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Relationship between child maltreatment and adolescent body mass index trajectories

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ABSTRACT

This study examines the relationship between childhood maltreatment experiences and body mass index (BMI) over time. Using data from the National Longitudinal Study of Adolescent to Adult Health, we use latent profile analysis to create child maltreatment experience classes and latent growth modeling to understand how classes relate to BMI trajectories from adolescence to early adulthood. The best-fitting model suggests four child maltreatment experience classes: 1) *poly-maltreatment* (n = 607); 2) *physical abuse* (n = 1578); 3) *physical abuse and neglect* (n = 345); and 4) *no childhood maltreatment* (n = 4188). Class membership differentially predicts BMI trajectories, such that individuals in the *no maltreatment*, *physical abuse,* and *physical abuse plus neglect* classes exhibit the most stable BMI, and individuals in the *poly-maltreatment* class increase most rapidly ($X^2[9] = 149.9$, $p < .001$). Individuals in the *poly-maltreatment* class experience significantly higher BMI over time compared to the other three classes. In addition to overall growth differing between classes, there is substantial inter-individual variability in BMI trajectories within each class. Because BMI trajectories differ across different childhood maltreatment experiences—and substantial variability in BMI trajectories exists within these different experiences—future analyses should investigate mediators and moderators of this relationship to inform trauma-based therapies and interventions.

1. Introduction

Annually, nearly 1.25 million children in the United States experience maltreatment (Sedlak et al., 2010), defined as the "nonaccidental physical injury, sexual exploitation or misuse, neglect or serious mental injury of a child … as a result of acts of commission or omission by a parent, guardian, or caretaker" (Cahill, Kaminer, and Johnson, 1999). Such adversity is associated with poor health outcomes across the life course, including obesity (Gilbert et al., 2009). Elevated BMI over time in this population warrants particular attention, as obesity is related to multiple negative health outcomes including depression, asthma, sleep disorders, and lower self-esteem (Gilbert et al., 2009), and child maltreatment already places individuals at risk for these conditions (Cornette, 2008; De Niet and Naiman, 2011; French, Story, and Perry, 1995; Kelly et al., 2013; Kelsey, Zaepfel, Bjornstad, and Nadeau, 2014; Rank et al., 2013). Beyond considering weight cross-sectionally, evaluating the shape of body mass index (BMI) trajectories of individuals who have faced childhood maltreatment provides insight into obesity development in this population. However, the relationship between overall child maltreatment experiences and BMI over time is not well understood.

Previous research suggests that individuals who experience child maltreatment exhibit elevated levels and steeper increases in BMI in the time between maltreatment and adulthood (Morris, Northstone, and Howe, 2016; Schneiderman, Negriff, Peckins, Mennen, and Trickett, 2015; Shin and Miller, 2012), which are characteristics of trajectories linked to obesity-related disorders in midlife (Tirosh et al., 2011). However, with respect to the relationship between specific forms of child maltreatment and later weight outcomes, findings are mixed. While some studies suggest sexual abuse in childhood is associated with an overweight or obese BMI in adulthood (Clark et al., 2014; Noll, Trickett, Harris, and Putnam, 2009; Richardson, Dietz, and Gordon-Larsen, 2014), others find no increase in risk among these individuals (Li, Pereira, & Power; Bentley and Widom, 2009). Likewise, studies focusing on physical abuse or neglect as the primary exposure report mixed results (Bentley and Widom, 2009; Helton and Liechty, 2014; Shin and Miller, 2012).

Mixed results from previous studies may partly be due to our operationalization of child maltreatment. Most research considers child maltreatment as categorical groups—typically physical abuse, sexual abuse, and neglect—often in a hierarchical manner (T. T. Clark, Yang, McClernon, and Fuemmeler, 2015; Gilbert et al., 2009; Schneiderman

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et al., 2015; Shin and Miller, 2012). For example, in a Schneiderman et al., 2015 study, individuals were categorized into the "sexual abuse" group if they ever experienced sexual abuse (regardless of other maltreatment). Of those individuals who did not experience sexual abuse, youth with any physical abuse (regardless of other maltreatment) were categorized into the "physical abuse" group. Then, among individuals without sexual or physical abuse, those with emotional abuse (with or without neglect) were categorized into the "emotional abuse" group. Lastly, the remaining individuals who experienced neglect were categorized into the "neglect" category (Schneiderman et al., 2015). Such hierarchical assignment requires a priori assumptions regarding which maltreatment type is most salient, and this is appropriate when assumptions are grounded in theory or previous research. Moreover, different coding schemes complicate comparisons across studies. However, measures that simultaneously capture maltreatment frequency, type(s), and type co-occurrence represent an individual's overall experience and therefore may provide better insights into the consequences of maltreatment when it is unclear what maltreatment types (or combinations) are most relevant for the given outcome. It may be particularly important to accurately capture maltreatment co-occurrence, as previous work has demonstrated a graded relationship between the number of childhood adversity types and adult health issues (Felitti et al., 1998). Moreover, nearly 41% of youth exposed to violence or abuse experience more than one such event (Finkelhor, Turner, Shattuck, and Hamby, 2015). Likewise, it may be disingenuous to assign individuals to one particular maltreatment experience if they experience multiple types. Here, we employ latent profile analysis (LPA) to uncover patterns of child maltreatment experiences to understand the relationship between overall maltreatment profiles and BMI trajectories.

Understanding the nature of BMI growth for different classes of maltreatment experiences enables us to identify particular groups of individuals who may be at risk of overweight and obesity. Although weight gain during the transition from childhood to adulthood is expected, adolescence is a risk period for excessive, unhealthy weight gain (McTigue et al., 2003; The, Suchindran, North, Popkin, and Gordon-Larsen, 2010). Individuals who experience child maltreatment are disproportionately susceptible to this unhealthy pattern (Power, Pinto Pereira, and Li, 2015; Schneiderman et al., 2015; Shin and Miller, 2012). Previous analyses have demonstrated that girls who experience sexual abuse and those who experience neglect exhibit greater BMI growth across adolescence compared to girls who were not maltreated (Schneiderman et al., 2015). Shin and Miller found that children of both sexes who experienced neglect had a faster average BMI growth over time compared to children who experienced no childhood maltreatment (Shin and Miller, 2012). As these studies operationalized child maltreatment in a hierarchical manner and assigned names to these groups accordingly, these findings imply the association between a specific exposure and BMI trajectories. The next line of inquiry in this field includes understanding how overall patterns of childhood maltreatment experience are associated with BMI growth from adolescence to early adulthood.

To our knowledge, only one previous study has evaluated the relationship between overall patterns of child maltreatment experiences and longitudinal weight outcomes. Sacks et al. identified four latent maltreatment classes: high abuse and neglect; physical abuse dominant; supervisory neglect dominant; and no/low maltreatment. They found that in girls, compared with no/low maltreatment, supervisory neglect dominant and physical abuse dominant maltreatment were associated with faster gains in BMI (Sacks et al., 2017). While Sacks et al. assessed if growth patterns differed between classes (i.e., intercept, linear slope, and quadratic slope), they did not evaluate if actual BMI differed between classes at all stages of development. We address this by modeling and comparing the corresponding 95% confidence limits of BMI for each latent maltreatment experience class across the entire developmental period of adolescence to young adulthood.

Table 1
Descriptive statistics of respondents.

Demographics	Proportion or mean (s.e.)
Male	0.51
Race	
White	0.70
Black	0.13
Hispanic	0.11
Other	0.06
Breastfeed 6+ months	0.21
Birthweight	2.24 (1.34)
US born	0.95
Pubertal status	0.09 (0.07)
Obese parent(s)	0.24
Employed parent(s)	0.80
Parent education	
< High school	0.11
High school	0.25
Some college	0.31
≥ College	0.33

Estimates based on analytic sample of 6718 respondents. Birthweight and pubertal status are mean-centered. All estimates account for survey clustering and weighting.

Despite the potential presence of different average BMI growth patterns across child maltreatment classes, inter-individual variance within classes may be substantial. On average, individuals who experience child maltreatment are at-risk for elevated BMI over time (Danese and Tan, 2014; Felitti et al., 1998; Schneiderman et al., 2015; Shin and Miller, 2012), but prior research has not considered the degree of heterogeneity within this population. Heterogeneity of weight outcomes within a maltreatment class would indicate multifinality; i.e., different weight outcomes among individuals with similar child maltreatment experiences due to the existence of moderators. Given there is significant BMI trajectory variability in the general population, this same heterogeneity likely exists among individuals within a given class of childhood maltreatment experiences. Identifying this variability is the first step in understanding how individuals can attain healthy outcomes despite extreme adversity. To address these gaps, the present study used LPA and latent growth modeling (LGM) to:

1. Detect latent profiles indicating actual patterns of child maltreatment experiences;
2. Determine if BMI trajectories differ by class of child maltreatment experiences; and
3. Evaluate variability around BMI trajectory parameter estimates (i.e., intercept, linear slope, and quadratic slope) by child maltreatment experience.

2. Methods

2.1. Data source

Data are from the National Longitudinal Study of Adolescent to Adult Health (Add Health), a longitudinal study of a nationally representative sample of 20,745 adolescents in grades 7–12 during 1994–95, with additional data collection seven ($N = 15,197$) and 13 years ($= 15,701$) later. The analytic sample includes 6718 respondents from Wave I (ages 13–21), Wave III (ages 18–28), and Wave IV (ages 24–31) with at least one measure of BMI across the three waves and complete information on all covariates. We omit Wave II from the present analysis, as this collection period was only one year after Wave I on a subset of respondents. As the present study was secondary data analysis, the University of North Carolina Chapel Hill Institutional Review Board granted exemption from human subjects' research approval.