Errors)				
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**
Family Structure (intact)					
Never married single mother	1.45 ** (.18)	1.39+ (.23)	1.26 (.23)	1.28 (.25)	1.31 (.26)
Cohabiting with bio father	2.17*** (.34)	1.94*** (.35)	1.70** (.31)	1.64** (.30)	1.65** (.30)
Cohabiting with step father	1.40* (.20)	1.41* (.22)	1.24 (.24)	1.27 (.24)	1.30 (.24)
Married step father	.89 (.24)	.96 (.27)	.82 (.24)	.88 (.24)	.89 (.24)
Divorced mother, married at birth	1.30 (.35)	1.29 (.36)	1.23 (.35)	1.26 (.37)	1.27 (.37)
Biological father-headed household	.86 (.36)	.90 (.40)	.79 (.36)	.83 (.38)	.82 (.38)
Relative-headed household	1.93** (.45)	2.00** (.47)	1.84* (.47)	1.99* (.56)	2.02* (.58)
Family Sociodemographic Characteristics					
Maternal age at birth	---	1.01 (.01)	1.02** (.01)	1.02 (.01)	1.02* (.01)
Child Gender (male)	---	.81* (.07)	.82* (.07)	.84 (.07)	.84* (.07)
Child black (White)	---	1.13 (.14)	1.06 (.13)	1.04 (.04)	1.06 (.14)
Child Hispanic	---	1.48* (.23)	1.34+ (.21)	1.30 (.21)	1.30 (.21)
Child other race/ethnicity	---	1.25+ (.16)	1.17 (.15)	1.19 (.16)	1.19 (.16)
Non-English speaking household	---	1.22 (.16)	1.09 (.15)	1.20 (.17)	1.19 (.16)
Number of children in household	---	.92* (.04)	.88** (.04)	.87 (.04)	.87** (.04)
Southwest region (Northeast)	---	.93 (.11)	.86 (.11)	.89 (.11)	.88 (.11)
Midwest region	---	.88 (.10)	.86 (.10)	.84 (.11)	.82 (.11)
West region	---	.66*** (.08)	.62*** (.07)	.65*** (.08)	.64*** (.08)
Focal child is mother's first birth	---	1.07 (.11)	1.09 (.13)	1.10 (.12)	1.10 (.11)
Family Socioeconomic Characteristics					
Mother high school degree (dropout)	---	---	.81+ (.09)	.84 (.09)	.85 (.09)
Mother some college	---	---	.79+ (.11)	.80 (.12)	.82 (.12)

Notes: *** *p*<.001, ** *p*<.01, **p*<.05, +*p*<.10

Table 2 Continued. Logistic Regression Models Predicting Children's Obesity Odds (*n* = 8,234)

	Odds Ratios (Standard Errors)				
	Model 1	**Model 2**	**Model 3**	**Model 4**	**Model 5**
Mother college degree	---	---	.57*** (.09)	.63** (.11)	.65* (.11)
Father college degree (no college)	---	---	.86 (.13)	1.07 (.16)	.97 (.15)
Mother part-time work (not working)	---	---	.90 (.11)	.90 (.11)	.91 (.12)
Mother full-time work	---	---	1.10 (.11)	1.05 (.11)	.91 (.12)
Father employed full-time	---	---	1.06 (.15)	1.07 (.16)	1.07 (.16)
Near poor (not poor)	---	---	1.22 (.16)	1.16 (.15)	1.16 (.16)
Poor	---	---	1.10 (.16)	1.02 (.16)	1.05 (.18)
Mother and Child Health Factors					
Maternal pre-pregnancy BMI	---	---	---	1.05*** (.01)	1.05*** (.01)
Maternal pregnancy complications	---	---	---	.98 (.07)	.98 (.07)
Child low birth weight	---	---	---	.67*** (.07)	.67*** (.06)
Child high birth weight	---	---	---	1.78*** (.22)	1.77*** (.22)
Child heath at birth (poor health)	---	---	---	1.22 (.35)	1.22 (.35)
Pregnancy paid for by Medicaid	---	---	---	1.01 (.13)	1.02 (.13)
Received WIC during pregnancy	---	---	---	1.12 (.12)	1.13 (.12)
Mother breastfed for 6 months	---	---	---	.81* (.08)	.81* (.08)
Mother smoked during pregnancy	---	---	---	1.12 (.30)	1.12 (.30)
Other Relevant Factors					
Food stamp receipt	---	---	---	---	.90 (.12)
Relative care (center care)	---	---	---	---	1.04 (.17)
In-home group care	---	---	---	---	1.15 (.13)
No child care	---	---	---	---	1.19+ (.10)

Notes: *** *p*<.001, ** *p*<.01, **p*<.05, +*p*<.10

Table 3. Logistic Regression Models Predicting Children's Obesity Odds with Family Structure x Family Socioeconomic Characteristics Interactions (*n* = 8,234)

	Odds Ratios (Standard Errors)	
	Family Structure x Family Poor	**Family Structure x Mother College**
Family Structure (intact)		
Never married single mother	1.35 (.40)	1.28 (.26)
Cohabiting with bio father	1.47 (.53)	1.65** (.30)
Cohabiting with step father	2.11 (.57)	1.25 (.24)
Married step father	1.67** (.67)	.82 (.23)
Single divorced mother, married at birth	1.72 (.72)	1.10 (.37)
Biological father-headed household	2.32 (1.46)	.86 (.41)
Relative-headed household	1.89 (.94)	1.64 (.59)
Family Socioeconomic Characteristics		
Family Poor (not poor)	1.38* (.20)	---
College (less than college)	---	.72* (.09)
Interactions (*intact*)		
Never married single mother x SES	.87 (.26)	1.26 (.66)
Cohabiting with bio father x SES	1.05 (.39)	1.02 (.79)
Cohabiting with step father x SES	.45** (.13)	1.39 (.55)
Married step father x SES	.26* (.16)	2.83 (2.57)
Divorced mother, married at birth x SES	.59 (.31)	2.05 (1.36)
Biological father-headed household x SES	.12** (.09)	.02 (.13)
Relative-headed household x SES	1.08 (.93)	3.18 (3.29)

Notes: *** $p<.001$, ** $p<.01$, *$p<.05$, +$p<.10$. SES = Socioeconomic status indicator for either poverty or mothers' education.