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The impact of positive contextual factors on the association between adverse family experiences and obesity in a National Survey of Children

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ABSTRACT

Adverse family experiences (AFEs) are associated with childhood obesity. We evaluated whether certain positive contextual factors reduce the risk of obesity and overweight among children exposed to AFEs in a nationally representative sample.

Using data derived from the National Survey of Children's Health 2011–12 (N = 43,864), we calculated the distribution of positive contextual factors (very good/excellent maternal mental health, neighborhood and school safety, and child resilience) and AFEs across weight status. The AFEs composite score was modeled as a categorical measure (0 or ≥1 AFEs). Positive contextual factors, AFEs and their interactions were evaluated in weighted, adjusted, multinomial logistic regression models predicting the odds of overweight and obesity.

Children exposed to lack of very good/excellent maternal mental health and at least one AFE were at risk for overweight (OR = 1.43; 95% CI: 1.16, 1.76) and obesity (OR = 1.53; 95% CI: 1.22, 1.93). Unsafe school or neighborhood environment and exposure to 1 or more AFEs was.

associated with overweight (OR = 1.32; 95% CI: 1.08, 1.61) and obesity (OR = 1.66; 95% CI: 1.34, 2.05). Lack of child resilience and exposure to 1 or more AFEs was associated with an increased risk of obesity (OR = 1.45; 95% CI: 1.17, 1.90) and overweight (OR = 1.29; 95% CI: 1.06, 1.57).

These odds of obesity and overweight all decreased when positive contextual factors were present.

Among children exposed to AFEs, overweight and obesity risk is reduced with positive contextual factors. Optimizing the early childhood environment can impact obesity risk.

1. Introduction

Childhood obesity is a public health crisis in the United States (US) with the prevalence of overweight and obesity status increasing two-fold in the past 30 years (Ogden et al., 2016). Currently, about 17% of US children between ages 2–19 years are obese, and this prevalence is higher among African-American (19.5%) and Hispanic (21.9%) youth (Ogden et al., 2016). Higher rates of childhood obesity in the US have been observed among households with low-income (Rogers et al., 2015; Li et al., 2015) and in rural settings (Tarasenko et al., 2016).

Adverse childhood experiences (ACEs) are distressing or traumatic events that occur in childhood and can include child abuse or

Abbreviations: ACEs, adverse childhood experiences; AFEs, adverse family experiences; BMI, body mass index; FPL, Federal Poverty Level; NSCH, National Survey of Children's Health

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household dysfunction (Felitti et al., 1998). Exposure to ACEs can lead to toxic stress in children which is manifested in multiple ways including increased stress hormone and inflammatory cytokine levels and epigenetic changes of DNA (Shonkoff & Garner, 2012). Children exposed to ACEs are at risk for developing high risk behaviors as adults including physical inactivity, alcohol use, drug use and smoking as well as adult chronic illnesses including depression, cardiovascular disease, and cancer (Felitti et al., 1998; Tamayo et al., 2010; Halonen et al., 2015; Hughes et al., 2017). Adverse family experiences (AFEs), a subset of ACEs which are more contextual or environmental than direct abuse or neglect, are present on the National Survey of Children's Health (NSCH) (CDC, 2017).

There is growing evidence that, both in the United States and in other countries, childhood early life stress exposure is associated with childhood obesity (Pretty et al., 2013; Heerman et al., 2016; Biehl et al., 2014; Morris et al., 2016). The studies outside of the United States, including England, Norway and Canada, have been in regional populations and do not contain data on positive contextual factors like the NSCH (Pretty et al., 2013; Biehl et al., 2014; Morris et al., 2016). Using the NSCH, Heerman et al. found that children exposed to ≥2 adverse family experiences (AFEs) were more likely to have obesity (Heerman et al., 2016). We found a similar increased risk for obesity in children exposed to 2 or more AFEs while adjusting for different socio-demographic factors (Lynch et al., 2016).

Hemmingsson et al. proposed a model of causation wherein socioeconomic disadvantage leads to adult distress, which results in a disharmonious family environment, offspring distress, and psychological and emotional overload of children, with subsequent disruption of chemical homeostasis (Hemmingsson, 2014). Neighborhood and school environments, parent education level, and household income can contribute to the socioeconomic disadvantage. Neighborhood poverty is associated with lower levels of safety and less social cohesion (Kaiser et al., 2016). Poor maternal mental health and AFEs can contribute to a disharmonious family environments and offspring distress. For example, maternal depression is associated with lower cognitive scores in infants (Liu et al., 2017). Child resilience can be protective for offspring distress and psychological and emotional overload of children (Hemmingsson, 2014). The disruption of chemical homeostasis from stress can lead to obesity (Danese & McEwen, 2012). Bethel et al. found, using the NSCH, that child resilience and factors indicative of nurturing family relationships could attenuate the relationship between exposure to AFEs and emotional, mental or behavioral conditions in children but did not look at obesity as an outcome (Bethell et al., 2014).

One current gap in the emerging scientific literature around the health impact of AFEs is how certain positive contextual factors may attenuate the association between AFEs and obesity. Borrell et al. found that a supportive neighborhood was protective against obesity but the study did not explore other factors on the NSCH which address neighborhood and school safety (Borrell et al., 2016). Using the theoretical background proposed by Hemmingson et al., the primary aim of our study was to evaluate whether certain positive contextual factors reduce the risk of obesity among children exposed to AFEs in a nationally representative sample. Our secondary aim was to evaluate how excellent or very good maternal mental health, safe school and neighborhood environment, and child resilience affect the odds of childhood obesity while adjusting for sociodemographic factors, AFEs and household income. We hypothesized that, in children exposed to AFES, exposure to positive contextual factors will decrease the odds of children being overweight or obese.

2. Methods

2.1. Patient population and data collection

We obtained data from the 2011–2012 National Survey of Children's Health (NSCH), which was conducted by the CDC National Center for Health Statistics (n = 95,677) (CDC, 2017). The NSCH is a cross-sectional survey of US households with at least one resident child under 18 years of age at the time of the interview. To be eligible for the study, at least one resident child aged 0–17 years needed to live in the household. If more than one eligible child lived in the household, the index child was randomly selected. Respondents were the parent or guardian who was most knowledgeable about the child's health and interviews were conducted in English or Spanish. The overall response rate was 23% overall, 38.2% for landline, and 15.5% for cellphone.

The survey data were collected from February 28, 2011 through June 25, 2012 using random digit-dialing of landlines and cell-phones from all 50 states and the District of Columbia. The 2011–12 NSCH contained data for 43,864 children aged 10 years and older (ages where BMI data were available). The race/ethnicity distribution of the study sample was 29,892 non-Hispanic Whites, 4677 Hispanics, 4253 multiracial participants, and 4129 non-Hispanic Blacks (missing data for 913) (CDC, 2017).

The survey contains over 100 indicators of children's health and well-being. The Child and Adolescent Health Measurement Initiative took responses from NSCH and created standardized indicators of child health that could be used by researchers or the general public (CAHMI, 2013). As the public data from the NSCH are de-identified, our study was determined to be exempt from the Mayo Clinic Institutional Review Board review.

2.2. Measures

2.2.1. Socio-demographic factors

We included the following socio-demographic variables in our analysis: age (continuous), sex (male, female), race/ethnicity (Hispanic; Black, non-Hispanic; White, non-Hispanic; Other or multiracial), parents' education-level (less than high school, high school graduate, more than high school), and household income (< 100% Federal Poverty Level [FPL], 100%–199% FPL, 200%–399% FPL, 400% or greater FPL (Lynch et al., 2016). These factors were included in our previous study which evaluated the association between AFEs and childhood obesity (Lynch et al., 2016).

2.2.2. Weight status

In the original survey, respondents were asked to report the child's height and weight on the survey and children were classified per the 2000 Center for Disease Control and Prevention (CDC) growth charts as underweight (body mass index (BMI) less than 5th percentile), healthy weight (BMI 5th up to 85th percentile), overweight (BMI 85th up to the 95th percentile) and obese (BMI 95th percentile or above) (Ogden et al., 2002). To determine weight status, respondents were asked, “How tall is [child] now?” and “How much does [child] weigh now?” (CDC, 2017). The age and sex of the child are needed to determine BMI percentile. To determine age, respondents were asked “…please tell me the age of the child less than 18 years old living in this household” (CDC, 2017). Since the NSCH reports age only in years, all children were assumed to be at the midpoint of their age-year in calculating BMI percentile. The NSCH suppresses BMI data for children under age 10 years because of the concern of caregiver overestimates of overweight and obesity in this age group (Akinbami & Ogden, 2009).

2.2.3. Adverse family experiences

There were nine questions specific to AFEs on the NSCH (CDC, 2017). Five of the questions were adopted from the Behavioral Risk Factor Surveillance System ACE Module and captured household dysfunction and family exposures (divorce or separation of parent; parent served time in jail; witnessed domestic violence; lived with someone who was mentally ill or suicidal; lived with someone with substance abuse problems) (Centers for Disease Control and Prevention, n.d.). The additional survey items (treated or judged unfairly due to race/ethnicity; death of parent; victim or witness of neighborhood violence;