



## Violence exposure and adolescents' same-day obesogenic behaviors: New findings and a replication



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### ABSTRACT

**Objective:** To test whether exposure to violence is associated with same-day increases in obesogenic behaviors among young adolescents, including unhealthy food and beverage consumption, poor quality sleep, and lack of physical activity.

**Methods:** Young at-risk adolescents between 12 and 15 years of age were recruited via telephone screening from low-income neighborhoods. Adolescents and their parents completed in-person assessments, followed by Ecological Momentary Assessment (EMA) delivered to 151 adolescents' mobile phones three times a day for 30 days (4329 person days). Three obesogenic behaviors – unhealthy food consumption, poor sleep quality, and lack of physical activity – and violence exposure were assessed daily. Adolescents' body mass index (BMI) was assessed prior to the EMA and 18 months later. A replication was performed among 395 adolescents from a population-representative sample (with 5276 EMA person days).

**Results:** On days that at-risk adolescents were exposed versus not exposed to violence, they were more likely to consume unhealthy foods and beverages ( $b = 0.12$ ,  $p = 0.01$ ), report feeling tired the next morning ( $OR = 1.58$ ,  $p < 0.01$ ), and to be active ( $OR = 1.61$ ,  $p < 0.01$ ). At-risk adolescents who reported higher consumption of soda and caffeinated beverages during the 30-day EMA were more likely to experience increases in BMI in later adolescence. Findings related to sleep and activity were supported in the population-based replication sample; however, no significant same-day associations were found between violence exposure and unhealthy dietary consumption.

**Conclusions:** This study provides evidence that exposure to violence is associated with same-day unhealthy dietary consumption among at-risk adolescents and next-day tiredness related to sleep quality among adolescents from both at-risk and normative populations. Findings also point to unhealthy soda consumption during early adolescence as an important predictor of weight gain among at-risk adolescents.

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## 1. Introduction

Childhood obesity is currently one of the most pressing health concerns in the United States. With one in every three children now classified as overweight or obese (Ogden et al., 2014) it is predicted that we may witness a decline in average life expectancy for this generation (Olshansky et al., 2005). Children from minority and low socioeconomic status (SES) families are disproportionately affected

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(Ogden et al., 2010; Rossen, 2014; Vieweg et al., 2007). For example, a recent study found that by kindergarten entry 18% of low-income children versus 7% of children from more affluent families were classified as obese (Datar and Chung, 2015). By adolescence, over 20% of adolescents aged 12 to 19 in the US are classified as obese, with the highest rates of obesity observed among Hispanic and Non-Hispanic Black adolescents (Ogden et al., 2015). Disparities in obesity rates between children from high versus low-SES households are also widening over time (Datar and Chung, 2015).

Exposure to adversity and stressors accompanying low-income environments are reliably associated with children's health (Evans, 2004). Results from large-scale cohort studies (Boynton-Jarrett et al., 2010) and meta-analyses (Danese and Tan, 2014; Hemmingsson et al., 2014) demonstrate a robust relationship between exposure to maltreatment, violence, and obesity risk during both childhood and adulthood (Bosch et al., 2015; Clark et al., 2014; Midei and Matthews, 2011). Prior research suggests both direct and indirect effects of exposure to childhood violence on obesity. Explanations range from the influence that family violence and related stressors may have on diet and exercise patterns (for a review see Midei and Matthews, 2011) to more direct biological theories of influence. For example, violence exposure may increase obesity risk by triggering unhealthy food consumption or disordered eating or by disrupting sleep (Bosch et al., 2015; Lissau and Sorensen, 1994). The effects of violence exposure on obesity risk may also be driven by stress-related abnormalities in biological pathways, including the hypothalamic-pituitary-adrenal (HPA) axis (Adam and Epel, 2007; Heim et al., 2008) and via heightened inflammation (Danese et al., 2007; Hotamisligil, 2006). In the former case, chronic stimulation of the HPA-axis due to stressors is hypothesized to increase obesity risk by elevating cortisol levels and promoting visceral fat accumulation and/or dysregulating neuroendocrine mediators of the reward pathway (Rutters et al., 2010).

Lower physical activity is also associated with increased risk of overweight status among youth (Janssen et al., 2005) and children growing up in violent neighborhoods may engage in reduced physical activity as they lack safe places to exercise and play. Consistent with this mechanism, adolescents participating in the Project on Human Development in Chicago Neighborhoods, who lived in neighborhoods with higher levels of social disorder and lower neighborhood safety, averaged fewer hours in recreational programming than their peers living in safer and less disordered neighborhoods (Molnar et al., 2004). Similar associations between higher neighborhood violent crime levels and reduced outdoor physical activity have been documented among Mexican-American adolescent girls (Gómez et al., 2004). However, not all studies have found that adolescents living in unsafe neighborhoods engage in decreased physical activity (see for example: Lee and Cubbin, 2002).

Unfortunately, few studies have been able to isolate exactly *how* witnessing and experiencing violence influences young people's day-to-day health behaviors related to weight status. In this study we used Ecological Momentary Assessment (EMA) via mobile phones to collect daily measures of violence exposure and obesogenic behaviors for 30 consecutive days and address the following three questions: First, are there daily associations between exposure to violence and obesogenic behaviors? That is, on days that adolescents are exposed versus not exposed to violence, do they consume unhealthier food and beverages? Are violence exposure, versus non-exposure, days more likely to be followed by disrupted sleep and next day fatigue and tiredness? Second, are some adolescents (e.g., girls, racial/ethnic minorities) more "reactive" to daily violence exposure (the term "reactivity" is used to refer to the strength of the *same-day association or coupling* between violence

exposure and obesogenic behaviors versus referencing a causal association)? Third, does daily violence exposure, unhealthy food consumption, or sleep disruption predict increases in adolescents' BMI or changes in overweight or obesity status across early adolescence?

This study is unique in that it employed an intensive assessment strategy where each adolescent is used as his/her own control when testing whether violence exposure was associated with *within-individual* elevations in risk for same-day obesogenic behaviors. This approach facilitates causal inference by holding constant all time-invariant factors within the adolescent. Although not sufficient to establish a causal connection, it represents a strong test of whether there are unique associations between violence exposure and behaviors that cannot otherwise be explained by often powerful invariant and potentially confounding factors, including sex, age, and socioeconomic status.

## 2. Method

### 2.1. Participants

The miLife Study used EMA via mobile phones to track daily experiences, health behaviors, and emotions of young adolescents ( $N = 151$ ) living in low-income neighborhoods in California. Adolescents were, on average, 13 years of age (range = 11–15 years,  $SD = 0.91$ ). Males and females were equally represented in the sample (48.3% female) and 42.7% of adolescents identified as belonging to an ethnic minority group (non-white ethnicity, primarily Latino). Parental reports (89% biological mother) were collected for 93% of the adolescents in the sample via in-person interviews ( $N = 141$ ). The University of California Irvine Institutional Review Board and the Duke University Institutional Review Board approved all measures and procedures in the studies.

### 2.2. Procedures

Adolescents from low-SES neighborhoods were recruited via telephone screening. Full details of the recruitment, sample demographics, eligibility, and procedures are described in full detail elsewhere (Russell et al., 2015). Briefly, adolescents at risk for behavioral, school-related, or mental health problems based on parent reports were eligible for inclusion in the study.

**Baseline assessment.** Adolescents attended an in-person assessment with at least one parent. In private interview rooms, both the parent and the adolescent completed self-report inventories on laptop computers that assessed baseline height, weight, diet and exercise.

**30-day EMA field-study.** Following the baseline assessments, adolescents were provided with smart phones individually programmed with each adolescent's normal waking hours and schedules to "beep" three times a day for approximately 30 consecutive days. The morning survey occurred between 7 and 10 a.m. (average time 2.3 min), the afternoon survey occurred between 2 and 5 p.m. (average time of 3.8 min) and the PM survey between 5 p.m. and midnight (average time of 8.3 min). A case manager monitored incoming data, tracked response rates, and sent a text message reminder when more than two consecutive sessions were missed. On average, adolescents responded to 92% of the surveys across the 30-day assessment (resulting in over 12,400 completed surveys and over 4300 person-days;  $M = 38.0$ ,  $SD = 13.5$ ).

**Follow-up assessment.** Eighteen months later, 93% of adolescents completed an in-person follow-up assessment and a second measure of self-reported BMI was obtained for 91% of these adolescents.

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