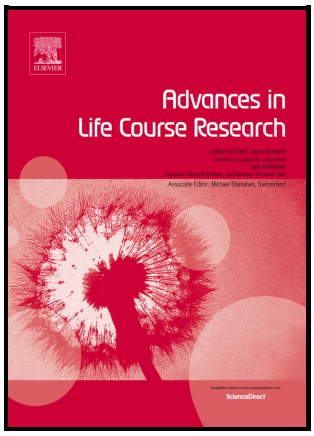
Carry that weight: Parental separation and children's Body Mass Index from childhood to young adulthood



Marco Tosi

PII: S1569-4909(24)00026-1

DOI: https://doi.org/10.1016/j.alcr.2024.100615

Reference: ALCR100615

To appear in: *Advances in Life Course Research*

Received date: 22 September 2023
Revised date: 21 March 2024
Accepted date: 26 April 2024

Please cite this article as: Marco Tosi, Carry that weight: Parental separation and children's Body Mass Index from childhood to young adulthood, *Advances in Life Course Research,* (2024) doi:https://doi.org/10.1016/j.alcr.2024.100615

Carry that weight: Parental separation and children's Body Mass Index from childhood to young adulthood

Marco Tosi
Associate Professor in Social Statistics
Department of Statistical Sciences, University of Padua, Italy.
marco.tosi@unipd.it

Abstract

Research has shown that parental separation is associated with worse physical health and unhealthy weight gains during childhood. However, limited empirical attention has been given to the evolution of child health before, upon and following parental union dissolution. Drawing on data from the Child Development Supplement and the Transition to Adulthood Supplement of the Panel Study of Income Dynamics (1997-2017), I investigate whether parental union dissolution during childhood is associated with children's Body Mass Index (BMI) and the risk of developing overweight/obesity in the short and long run (n=2,675 children aged 0-12 in 1997). The results from a combination of propensity score matching and fixed-effects linear regression models show that union dissolution is associated with increases in child BMI and an increased risk of developing overweight/obesity. These changes in children's weight status persist for at least ten years after parental separation. Unhealthy weight gains following parental separation are more pronounced among female children and those with lower-educated and non-White parents. The findings suggest that in the United States parental union dissolution contributes to increase socioeconomic inequalities in child health. Therefore, children with

separated parents and lower socioeconomic backgrounds have greater risks of developing overweight/obesity and other obesity-related morbidities over their life courses.

Keywords: child health, obesity, family instability, parental separation, life-course analysis.

1. Introduction

In the United States child obesity has dramatically increased over the last three decades, and approximately 20% of children and adolescents now have overweight or obesity (Hales et al., 2017). Obesity is a major problem during childhood and has been linked with adverse health and social outcomes in adulthood (World Health Organization, 2006). Families play a crucial role in influencing the health development of children through the promotion of healthy behaviors and the provision of social and economic resources (e.g., Garasky et al., 2009). Disruptive family events, such as union dissolution, may alter these family resources and environment, and previous studies show that parental separation is associated with worse physical health and unhealthy weight gains during childhood (Biehl et al., 2014; Björkenstam et al., 2015; Bzostek & Beck, 2011; Chen & Escarce, 2010; Gable & Lutz, 2000; Garasky et al., 2009; Hohwü et al., 2015; Schmeer, 2012a; Yannakoulia et al., 2008). Despite a number of studies that have brought to light the association between parental union dissolution and children's overweight/obesity, longitudinal research examining the evolution of child body mass index (BMI) from childhood to young adulthood is still scarce.

The small body of research focusing specifically on the long-term health consequences of family instability relies on follow-up studies conducted many years after parental separation (Gaydosh & Harris, 2018; Hernandez et al., 2014). This is a limitation, given that these previous

findings provide only limited insight into how child BMI develops before, upon, and after parental union dissolution. In addition, the higher BMI of children from dissolved families may be due to unobserved confounders, such as parental personality and parenting styles, that can influence both the weight status of children and the probability of experiencing parental separation (Arkes, 2012). To mitigate the bias introduced by unobserved confounders, some studies adopt a within-child approach and show that young children from recently dissolved families face an increased risk of developing overweight or obesity (Goisis et al., 2020; Schmeer, 2012b). Compared to these previous studies, I use a longer observation window (from age 5 to 28) and a combination of matching and within-child estimates to investigate whether family instability experienced in childhood and adolescence has enduring BMI consequences across the life course. Studying the effects of parental separation in the short and long run is important because a temporary increase in child weight is much less detrimental than a persistent effect that might lead to other obesity-related morbidities. Additionally, following individuals from childhood to young adulthood allows us to study parental separation as a process that develops from the pre-separation/ conflictual period to the post-separation/ adaptation period (for a discussion, see Goisis et al., 2020; Sun & Li, 2002). This may reveal whether the association between family instability and child BMI is due to the deterioration of family relationships occurring before the actual separation.

The consequences of parental separation on children's BMI may be unevenly distributed across different population subgroups. According to the 'diverging destinies' thesis, the diffusion of union dissolutions, which is more widespread among socioeconomically disadvantaged families, contributes to increase social inequalities across generations (Härkönen et al., 2017; McLanahan, 2004). Because children's healthy development may be positively associated with growing up in intact families (e.g., Hernandez et al., 2014; Hohwü et al., 2015), union dissolution may strengthen ethnic and educational disparities in child health. Studies find

evidence in support of the 'diverging destinies' thesis, showing that parental separation increases social background differences in educational outcomes of children (Lee & McLanahan, 2015; McLanahan, 2004; McLanahan & Percheski, 2008). However, far less is known on whether the health outcomes of children from disadvantaged social groups are more negatively affected by parental separation compared to those of children from more advantaged families. Herein I examine whether some population groups defined on the basis of parental education and race/ethnicity are more exposed to the negative consequences of union dissolution on child BMI and overweight/obesity risk.

In this study, I use data from the Panel Study of Income Dynamics (PSID) – the Child Development Supplement (CDS) and the Transition to Adulthood Supplement (TAS) – to analyze the short- and longer-term effects of parental separation on children's weight status. I ask two research questions. First, is parental union dissolution during childhood associated with increases in child BMI and an increased risk of developing overweight/obesity in both the short and long run? Second, is this association more pronounced among ethnic minority children and those with lower-educated parents compared to children of White ethnicity and those with highly-educated parents? To address these questions, gender differences between boys and girls are analyzed to account for gender-specific BMI trajectories during childhood and early adulthood.

2. Background

Family instability is associated with lower levels of child and adolescent health (Cherlin et al., 1998; Fomby & Cherlin, 2007). This 'divorce effect' has been attributed to changes in the amount and allocation of household resources that parents can invest on children. Divorced, parents, compared to married parents, often face financial constraints that may limit their ability to provide healthy food and access to sports and extracurricular activities (McLanahan &

Sandefur, 2009). The reduction of social and economic resources may affect food and exercise preferences in the long run, which may influence weight status in young adulthood. Additionally, separated parents may have less time available to focus on nutrition intake, monitoring children's health-related behaviors, and establishing regular routines (Bzostek & Beck, 2011; Drewnowski & Specter, 2004). Disruptions in eating and sleeping routines can contribute to unhealthy dietary behavior, such as consuming ready meals or processed food, and sedentary lifestyles, which increase the risk of overweight/obesity (Anderson & Whitaker, 2010; Goisis et al., 2020). The disruption of family routines is also associated with a decrease in the quality and amount of parental involvement, providing more opportunities for unsupervised behaviors, such as smoking and the consumption of unhealthy food (Westphal et al., 2014).

As suggested by social stress theories, changes in marital and romantic relationships introduce stress into the entire family unit (Teachman, 2003; Conger et al., 2010). The end of marriage or cohabitation is a stressful event, accompanied by disputes and conflicts between partners. Additional stress may be related to the events surrounding a separation, such as finding new accommodation, arranging custody for children, and division of goods (Amato, 2000). Parents' emotional response to separation may reverberate into a child's psychological stress and unhealthy dietary behaviors through mechanisms such as mood contagion, reduced relationship quality, or less sensitive parenting styles (Augustine & Kimbro, 2017; Kim, 2011; Strohschein, 2005; Tosi & Albertini, 2019). Studies show that parenting styles and family relationships are particularly relevant for ensuring healthy development in children's BMI (McConley et al., 2012; Patrick & Nicklas, 2005; Rhee et al., 2006), and that children's consumption of comfort food is often used as a coping mechanism to handle the stress associated with conflictual family relationships (Tanofsky-Kraff et al., 2008). Children's eating behaviors and sleeping routines may change when family relationships are conflictual. Given that family tensions usually occur

before and upon a disruption, the BMI of children from divorced families may deviate from the BMI of children from intact families in anticipation of an upcoming separation. In other areas of research, there is evidence that divorced parents and their children manifest higher levels of psychological distress prior to union dissolution, which suggests that the health consequences of divorce are, in part, due to a selective effect (Amato, 2010; Lin et al., 2019; Tosi & van den Broek, 2020).

According to a stress-to-adjustment perspective (Amato, 2000; 2010), the strain produced by parental separation is short lived. Parental separation is a critical life event that reduces healthy eating/exercise, sleep routines, and emotional support for children (Augustine & Kimbro, 2017; Yannakoulia et al., 2008; Singh et al., 2008b). These practical and emotional changes may be followed by adjustment, through which children's eating behaviors and lifestyles return to previous routines. Sun and Li (2002) show that compared with adolescents from intact families, those from non-intact families have a lower score in socio-psychological indicators before and during marital disruption but recover few years after separation. However, some negative consequences may persist over the life course. Weight gains in early adolescence bring a higher risk of being overweight in young adulthood, and abnormal changes in BMI during the first years of life tend to shape subsequent weight trajectories (Centers for Disease Control and Prevention, 2011; Singh, 2008b; Srinivasan et al., 1996). This may be due to an inability to self-regulate one's energy intake that may persist after a disruptive family event (Hernandez et al., 2014). Moreover, poor relationships and continuing conflicts with divorced parents might affect children's BMI many years after parental separation. Some studies show that adverse childhood experiences and the stress associated with family instability increase children's probability of having overweight/obesity in young adulthood (Björkenstam et al., 2015; Gaydosh & Harris, 2018; Slopen et al., 2014).

2.1 Parental education and race/ethnicity

Regardless of whether or not the effect of parental union dissolution persists over time, the extent to which a child's physical development is affected by a disruption of a union may depend on parental socioeconomic position. The 'diverging destinies' thesis suggests that the increase in non-intact families over time is leading to greater differences between children from socioeconomically advantaged and disadvantaged backgrounds (Boertien & Bernardi, 2022; McLanahan, 2004; McLanahan & Percheski, 2008; Sun & Li, 2011). Parental education is associated with differential exposure to stressors and the accumulation of material and social resources known to be important for children's health and weight status (Baltrus et al., 2005). While children from higher-educated families have more resources to cope with the stress of parental separation and to ensure healthy food intake, children of lower-educated parents may suffer more from the loss of social and economic resources following parental separation (Isong et al., 2018; Singh et al., 2008). These resource shortages are likely to contribute to a wide range of problems related to unhealthy food consumption and unsupervised behaviors among children of lower-educated parents (Sun & Li, 2002). Highly educated parents may be also more aware of the importance of remaining involved and investing in children after separation to foster their healthy development and wellbeing (Mandemakers & Kalmijn, 2014). However, it has been also suggested that children whose parents have more cultural and economic resources have more to lose from the absence of a parent in the household (Bernardi & Radl, 2014; Boertien & Bernardi, 2022). If highly educated parents are better able to promote healthy behaviors and a normal BMI development during coresidence, then the children of these parents may experience a relatively greater loss of benefits after separation compared to children with lower-educated parents.

In the United States, race and ethnicity are fundamental dimensions of social and health inequalities. Ethnic minority children, on average, have fewer socioeconomic resources such as

income, wealth, and quality neighborhoods than White children (Boardman & Alexander, 2011; Charles, 2006; Singh et al., 2008a). Due to the structure of the housing market and limited residential mobility (apart from their own resources), African Americans are more likely to live in high-poverty neighborhoods characterized by few amenities that support physical activity and health-food consumption (Sharkey, 2013); and these neighborhood characteristics increase the risk of having overweight/obesity (Isong et al., 2018; Zick et al., 2013). Baltrus et al. (2005) find that racial differences in body weight trajectories are largely explained by an accumulation of socioeconomic resources over the life course. Therefore, the effect of parental union dissolution may be more pronounced among children belonging to racial/ethnic groups that are more socioeconomically disadvantaged. However, given their exposure to socioeconomically stressful environments, ethnic minority children may have more abilities to respond and adapt to family stressors. Some scholars suggest that the stress associated with parental union dissolution is less detrimental for the wellbeing of Black children, given the high number of stressors that they face in their daily lives (Cherlin et al., 1998; Cross, 2020; Fomby & Cherlin, 2007). Ethnic minority children also receive greater support from the extended family network in times of need, which may help them to recover after stressful family events (Cross, 2020; Hamilton et al., 2011).

2.2 Gender differences and hypotheses

When investigating the BMI consequences of parental separation, researchers often take into account gender differences, as previous studies indicate varying levels of post-divorce stress experienced by male and female children (Demo & Acock, 1988). Boys with separated parents are more likely than girls to experience behavioral problems related to the lack of a same-sex role model, while girls are more likely than boys to have socioemotional problems associated with maternal stress (Demo & Acock, 1988; Hernandez et al., 2014; Liu et al., 2011; Holroyd

& Sheppard, 1997). These socioemotional problems are found to be associated with unhealthy eating behaviours and the use comfort food as a coping mechanism (McConley et al., 2011). However, previous studies provide mixed evidence on gender differences among children. Some findings show that post-divorce development problems, including unhealthy BMI gains, are more severe among boys than among girls (Cavanagh et al., 2008; Cavanagh & Huston, 2008), whereas others indicate more obesity-related problems among girls than among boys following parental separation (Augustine & Kimbro, 2017; Crosnoe, 2012; Doherty & Needle, 1991; Hernandez et al., 2014). There are also research findings suggesting that health trajectories after parental separation do not vary according to child gender: Sun and Li (2001) find no gender differences in terms of psychological and behavioral problems; similarly, Goisis et al. (2020) show that for both girls and boys the risk of overweight/obesity increased after parental separation. It remains unclear whether marital disruption affects boys and girls dissimilarly, and how males' and females' weight status may be differently affected by family instability.

This study examines the BMI trajectories of girls and boys of partnered and separated parents and extends previous research on parental separation and child obesity, by testing two hypotheses. First, given that weight gains during childhood are associated with subsequent BMI trajectories in adulthood (Hernandez et al., 2014; Mooyaart et al., 2019), I hypothesize that parental separation is associated with increased in child BMI and an increased risk of developing overweight/obesity risk in both the short and long run (H1). Second, I hypothesize that according to the 'diverging destinies' thesis (McLanahan, 2004), the BMI outcomes of children from socioeconomically disadvantaged social groups (defined in terms of education and ethnicity) are more negatively affected by parental separation (H2).

3. Data and Methods

3.1 Sample

The analysis is conducted with data from the Child Development Supplement (CDS 1997, 2002, and 2007) and the Transition to Adulthood Supplement (TAS 2005, 2007, 2009, 2011, 2013, 2015 and 2017) of the Panel Study of Income Dynamics (PSID). The PSID collects information on American families since 1968. In 1997, the CDS was introduced to collect detailed information on a nationally representative sample of children aged 0-12 and their primary caregivers who were re-interviewed in 2002 and 2007 (CDS User Guide 2012). As children grew up, children transited from the CDS to TAS, a survey module collecting information on young adults every two years, from age 18 to 28. 3,563 children were eligible for the CDS-1997, corresponding to a total of 17,889 child-year observations, and were followed over time.

The study sample includes children aged 0-12 living with both parents in 1997. Parents either remained in partnership (both in marriage or cohabitating union) or separated during the observed period. Given the study objective focusing on changes in child BMI before and after parental separation, children whose parents never married and never cohabited throughout the observation window are excluded from the sample. An additional selection criterion is based on the measurement of BMI, which is assessed in children aged 5 or older. Children below the age of 5 are included in subsequent waves of the sample when they become eligible for BMI measurement. Therefore, children who undergo parental separation between the ages of 0 and 4 are not observed in the immediate period after the separation, but they do contribute to the estimates regarding the long-term effects of union dissolution. The final sample includes 2,675 children corresponding to 12,608 child-year observations (on average, 4.7 observations per child).

3.2 Body Mass Index and Overweight/Obesity

CDS data collect information on the weight and height of children through questions answered by the primary caregivers or other caregivers. The primary caregiver reported the weight of the child, while the children's height was measured by the interviewer asking the children to take off their shoes and stand against a wall (CDS User Guide, 2012). In the TAS module information on weight and height was self-reported by young adult respondents. Although self-reported measured may be biased according to respondents' characteristics and preferences (Cole et al., 2005), our model strategy focusing on within-individual changes in BMI over time is less affected by this source of noise. BMI score is derived from the arithmetic calculation of body weight and height ([Weight in pounds / Height in inches^2] X 703). The literature suggests that linear BMI (with controls for age and gender) is less biased by initial weight status than z-score measures when analyzing changes in adiposity among children (Cole et al., 2005). Therefore, I use the linear unstandardized BMI score as the first dependent variable (mean = 24.1; S.D. = 6.3).

The second dependent variable is the risk of overweight/obesity – like in other studies on the U.S. (e.g., Hernandez et al., 2014). Among children aged below 18, the BMI thresholds to identify the risk of overweight/obesity are based on its distribution according to child gender and age. Children with a BMI exceeding the 95th percentile are defined as overweight or obese. Among young adults aged 18-28, a BMI equal to 25.0 or greater is classified in the category "overweight/obesity" (Centre of Disease Control and Prevention, 2011).

3.3 Parental Separation

To identify separated parents, information collected in the regular PSID survey was linked to children's characteristics collected in the CDS and TAS modules, by using mothers' and fathers' identification numbers. Parental separation is measured through two variables, i.e. the

marital status of the household heads (for parents classified as heads, i.e. the persons with the most financial responsibility in the household) and marital histories (i.e., number and timing of marriages and separations). Missing values (2.7%; N=432) in parental marital status are concentrated among children living with grandparents only. The analysis focuses on parental separation occurring at age 18 or younger, because the effects of family disruption on children's health may differ when they are older and living independently. 758 children (3,922 year-child observations) experienced parental separation throughout the observation window, while 1,917 children (8,686 year-child observations) lived in intact families (see Table 2 in the Descriptive Results section). Notably, children who experienced multiple parental separations were excluded at the time of the second separation to focus on the separation of biological parents.

After having identified separated parents, I calculate the number of years elapsed between the transition to parental separation and the date of each interview, by using information on the end of the first or last marriage. In case of missing dates, I use the number of years elapsed between interview dates. I then divide the time since/to parental union dissolution into the following categories: more than 3 years before parental separation (baseline); 3-1 years before separation (anticipation effect); the year of separation or the year after (immediate effect); 2-4 years after separation; 5-7 years after separation; 8-10 years after separation; and more than 10 years after separation (long-term effects).

3.4 Confounders

A set of confounders is included in the analysis to match the group of children whose parents separate during the observation window and the group of children whose parents remain in partnership (see the Analytical Strategy). The potential confounders refer to economic resources and family climate measured in the first wave observed in the data, i.e. in 1997 (see

Table 1A in Appendix). Economic resources are measured via four variables: mothers' employment status distinguishing between employed, unemployed, and out of the labor market; the total household income (divided in quartiles from the first, i.e. the highest, to the fourth, i.e. the lowest); and the amount of money spent on food at the household level (logarithmic transformation).

A set of indicators of family climate are included in the matching analysis. First, parental distress is measured through the K-6 Non-Specific Psychological Distress Scale, a 6-item scale that screens for mood and anxiety disorders (Kessler et al. 2002). This is an additive scale of the following items ranging from 0 (none of the time) to 4 (all of the time): primary caregivers were asked if during the last 4 weeks they felt (a) so sad that nothing could cheer them up; (b) nervous; (c) restless or fidgety; (d) hopeless; (e) worthless; (f) that everything was an effort. The total distress score ranges from 0 to 24 (mean = 3.7; S.D. = 2.7).

Second, I use the Rosenberg Self-esteem Scale (range = 1-4; mean = 3.4; S.D. =0.4). It was administered to primary caregivers to assess the degree of approval or disapproval toward oneself. The scale is the mean score of 10 items, using response scale of 1 (strongly disagree) – 4 (strongly agree). The 10 items are related to (a) feeling a person of worth; (b) having good qualities; (c) feeling like a failure; (d) doing things well; (e) having not much to be proud of; (f) having positive attitudes; (g) being satisfied with self; (h) wanting more respect; (i) feeling useless at times; and (j) thinking I am not good.

Third, parental warmth scale measures affective relationships between the child and his/her parents. The scale, ranging from 1 to 5 (mean = 4.4; S.D. = 0.7), is constructed as an average score of six items asking whether in the past month the primary caregiver has (a) shown physical affection to her/his child; (b) said I love you; (c) spent time with his/her child; (d) joked or played with the child; (e) talked about his/her interests; (f) appreciated something. The answer categories range from 1 (not in the past month) to 5 (every day). Additionally, father-child and

mother-child closeness are measured through a direct question of whether the child feels extremely close (score equal to 4), quite close, fairly close or not at all close (score equal to 1) to his/her mother and father. Despite these variables reflect the primary caregiver's perception of family climate, previous research indicates that these are validated measures associated with child health (Garasky et al., 2009). In the present analysis, these variables, which capture the degree of closeness of family relationships, are treated as potential confounders of the effect of parental union dissolution on child BMI. In fact, family conflicts and stressors may induce mothers and fathers to escape from troubled relationships (e.g., Amato & Hohmann-Marriott, 2007) and may be also associated with unhealthy BMI gains in childhood (Björkenstam et al., 2015; Bzostek & Beck, 2011; Garasky et al., 2009). Therefore, these indicators (available in the CDS) are measured at baseline when all children in the sample live with both parents at home.

3.5 Moderators

The study aim is to analyze the moderating effects of parental education and race/ethnicity. These variables are considered as time-invariant indicators and are interacted with parental union dissolution in the following analyses. Regarding parental socioeconomic position, I use information on mothers' education and divide the completed grades of schooling into three categories: up to lower secondary education (from Grade 1 to 11), high school degree (Grade 12), and post-secondary education (from Grade 13 to 17). Given that in standard surveys separated fathers are often difficult to follow after moving out of the household, mothers' educational level is used to avoid missing values in parental socioeconomic position. The choice of considering post-secondary education, which includes some college and Bachelor's degree or more, is driven by the need to have sufficient cell sizes to examine variations of the divorce

effect by parental education. The same reasoning is applied when categorizing children's race/ethnicity, distinguishing between White, Black, and the residual category "Others", which primarily includes Hispanic children (see Table 1).

Table 1. Number of child-year observations according to the time since/to parental separation, child gender, parental education and race/ethnicity

	Child gender		Parental education			Race/ ethnicity			Total
	Boys	Girls	Up to lower secondary	High school	Post-secondary	White	Black	Others	
Years since/to parental separation									
>3 y. before	203	217	206	108	106	210	174	36	420
1-3 y. before	176	169	140	107	98	163	155	27	345
0-1 y. after	180	174	112	111	131	168	159	27	354
2-4 y. after	259	279	268	141	129	245	248	45	538
5-7 y. after	279	275	265	148	141	246	255	53	554
8-10 y. after	303	327	299	173	158	283	281	66	630
>10 y. after	489	592	566	314	201	458	476	147	1,081
N. of child-year obs.	1,889	2,033	1,856	1,102	964	1,773	2,149	401	3,922

3.6 Analytical strategy

I use child fixed-effects linear regression models on child BMI score and the probability of developing overweight/obesity. Linear probability models with individual fixed effects are often preferred over maximum-likelihood specifications to produce more accurate estimates on rare events, such as developing overweight/obesity (Timoneda, 2021). The estimates are based on within-child changes in BMI, which has the advantage to account for time-constant characteristics. As part of the fixed-effects analytical strategy, the mean score for a person over all time points for the respective variable has been deducted from a person's score on this variable on a specific time-point. Consequently, all time-invariant characteristics, including those not observed, that may bias the estimate of the association between parental divorce and child health outcomes are accounted for (Allison, 2009). More specifically, child BMI is modelled as indicated in the following equation:

$$BMI_{it} \,/\, OV_{it} = \beta_{1-6} SEP_{it}^{k} + \beta_{7-22} X_{it} + \alpha_i + \varepsilon_{it}$$

BMI / OV is the body mass index and overweight/obesity risk of child *i* at time point *t*. *SEP* is a set of dummy variables capturing the time to/since the parental union dissolution of child *i* at time *t*. The superscript *k* refers to the six dummy variables for the group of children with separated parents, and β_{1-6} indicates the respective coefficients associated with intervals in the pre- and post-separation periods. X is a vector of control variables, and β_{7-22} refers to the respective coefficients. α – which is an individual-specific constant that varies across individuals but is fixed over time – is not estimated in the models and captures any time-invariant characteristic of the individual *i*. Similar modelling specifications have been used in previous studies to separate the effects of life course events for the pre- and post-event periods (e.g., Dougherty, 2006; Goisis et al. 2020; Tosi & Goisis, 2021).

In the fixed effects framework, we assume that the treatment and control groups are characterised by similar (and parallel) trends in the outcome variable before the treatment. However, in many applications the parallel trends assumption does not fully hold because of the effects of unobserved confounding factors (Ludwig & Brüderl, 2018). I use a matching strategy to create a group of children who do not experience parental separation but have similar characteristics (at the baseline) and are comparable to those whose parents separate during the observation window. This technique has two steps. In the first step, a probit model is estimated on the probability of experiencing parental separation (treatment) as a function of the above mentioned confounders. Predicted probabilities, i.e. propensity scores, are calculated to match children with similar values of the propensity score. Therefore, the two matched groups have the same distribution of the confounding factors included in the model (Rosenbaum & Rubin, 1983). Epanechnikov kernel matching algorithm is used to balance the confounders on the first observed wave, i.e. in 1997, when all observed children live with biological parents at home

(Arkhangelsky & Imbens, 2018). In the second step, the estimates from fixed effects models are weighted by using the matching weight given to each matched observation.

The analytical strategy consists of three steps. First, after presenting summary statistics for the selected sample, I show results from propensity score matching to evaluate the balancing property of the baseline confounders used in the analysis. Second, I analyze the association between parental separation and children's weight status, by dividing the pre-separation and post-separation periods in a set of dummy variables. The corresponding estimates are interpreted with respect to the baseline level measured three years before marital disruption. The reference category, which includes both children from intact and non-intact families, refers to a child-specific baseline level and is not estimated in the models because it is indistinguishable from the child-specific constant term (Dougherty 2006). The models are performed on the entire sample, as well as on the two distinct subsamples of boys and girls. Third, I analyze the moderating effects of parental education and race/ethnicity – characteristics used as time-constant variables – by including interaction terms in fixed-effects models. To evaluate the effect of parental separation among different population subgroups defined on the basis of parental education and race/ethnicity, Figures 1-4 present the predicted BMI scores and probabilities of developing overweight/obesity according to the time before, upon and following parental union dissolution. These figures also present results separately for boys and girls. Due to the small sample size, there is considerable uncertainty around the estimates. Therefore, point estimates without confidence intervals are reported for illustrative purposes, while the main interpretation of the results is based on the average effects of parental separation on the body weight status of children. All the analyses are performed on the full-information sample using the software STATA 18.

4. Results

4.1 Descriptive Results

Table 2 provides summary statistics for our sample including children (CDS) and young adults (TAS) from 1997 (0-12 years of age) to 2017 (18-28 years of age). Children's body weight changes over time as they grow: there is an upward trend in BMI values from 18.6 in 1997 (average age equal to 8.6) to 27.2 in 2017 (average age equal to 23.9). Changes in BMI over time are illustrated in Figure 1A in the Appendix, showing an increase as children grow older that is more pronounced during childhood and adolescence compared to young adulthood. Approximately 20% of children are at risk of developing overweight/ obesity. This proportion is significantly smaller in 2005 due to the small sample of children aged 0-12 in 1997 interviewed in the TAS module collecting information on young adults (18-28). The risk of having overweight/ obesity is higher in the more recent waves of the data when young adults are on average 22-24 years old.

Table 2. Sample description according to the year of the interview

Interview year	Divorce events N.	Child Age mean	BMI mean	Overweight %	Total N.	Survey Module
1997	0	8.6	18.6	17.7	1,373	CDS
2002	378	10.3	21.6	20.9	2,010	CDS
2005	174	18.9	24.4	12.6	580	TAS
2007	113	16.2	24.2	19.9	2,016	CDS/TAS
2009	73	20.9	25.5	16.9	1,229	TAS
2011	65	21.9	25.9	19.8	1,511	TAS
2013	33	22.1	25.9	20.1	1,440	TAS
2015	22	22.3	26.5	24.6	1,315	TAS
2017	0	23.9	27.2	28.7	1,134	TAS
Total	758	17.6	24.3	20.5	12,608	CDS/TAS

Note: Full-information sample of children aged 0-12 in 1997. CDS on children aged 0-17; TAS on children aged 18-28. In 2005 the sample includes children aged 10-12 in CDS-1997.

Table 3 shows that the number of divorce events decreases over time, given the study's objective of analyzing the effects of parental separation before age 19. Therefore, the number of individual-year observations presented in Table 3 increases in the post-separation period. More specifically, the pre- and post-separation periods are divided into dummy variables to

examine the short- and long-term associations between parental separation and child BMI. Children's BMI tends to increase in the year of separation and remains higher than the baseline (measured 3 years or more before parental separation) in the subsequent time-points. The proportion of children at risk of overweight/obesity also increases around the time of parental union dissolution and is particularly high eight-ten years after the event.

Table 3. Time elapsed since/to parental separation and BMI

	Continuously in partnership			Transition to divorce/separation		
	Total N	BMI Mean(SD)	Overweight %	Total N	BMI Mean(SD)	Overweight %
Years since/to parental separation						
Ref. (no separation or >3 y. before)	8,686	20.9 (6.1)	18.9	420	20.9 (5.9)	19.6
1-3 y. before				345	21.8 (5.9)	22.8
0-1 y. after				354	23.4 (6.5)	23.6
2-4 y. after				538	24.4 (6.4)	21.9
5-7 y. after				554	24.9 (6.5)	22.9
8-10 y. after				630	25.9 (6.2)	26.6
>10 y. after				1,081	26.7 (6.3)	25.9

4.2 Propensity score matching

I use propensity score matching to create two meaningful comparison groups for children whose parents separate and those who remain in partnership during the observation window. Table 4 presents summary statistics before (unmatched sample) and after matching (matched sample). In the unmatched sample, the treatment group includes a lower proportion of highly educated mothers (24%) and a higher proportion of unemployed mothers (7%) but lower rates of low-income households (15%), compared to the control group (35%, 27%, and 29%). Black children are overrepresented in the group of parents who separate in the following years (43% vs. 27%). On average, mothers in the treated group are younger and spend less money on food, than those belonging to the control group. Parents who separate during the observation window tend to report higher levels of distress, a lower score in the parental warmth scale, and a lower degree of closeness in father-child relationships, in comparison with those who remain in partnership

over their life courses. These differences observed in the unmatched sample become close to zero in the matched sample, indicating that the two groups are balanced with respect of the confounding factors when comparing children with a similar propensity score.

Table 4. Summary statistics of the matched and unmatched treatment and control groups.

	Matched Unmatched	Treated	Control	T-Test
Child gender (Boy)	U	0.49	0.48	0.40
	M	0.49	0.49	-0.06
Child age	U	5.23	6.62	-9.40**
	M	5.23	5.32	-0.52
Child race/ethnicity				
Black	U	0.43	0.27	7.99**
	M	0.43	0.43	0.05
Other	U	0.10	0.15	-3.23**
	M	0.10	0.10	-0.00
Mother age	U	30.81	34.78	-14.68**
	M	30.81	30.95	-0.42
Mother education				
High school degree	U	0.26	0.21	3.32**
	M	0.26	0.26	0.18
Post-secondary	U	0.24	0.35	-6.16**
	M	0.24	0.24	-0.01
Mother employment				
Unemployed	U	0.07	0.05	1.96*
	M	0.07	0.07	-0.20
Inactive	U	0.28	0.27	0.54
	M	0.28	0.28	0.48
Household income quartile				
2nd	U	0.28	0.23	3.21*
	M	0.28	0.28	0.01
3th	U	0.25	0.25	-0.13
	M	0.25	0.25	0.29
4^{th} (lowest)	U	0.15	0.29	-8.07**
	M	0.15	0.15	-0.07
Money spent on food (log)	U	3.83	4.15	-4.15**
	M	3.83	3.77	0.68
Parental distress scale (0-24)	U	4.03	3.49	4.73**
	M	4.03	4.01	0.14
Parental self-esteem scale (1-4)	U	3.44	3.45	-0.77
	M	3.44	3.45	-0.32
Parental warmth scale (1-5)	U	4.36	4.62	-3.57**
	M	4.62	4.62	0.02
Closeness to father (1-4)	U	3.16	3.36	-5.10**
	M	3.16	3.16	0.10
Closeness to mother (1-4)	U	3.75	3.74	0.39
	M	3.75	3.76	-0.21

4.3 Parental separation and children's weight status

Tables 5 and 6 present results from fixed-effects linear regression models predicting changes in children's BMI and overweight/obesity. The average effect of parental union dissolution is divided in dummy variables for the pre- and post-separation periods to investigate whether the effect of parental separation varies according to the time spell between the family breakdown and the observed weight status. In all models, the coefficients do not reach the significance level until the year of parental union dissolution, indicating that there are no anticipation effects in the process leading up to parental separation. Child BMI increases around the year of parental separation and, despite some fluctuations over time, remains higher than the baseline in the following years (Table 5). Child BMI increases by 0.58 points (C.I. = 0.14 – 1.03) in the year of separation and by 0.44 points (C.I. = 0.01 – 0.87) ten years after separation. Similarly, the risk of developing overweight/obesity increases by 6 percentage points (C.I. = 2 – 11) in the year of parental separation and remains approximately 5 percentage points (p.p.) higher than the baseline in the following ten years (C.I. = 2 – 10, eight to ten years after separation) (Table 6). These results suggest that parental separation is associated with increases in BMI and overweight/obesity risk in the long run. These long-term associations between family disruption and children's weight status are also consistent with a view of parental separation as a chronic strain, but in contrast with the recovering trajectories in health postulated by the stress-to-adjustment perspective.

With regard to gender differences, separate models for boys and girls show that among female children parental separation is associated with an increase in BMI and an increased risk of developing overweight/obesity. Specifically, one year after parental separation, girls experience an increase of 1.26 points in BMI (C.I. = 0.60 – 1.91) and an increase of 8 percentage points

(C.I. = 3 – 14) in the risk of developing overweight/obesity. In the following years, the effect size of parental union dissolution on BMI is slightly smaller but significantly higher than the baseline (AME = 6 p.p.; C.I. = 0 – 11, more than ten years after separation). Conversely, male children who undergo parental union dissolution during childhood do not experience significant changes in their weight status. Their BMI score decreases by 0.7 points eight to ten years after parental separation; however, this reduction in BMI score does not correspond to a lower risk of developing overweight/obesity.

Table 5 Fixed-effects linear regression models predicting changes in child BMI. Estimates weighted for matching weights.

	Overall		Girls		Boys	
	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
Time before/after separation (ref. no separation or > 3y. before)						
3-1 y. before	0.13	(0.23)	0.23	(0.34)	-0.06	(0.30)
0-1 y. after	0.58*	(0.23)	1.26**	(0.33)	-0.26	(0.31)
2-4 y. after	0.56**	(0.20)	1.03**	(0.29)	0.03	(0.27)
5-7 y. after	0.16	(0.21)	0.60*	(0.30)	-0.32	(0.28)
8-10 y. after	0.44*	(0.22)	0.90**	(0.31)	-0.74*	(0.29)
>10 y. after	0.44*	(0.22)	1.19**	(0.33)	-0.69*	(0.32)
Child age	0.77**	(0.11)	0.62**	(0.16)	0.96**	(0.16)
Child age^2	-0.02**	(0.00)	-0.02**	(0.00)	-0.02**	(0.00)
Constant	13.26**	(0.66)	13.72**	(0.97)	12.62**	(0.89)
N. of children	2,675		1,313		1,362	
N. of child-year observations	12,603		6,441		6,162	
R-squared	0.48		0.50		0.48	

Note: Control variables include wave dummies. ** p<0.01, * p<0.05, † p<0.1

Table 6 Fixed-effects linear regression models on the probability of developing overweight/obesity. Estimates weighted for matching weights.

	Overall		Girls		Boys	
	Coef.	S.E.	Coef.	S.E.	Coef.	S.E.
Time before/after separation (ref. no separation or > 3y. before)						
3-1 y. before	0.00	(0.02)	0.04	(0.03)	-0.04	(0.03)
0-1 y. after	0.06**	(0.02)	0.08**	(0.03)	0.04	(0.03)
2-4 y. after	0.05**	(0.02)	0.07**	(0.02)	0.02	(0.02)
5-7 y. after	0.04*	(0.02)	0.06*	(0.03)	0.02	(0.03)
8-10 y. after	0.05**	(0.02)	0.07**	(0.03)	0.04	(0.03)
>10 y. after	0.04*	(0.02)	0.06*	(0.03)	0.01	(0.03)
Child age	-0.02*	(0.01)	-0.02*	(0.01)	-0.02	(0.01)
Child age^2	0.01**	(0.00)	0.01**	(0.00)	0.01*	(0.00)
Constant	0.29**	(0.06)	0.29**	(0.08)	0.28**	(0.08)
N. of children	2,675		1,313		1,362	
N. of child-year observations	12,603		6,441		6,162	
R-squared	0.02		0.04		0.02	

Note: Control variables include wave dummies. ** p<0.01, * p<0.05, † p<0.1

4.4 Heterogeneity by parental education and race/ethnicity

Figures 1 and 2 present the findings on the moderating effect of parental education. The predicted BMI score and overweight/obesity risk reported in the two figures are calculated from fixed-effects linear regression models including interaction terms between parental separation and mothers' education (see Tables 2A and 3A in Appendix). Gender-specific BMI trajectories are illustrated by the gray lines. Figures 1 and 2 show that children with lower-educated mothers experience an increase in BMI (AME = 1.72 p.; C.I. = 0.64 – 2.79) and an increased risk of developing overweight/obesity (AME = 16 p.p.; C.I. = 7 – 26) in the year of parental separation. As noted in the analysis above (Tables 5 and 6), there is no anticipation effect suggesting that the process leading up to parental separation is not correlated with changes in child BMI and the risk of developing overweight/obesity. Among these families, the association between parental separation and children's weight gains is significant starting from the year of separation and remains higher than the pre-separation level for the following ten years. In fact, ten years after separation, children with lower-educated mothers have a BMI score 0.95 points (C.I. = 0.10 – 1.79) higher and a risk of developing overweight/obesity 8 point higher than the baseline (C.I. = 1 – 16). The long-term association between parental union dissolution and weight status seems to be driven by female children. Two years after parental separation, girls with lower-educated mothers experience an increase in BMI (AME = 1.8 p.; C.I. = 0.48 – 3.05) and overweight/obesity risk (AME = 17 p.p.; C.I. = 6 – 27), which persist above the baseline level for at least ten years (AME = 13 p.p.; C.I. = 2 – 24). By contrast, boys with lower-educated parents experience a short-term increase in their risk of developing overweight/obesity during parental separation (AME = 20 p.p.; C.I. = 7 – 34) and tend to recover after a few years (AME = 6 p.p.; C.I. = -5 – 16, two to four years after separation).

Among both boys and girls, higher parental education mitigates the negative effects of union

dissolution on child health. In fact, children with highly-educated mothers do not show significant changes in BMI and overweight/obesity risk during both the pre- and post-separation periods. This result is confirmed by the significant interaction terms presented in Tables 2A and 3A in Appendix. Among male children with highly-educated mothers, there is a decreasing trajectory in BMI and overweight/obesity risk in the post-separation period. Among female children with highly-educated mothers, the BMI score and overweight/obesity risk are only slightly higher than the baseline level.

Children whose mothers have a high school degree exhibit intermediate levels between the other two groups. Their risk of developing overweight/obesity increases by 7 percentage points (C.I. = 0 – 14) in the year of parental separation and remains slightly higher than the baseline thereafter (AME = 7 p.p.; C.I. = 1 – 13, more than ten years after separation). This small increase in overweight/obesity risk is mainly driven by female children (AME= 12 p.p.; C.I. = 2 – 22 in the year of parental separation), while the weight status of male children is approximately equal to the baseline level.

Figure 1 Predicted BMI score relative to the time before/after parental separation by mothers' education

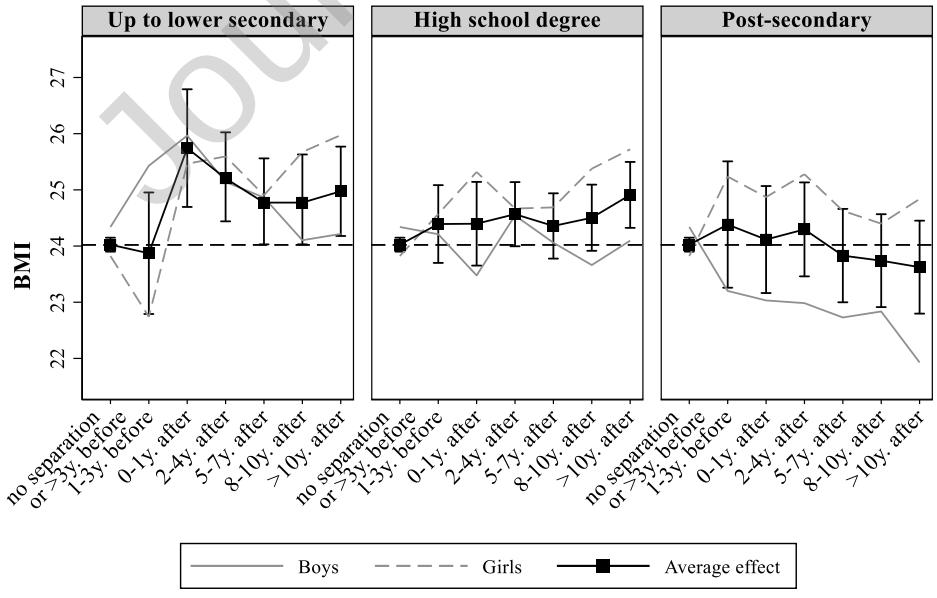
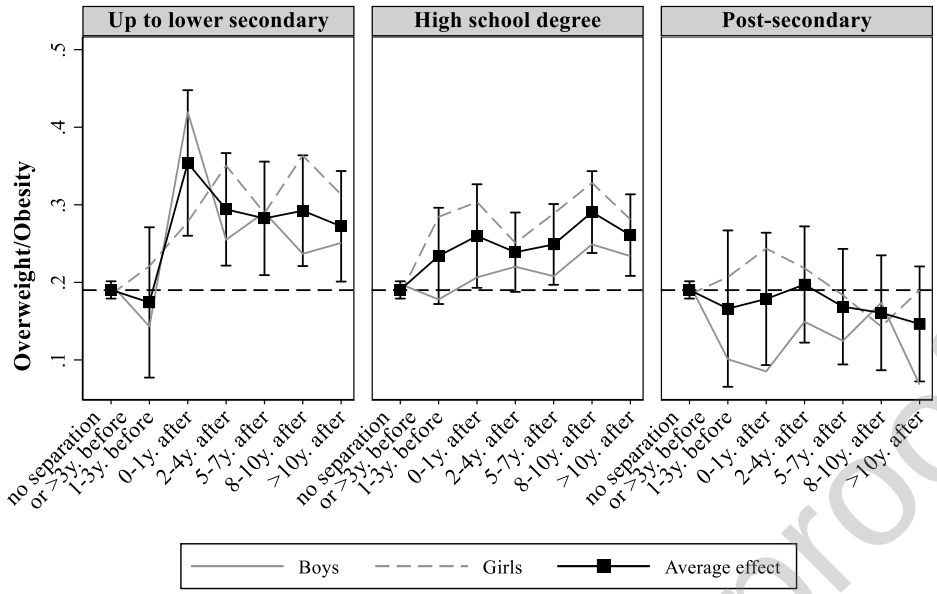


Figure 2 Predicted probabilities of developing Overweight/Obesity relative to the time before/after parental separation by mothers' education



Figures 3 and 4 report the findings on the association between parental separation and children's weight gains among different racial/ethnic groups (see Tables 4A and 5A in Appendix). The BMI of White children increases two years after parental separation (AME= 0.58 p.; C.I. = 0.04 – 1.11) and rapidly returns to approximately the baseline level (Figure 3). This short-term increase in BMI does not correspond to a significant increase in the risk of developing overweight/obesity (Figure 4), which suggests that parental separation is associated with minor changes in BMI score without implications for the weight status of their children. On the contrary, among Black children, the BMI score (AME = 0.65 p.; C.I. = 0.02 – 1.32) and the risk of developing overweight/obesity (AME = 8 p.p.; C.I. = 3 – 13) increase around the time of parental union dissolution and remain higher than the baseline for the ten years after parental separation (AME = 0.80 p.; C.I. = 0.21 – 1.38 on BMI score; AME = 6 p.p.; C.I. = 1 – 11 on overweight/obesity). Differences between White and Black children are marked in the analysis on overweight/obesity risk. The overweight/obesity trajectories of White and Black children significantly differ from each other in the post-separation period, with Black children being more negatively affected by family disruption than their White counterparts. The long-term

negative association between parental separation and the BMI of Black children seems to be more pronounced for girls than for boys. Among Black girls, the risk of developing overweight/ obesity tends to increase after parental separation (AME = 13 p.p.; C.I. = 5 – 21) and remains higher than the baseline in the following years (AME = 15 p.p.; C.I. = 8 – 22, more than ten years after separation).

Among other non-White ethnic groups, child BMI and the risk of developing overweight/obesity increase before parental union dissolution (AME = 2.07 p.; C.I = 0.69 – 3.44 on BMI score; AME = 12 p.p.; C.I. = 1 – 22 on overweight/obesity) and remain higher than the baseline level around the time of separation. Although the sample size for these ethnic groups is small and the confidence intervals are large, this pattern suggests that children of non-White parents are more susceptible to developing overweight or obesity following parental separation, compared to those with White parents. Overall, there is evidence of long-term increases in BMI score and overweight/obesity risk among non-White children, whereas these associations are not significant among White children.

Figure 3 Predicted BMI score relative to the time before/after parental separation by race/ethnicity

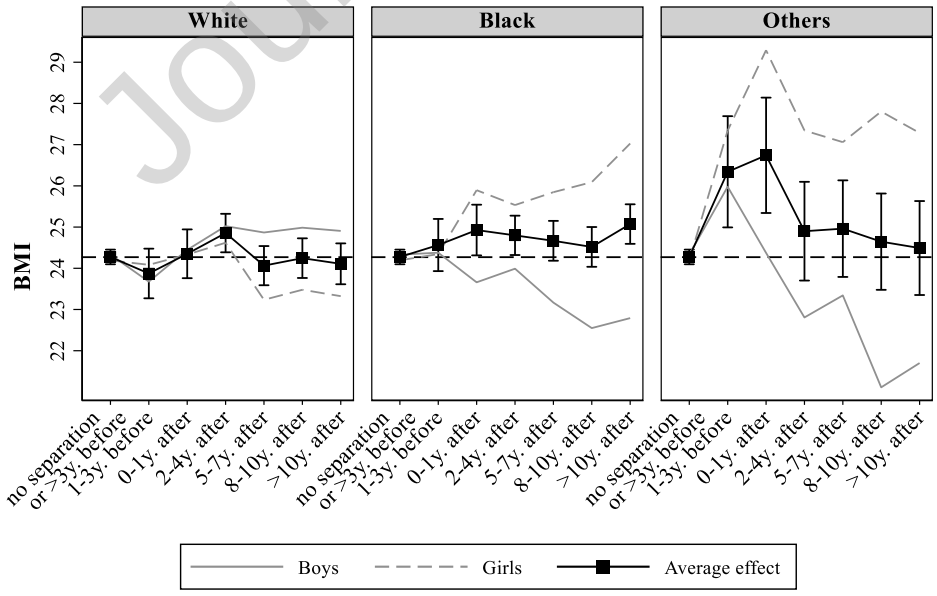
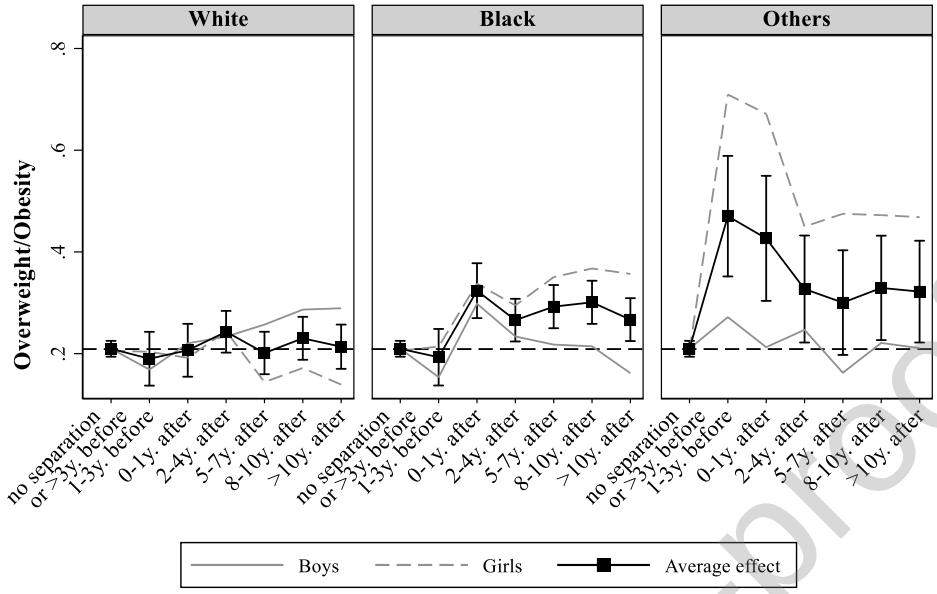


Figure 4 Predicted probabilities of developing Overweight/Obesity relative to the time before/after parental separation by race/ethnicity



5. Discussion

By using longitudinal data and distinguishing between anticipation, immediate, and long-term effects, this study examines whether the impact of parental separation endures throughout the life course, from childhood to young adulthood, and whether this association varies according to parental education and race/ethnicity. The results show that, consistent with hypothesis 1, children's BMI and their risk of developing overweight/obesity increase around the year of parental separation and remain above the baseline ten years after family breakdown. These unhealthy BMI gains associated with parental separation are more pronounced among girls and children with lower-educated and non-White parents, which provides evidence in support of hypothesis 2.

The negative association between parental separation and children's weight status has been found in previous cross-sectional studies (e.g., Bzostek & Beck, 2011; Chen & Escarce, 2010; Yannakoulia et al., 2008) as well as in longitudinal analyses (Arkes, 2012; Goisis et al., 2020; Schmeer et al., 2012). However, limited empirical attention has been given to the evolution of

child BMI before, upon and after parental union dissolution. The analysis presented here captures parental separation as a process (rather than an event) developing from the pre-separation to the post-separation periods. The findings show that there is no significant increase in child BMI in the years leading up to a family disruption. The absence of pre-separation effects is consistent with Goisis et al. (2020), while in contrast with Arkes (2012). This suggests that family conflicts and tensions occurring before the decision to separate have no immediate influence on children's BMI and the risk of developing overweight/obesity. Notably, our matching analysis shows that indicators of family climate, including parent-child closeness, parental distress, and parental warmth scale, are associated with the propensity to separate during the following years. The matching strategy used in this study serves to rule out the confounding effect of family climate, despite its role seems to be marginal in predicting changes in body weight around parental union dissolution.

Moreover, studying parental separation as a process allows us to distinguish short- and long-term effects in the post-separation period. The results support a view of parental union dissolution as a chronic strain, from which children and young adults can hardly recover during their life courses (Amato, 2000). As previous studies have indicated, body weight status and unhealthy BMI gains during adolescence are associated higher risks of having obesity in adulthood (Singh, 2008b; Srinivasan et al., 1996), partly due to difficulties in self-regulating nutritional intake (Hernandez et al., 2014). Therefore, the physical changes occurring at the time of parental separation tend to have lasting implications for the weight status of young adults, particularly female children.

The findings on gender differences indicate that parental union dissolution influences the risk of developing overweight/obesity for girls, but not for boys. Consistent with some previous studies (Augustine & Kimbro, 2017; Crosnoe, 2012; Hernandez et al., 2014), girls may have more difficulties than boys in dealing with the stress associated with parental separation,

specifically in relation to body weight outcomes and the consumption of comfort food as a coping mechanism (Demo & Acock, 1988; Liu et al., 2011). While male children are more likely to report externalizing disorders associated with smoking and drug use after parental separation, the female children of separated parents are at higher risk of internalizing conditions, such as depressive disorders and emotional problems (Anderson & Whitaker, 2010; Liu et al., 2011; Holroyd & Sheppard, 1997); socioemotional symptoms that are associated with unhealthy weight gains (McConley et al., 2011).

Our findings indicate significant variations in the effects of parental separation on child BMI and overweight/obesity risk based on parental education and race/ethnicity. The health of children with higher-educated and White parents is less affected by parental separation compared to children with lower-educated and Black parents. This finding contradicts theories suggesting that minority groups have greater abilities to respond to family stressors, and that children with higher-educated parents have more to lose in terms of socioeconomic resources (Bernardi & Radl, 2014; Cross, 2020). Children from Black and lower-educated families generally have fewer resources to deal with stressful family events, such as union dissolution; and low-educated separated mothers usually increase their involvement in the labor market (Özcan & Breen, 2012), thus reducing the amount of time available to invest in children and control their eating behaviors. By contrast, the highly educated have not only more social and economic resources but also stronger attitudes concerning the beneficial effect of parental involvement for the health development of children (Mandemakers & Kalmijn, 2014; Spaan et al., 2022). In line with this argument, the health impact of parental union dissolution is found to be more prevalent among social groups that already face socioeconomic disadvantages. This provides evidence in support of the ‘diverging destinies’ thesis, which suggests that the diffusion of parental union dissolution contributes to increase socioeconomic inequalities across generations (McLanahan, 2004; McLanahan & Percheski, 2008).

This study has five main limitations. First, the main variable of interest, children's BMI, is measured for children aged at least five. The reported changes in child BMI and the risk of overweight/obesity following parental separation could be underestimated, considering that parental separation may have more substantial impacts on younger children's wellbeing (Amato, 2000). Second, the used data collect information on children aged 0-12 in 1997, suggesting a need for future research that examines more recent cohorts to determine if these findings hold true for younger generations. Third, information on children's weight reported by the primary caregiver (in the CDS) or by respondents themselves (in the TAS) may introduce a bias in the between-individual estimates based on the average BMI score; however, the results presented here focus on within-individual changes in child BMI and thus are less affected by individual characteristics and preferences associated with this type of information bias. Fourth, this study provides limited insight into the underlying mechanisms that explain why a child's weight status is affected by parental separation. More comprehensive and harmonized information on children's diets, activities, and time use is necessary to identify the specific pathways through which family disruption influences a child's health. Fifth, this study has the ideal goal to identify the causal effect of parental separation using a combination of matching and fixed effects models; however causal inference can hardly be established using observational data.

Nevertheless, the results of this study have two key implications. First, the use of rich longitudinal data enables the adjustment for baseline and time-constant confounders and the investigation of both short- and long-term consequences associated with parental separation. In fact, changes in child BMI following family disruption do not necessarily indicate significant health issues later in life. The findings provide evidence that parental separation is associated with an increased long-term risk of developing overweight/obesity among female children and young adults, which may have additional implications for obesity-related morbidities. Second,

the results emphasize the differential impact of family events on various social groups, characterized by parental education and ethnicity. Specifically, children from lower-educated families and minority ethnic groups tend to experience a greater impact on their health outcomes following parental separation. This suggests that family instability may further exacerbate existing socioeconomic disadvantages: changes in family structures tend to have socioeconomically stratified effects, contributing to diverging destinies in child health outcomes. These disparities observed in child health highlight the importance of addressing the underlying social and economic inequalities that intersect with family dynamics.

Acknowledgements

Support for this study was provided by a Seed Grant from the Institute for Social Research at University of Michigan and the Eunice Kennedy Shriver National Institute of Child Health and Human Development (R25-HD083146).

References

Allison, P. D. (2009). *Fixed effects regression models.* Thousand Oaks, CA: SAGE Publications.

Amato, P. R. (2000). The consequences of divorce for adults and children. *Journal of Marriage and the Family*, 62(4), 1269–1287. https://www.jstor.org/stable/1566735

Amato, P. R. (2010). Research on divorce: Continuing trends and new developments. *Journal of Marriage and Family*, 72(3), 650-666. https://doi.org/10.1111/j.1741-3737.2010.00723.x

Amato, P. R., & Hohmann-Marriott, B. (2007). A comparison of high- and low distress marriages that end in divorce. *Journal of Marriage and Family*, 69, 621–638. https://doi.org/10.1111/j.1741-3737.2007.00396.x

Anderson, S. E., & Whitaker, R. C. (2010). Household routines and obesity in US preschool-aged children. *Pediatrics*, 125(3), 420–428. https://doi.org/10.1542/peds.2009-0417

Arkes, J. (2012). Longitudinal association between marital disruption and child BMI and obesity. *Obesity*, 20(8), 1696-1702. https://doi.org/10.1038/oby.2012.84

Arkhangelsky, D., & Imbens, G. (2018). The role of the propensity score in fixed effect models (No. w24814). National Bureau of Economic Research.

Augustine, J. M., & Kimbro, R. T. (2017). Associations and intervening mechanisms between family structure and young children's obesity. *Journal of Family Issues*, 38(16), 2277–2302. https://doi.org/10.1177/0192513X15621344

Baltrus, P. T., Lynch, J. W., Everson-Rose, S., Raghunathan, T. E., & Kaplan, G. A. (2005). Race/ethnicity, life-course socioeconomic position, and body weight trajectories over 34 years: The Alameda County Study. *American Journal of Public Health*, 95(9), 1595-1601. https://doi.org/10.2105/AJPH.2004.046292

Bernardi, F., & Boertien, D. (2017). Non-intact families and diverging educational destinies: A decomposition analysis for Germany, Italy, the United Kingdom and the United States. *Social Science Research*, 63, 181-191. https://doi.org/10.1016/j.ssresearch.2016.09.004

Bernardi, F., & Radl, J. (2014). Parental separation, social origin, and educational attainment: The long-term consequences of divorce for children. *Demographic Research*, 30, 1653–1680. https://doi.org/10.4054/DemRes.2014.30.61

Biehl A., Hovengen R., Grøholt E., Hjelmesæth J., Strand, B. H., & Meyer, H. E. (2014). Parental marital status and childhood overweight and obesity in Norway: A nationally

representative cross-sectional study. *BMJ Open,* 4(6), 1-8. https://doi.org/10.1136/bmjopen-2013-004502

Björkenstam, E., Burström, B., Brännström, L., Vinnerljung, B., Björkenstam, C., & Pebley, A. R. (2015). Cumulative exposure to childhood stressors and subsequent psychological distress. An analysis of US panel data. *Social Science & Medicine,* 142, 109-117. https://doi.org/10.1016/j.socscimed.2015.08.006

Boardman, J. D., & Alexander, K. B. (2011). Stress trajectories, health behaviors, and the mental health of black and white young adults. *Social Science & Medicine*, 72(10), 1659-1666. https://doi.org/10.1016/j.socscimed.2011.03.024

Boertien, D., & Bernardi, F. (2022). Gendered diverging destinies: Changing family structures and the reproduction of educational inequalities among sons and daughters in the United States. *Demography* 59(1), 111-136. https://doi.org/10.1215/00703370-9612710

Brown, L. J., & Sear, R. (2021). How do reproduction, parenting, and health cluster together? Exploring diverging destinies, life histories and weathering in two UK cohort studies. *Advances in Life Course Research*, 50, 100431. https://doi.org/10.1016/j.alcr.2021.100431

Bzostek, S. H., & Beck, A. N. (2011). Familial instability and young children's physical health. *Social Science & Medicine*, 73(2): 282–292. https://doi.org/10.1016/j.socscimed.2011.04.014

Cavanagh S. E., Crissey S. R., & Raley K. R. (2008). Family structure history and adolescent romance. *Journal of Marriage and Family,* 70(3), 698–714. https://doi.org/10.1111/j.1741-3737.2008.00515.x

Cavanagh, S. E., & Huston, A. C. (2008). The timing of family instability and children's social development. *Journal of Marriage and Family,* 70(5), 1258–1270. https://www.jstor.org/stable/40056341

CDS User Guide (2012). The Panel Study of Income Dynamics Child Development Supplement User Guide for CDS-III.

Centers for Disease Control and Prevention (2011). *Childhood overweight and obesity*. In: CDC (Ed.). CDC, Atlanta, GA.

Charles, C. Z. (2006). *Won't you be my neighbor? Race, class and residence in Los Angeles*. New York, NY: Russell.

Chen, A. Y., & Escarce, J. J. (2010). Family structure and childhood obesity, early childhood longitudinal study—Kindergarten cohort. *Preventing Chronic Disease*, 7(3), A50.

Cherlin, A. J., Chase-Lansdale, L. P., & McRae, C. (1998). Effects of parental divorce on mental health throughout the life course. *American Sociological Review*, 63(2), 239-249. https://www.jstor.org/stable/2657325

Cole, Tim J., Faith, M.S., Pietrobelli, A., & Heo, M. (2005). What is the best measure of adiposity change in growing children: BMI, BMI %, BMI z-score or BMI centile? *European Journal of Clinical Nutrition*, 59(3), 419–425. https://doi.org/10.1038/sj.ejcn.1602090

Cross, C. J. (2020). Racial/ethnic differences in the association between family structure and children's education. *Journal of Marriage and Family*, 82(2), 691-712. https://doi.org/10.1111/jomf.12625

Crosnoe, R. (2012). Obesity, family instability, and socioemotional health in adolescence. *Economics & Human Biology*, 10(4), 375–384. https://doi.org/10.1016/j.ehb.2012.04.005

Demo, D. H., & Acock, A. C. (1988). The impact of divorce on children. *Journal of Marriage and the Family*, 619-648. https://www.jstor.org/stable/352634

Doherty, W. J. & Needle, R. H. (1991). Psychological adjustment and substance use among adolescents before and after a parental divorce. *Child Development*, 62, 328–337. https://doi.org/10.1111/j.1467-8624.1991.tb01534.x

Dougherty, C. (2006). The marriage earnings premium as a distributed fixed effect. *Journal of Human Resources*, 41(2), 433–443. https://doi.org/10.3368/jhr.XLI.2.433

Drewnowski, A., & Specter S. E. (2004). Poverty and obesity: the role of energy density and energy costs. *American Journal of Clinical Nutrition*, 79(1), 6–16.

Fomby P., & Cherlin A. J. (2007). Family instability and child well-being. A*merican Sociological Review*, 72(2), 181–204. https://doi.org/10.1177/000312240707200203

Gable S., & Lutz S. (2000). Household, parent, and child contributions to childhood obesity. *Family Relations*, 49(3), 293-300. https://doi.org/10.1111/j.1741-3729.2000.00293.x

Gaydosh, L., & Harris K. M. (2018). Childhood family instability and young adult health. *Journal of Health and Social Behavior*, 59(3), 371-390. https://doi.org/10.1177/0022146518785174

Garasky, S., Stewart, S. D., Gundersen, C., Lohman, B. J., & Eisenmann J. C. (2009). Family stressors and child obesity. *Social science research*, 38(4), 755-766. https://doi.org/10.1016/j.ssresearch.2009.06.002

Goisis, A., Özcan, B., & Van Kerm, P. (2020). Do children carry the weight of divorce? *Demography*, 56, 785-811. https://doi.org/10.1007/s13524-019-00784-4

Härkönen, J., Bernardi, F., & Boertien, D. (2017). Family dynamics and child outcomes: An overview of research and open questions. *European Journal of Population*, 33, 163-184. https://doi.org/10.1007/s10680-017-9424-6

Hales, C. M., Carroll, M. D., Fryar, C. D., & Ogden, C. L. (2017). Prevalence of obesity among adults and youth: United States, 2015–2016. *NCHS data brief* No.288.

Hernandez, D. C., Pressler, E., Dorius, C., & Mitchell, K. S. (2014). Does family instability make girls fat? Gender differences between instability and weight. *Journal of Marriage and Family*, 76(1), 175–190. https://doi.org/10.1111/jomf.12080

Hohwü, L., Zhu, J. L., Graversen, L., Li, J., Sørensen, T. I., & Obel, C. (2015). Prenatal parental separation and body weight, including development of overweight and obesity later in childhood. *PLoS One*, 10(3), e0119138. https://doi.org/10.1371/journal.pone.0119138

Holroyd, R., & Sheppard, A. (1997). Parental separation: Effects on children; implications for services. *Child: Care, Health and Development*. 23(5), 369-378. https://doi.org/10.1111/j.1365-2214.1997.tb00904.x

Isong, I. A., Rao, S. R., Bind M., Avendaño M., Kawachi I., & Richmond, T. K. (2018). Racial and ethnic disparities in early childhood obesity. *Pediatrics*, 141(1), 1-11. https://doi.org/10.1542/peds.2017-0865

Kessler, R. C. et al. (2002). Short screening scales to monitor population prevalences and trends in non-specific psychological distress. *Psychological medicine* 32(6), 959-976. https://doi.org/10.1017/S0033291702006074

Kim, H. S. (2011). Consequences of parental divorce on child development. *American Sociological Review*, 76(3), 487-511. https://doi.org/10.1177/0003122411407748

Liu, J., Chen, X., & Lewis, G. (2011). Childhood internalizing behaviour: analysis and implications. *Journal of psychiatric and mental health nursing*, 18(10), 884-894. https://doi.org/10.1111/j.1365-2850.2011.01743.x

Ludwig, V., & Brüderl, J. (2018). Is there a male marital wage premium? New evidence from the United States. *American Sociological Review*, 83(4), 744-770.

Mandemakers, J. J., & Kalmijn, M. (2014). Do mother's and father's education condition the impact of parental divorce on child well-being?. *Social science research*, 44, 187-199. https://doi.org/10.1016/j.ssresearch.2013.12.003

McConley, R. L., Mrug, S., Gilliland, J. M., Lowry, R., Elliott, M. N., Schuster, M. A., Bogart, L. M., Franzini, L., Escobar-Chaves, S. L., & Franklin, F. A. (2012). Mediators of maternal depression and family structure on child BMI: Parenting quality and risk factors for child overweight. *Obesity*, 19(2), 345–352. https://doi.org/10.1038/oby.2010.177

McLanahan, S. (2004). Diverging destinies: How children are faring under the second demographic transition. *Demography*, 41(4), 607-627. https://doi.org/10.1353/dem.2004.0033

McLanahan, S., & Sandefur, G. D. (1994). *Growing up with a single parent: What hurts, what helps*. Cambridge, MA: Harvard University Press.

McLanahan, S., & Percheski, C. (2008). Family structure and the reproduction of inequalities. *Annual Review of Sociology*, 34, 257-276. https://doi.org/10.1146/annurev.soc.34.040507.134549

Mooyaart, J. E., Liefbroer, A. C., & Billari, F. C. (2019). Becoming obese in young adulthood: the role of career-family pathways in the transition to adulthood for men and women. *BMC Public Health*, 19(1), 1-12. https://doi.org/10.1186/s12889-019-7797-7

Özcan, B., & Breen, R. (2012). Marital instability and female labor supply. *Annual Review of Sociology*, 38, 463-481. https://doi.org/10.1146/annurev-soc-071811-145457

Patrick, H., & Nicklas, T. A. (2005). A review of family and social determinants of children's eating patterns and diet quality. *Journal of the American College of Nutrition*, 24(2), 83–92. https://doi.org/10.1080/07315724.2005.10719448

Rhee, K. E., Lumeng, J. C., Appugliese, D. P., Kaciroti N., & Bradley R. H. (2006). Parenting styles and overweight status in first grade. *Pediatrics,* 117(6), 2047–2054. https://doi.org/10.1542/peds.2005-2259

Rosenbaum, P. R., & Rubin, D. B. (1983). The central role of the propensity score in observational studies for causal effects. *Biometrika,* 70(1), 41-55.

Schmeer, K. K. (2012a). Union transitions and changes in BMI among adults in Mexico. *Journal of health and social behavior*, 53(2), 263-275. https://doi.org/10.1177/0022146512445898

Schmeer, K. K. (2012b). Family structure and obesity in early childhood. *Social Science Research*, 41(4), 820–832. https://doi.org/10.1016/j.ssresearch.2012.01.007

Sharkey, P. (2013). *Stuck in place: Urban neighborhoods and the end of progress toward racial equality*. University of Chicago Press.

Singh, G. K., Kogan, M. D., Van Dyck, P. C., & Siahpush, M. (2008a). Racial/ethnic, socioeconomic, and behavioral determinants of childhood and adolescent obesity in the United States: analyzing independent and joint associations. *Annals of epidemiology*, 18(9), 682-695. https://doi.org/10.1016/j.annepidem.2008.05.001

Singh, A. S., Mulder, C., Twisk, J. W., Van Mechelen, W., & Chinapaw, M. J. (2008b). Tracking of childhood overweight into adulthood: a systematic review of the literature. *Obesity reviews*, 95, 474-488. https://doi.org/10.1111/j.1467-789X.2008.00475.x

Slopen, N., Koenen, K. C., & Kubzansky, L. D. (2014). Cumulative adversity in childhood and emergent risk factors for long-term health. *The Journal of pediatrics,* 164(3), 631-638. https://doi.org/10.1016/j.jpeds.2013.11.003

Srinivasan, S. R., Bao, W., Wattigney, W. A., & Berenson, G. S. (1996). Adolescent overweight is associated with adult overweight and related multiple cardiovascular risk factors: The

Bogalusa Heart Study. *Metabolism,* 45, 235–240. https://doi.org/10.1016/S0026-0495(96)90060-8

Strohschein, L. (2005). Parental divorce and child mental health trajectories. *Journal of Marriage and Family*, 67(5), 1286–1300. https://doi.org/10.1111/j.1741-3737.2005.00217.x

Sun, Y. & Li, Y. (2002). Children's well-being during parents' marital disruption process: a pooled time-series analysis. *Journal of Marriage and Family,* 64(2), 472-488. https://doi.org/10.1111/j.1741-3737.2002.00472.x

Sun, Y., & Li Y. (2011). Effects of family structure type and stability on children's academic performance trajectories. *Journal of Marriage and Family,* 73(3), 541–556. https://doi.org/10.1111/j.1741-3737.2011.00825.x

Tanofsky-Kraff, M., Ranzenhofer, L. M., Yanovski, S. Z., Schvey, N. A., Faith M., Gustafson, J., Yanovski, J. (2008). Psychometric properties of a new questionnaire to assess eating in the absence of hunger in children and adolescents. *Appetite,* 51(1), 148–155. https://doi.org/10.1016/j.appet.2008.01.001

Teachman, J. (2003). Childhood living arrangements and the formation of coresidential unions. *Journal of Marriage and Family,* 65(3), 507–524. https://doi.org/10.1111/j.1741-3737.2003.00507.x

Tosi, M. (2020). Boomerang kids and parents' well-being: adaptation, stressors, and social norms. *European* Sociological *Review,* 36(3), 460-473. https://doi.org/10.1093/esr/jcz068

Tosi, M. & Albertini, M. (2019). Does Children's Union Dissolution Hurt Elderly Parents? Linked Lives, Divorce and Mental Health in Europe. *European Journal of Population* 35, 695–717. https://doi.org/10.1007/s10680-018-9501-5

Tosi, M., & Goisis, A. (2021). Mental health around the transition to first birth: Does Medically Assisted Reproduction matter? *Demography* 58(4), 1347-1371. https://doi.org/10.1215/00703370-9335177

Tosi M., & van den Broek, T. (2020). Gray divorce and mental health in the United Kingdom. *Social Science and Medicine,* 256: 1-8. https://doi.org/10.1016/j.socscimed.2020.113030

Timoneda, J. C. (2021). Estimating group fixed effects in panel data with a binary dependent variable: How the LPM outperforms logistic regression in rare events data. *Social Science Research*, 93, 102486. https://doi.org/10.1016/j.ssresearch.2020.102486

Yannakoulia, M., Papanikolaou, K., Hatzopoulou, I., Efstathiou, E., Papoutsakis, C., & Dedoussis, G. V. (2008). Association between family divorce and children's BMI and meal patterns: The GENDAI Study. *Obesity*, 16(6), 1382–1387. https://doi.org/10.1038/oby.2008.70

Wagner, M. (2020). On Increasing Divorce Risks. In Mortelmans, D. *Divorce in Europe* (pp. 37-61). Springer, Cham.

Westphal S. K., Poortman A., & Van Der Lippe T. (2014). Non-resident father–child contact across divorce cohorts: The role of father involvement during marriage. *European Sociological Review* 30(4): 444-456. https://doi.org/10.1093/esr/jcu050

World Health Organization, (2006). Obesity and Overweight. http://www.who.int/mediacentre/factsheets/fs311/en/index.html

Zick, C. D., Hanson, H., Fan, J. X., Smith, K. R., Kowaleski-Jones, L., Brown, B. B., & Yamada, I. (2013). Re-visiting the relationship between neighbourhood environment and BMI: an instrumental variables approach to correcting for residential selection bias. *International Journal of Behavioral Nutrition and Physical Activity*, 10(1), 1-10. https://ijbnpa.biomedcentral.com/articles/10.1186/1479-5868-10-27

Figure 1 Predicted BMI score relative to the time before/after parental separation by mothers' education

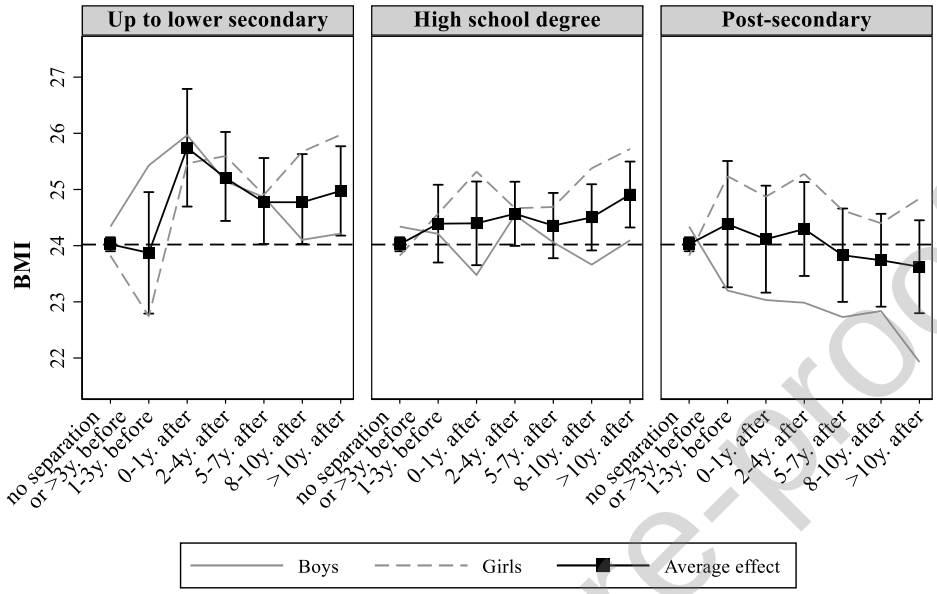


Figure 2 Predicted probabilities of developing Overweight/Obesity relative to the time before/after parental separation by mothers' education

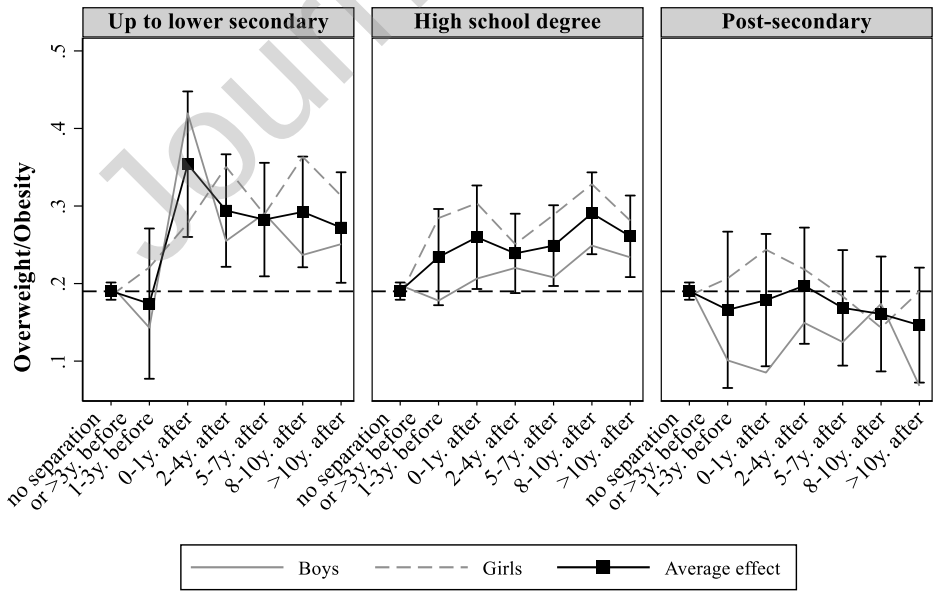


Figure 3 Predicted BMI score relative to the time before/after parental separation by race/ethnicity

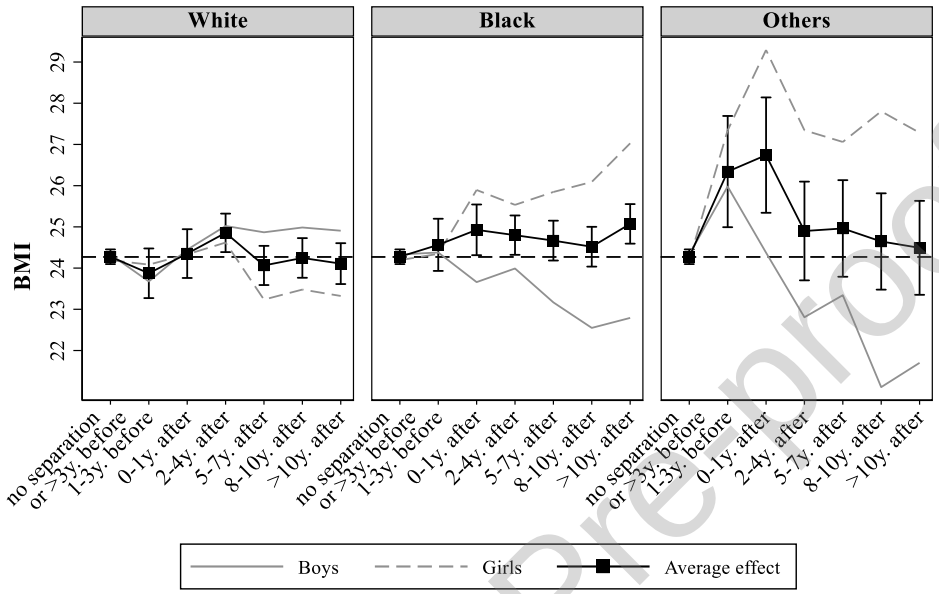
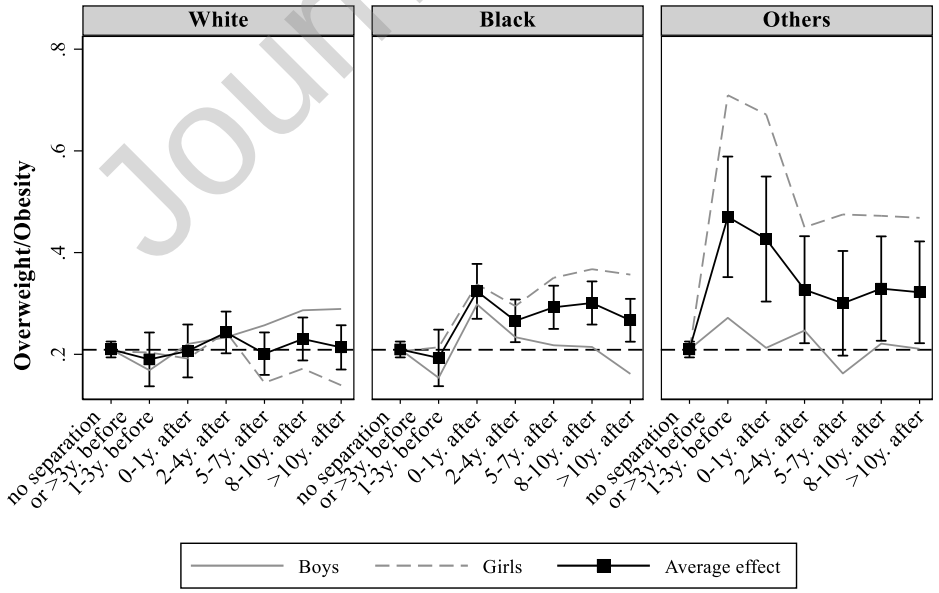


Figure 4 Predicted probabilities of developing Overweight/Obesity relative to the time before/after parental separation by race/ethnicity



Highlights

- Over the last decades, child obesity has dramatically increased in the U.S.
- Parental separation is associated with an increased risk of developing obesity.
- The risk persists for at least ten years after parental separation.
- The risk is higher among children with lower-educated and non-White parents.

Parental separation increases socioeconomic inequalities in child health.