



Family-centered prevention ameliorates the association between adverse childhood experiences and prediabetes status in young black adults



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ABSTRACT

Individuals exposed to adverse childhood experiences (ACEs) are vulnerable to various health problems later in life. This study was designed to determine whether participation in an efficacious program to enhance supportive parenting would ameliorate the association between ACEs and prediabetes status at age 25. Rural African American parents and their 11-year-old children ($N = 390$) participated in the Strong African American Families (SAAF) program or a control condition. Each youth at age 25 provided a total ACEs score and a blood sample from which overnight fasting glucose was assayed. Logistic regression equations were used to test the hypotheses. The logistic regression analyses revealed a significant interaction between total ACEs and random assignment to SAAF or control, $OR = 0.56, 95\% CI [0.36, 0.88]$. Follow-up analyses indicated that, for participants in the control condition, a 1-point increase in ACEs was associated with a 37.3% increase in risk of having prediabetes. ACEs were not associated with the likelihood of having prediabetes among participants in the SAAF condition. Control participants with high total ACEs scores were 3.54 times more likely to have prediabetes than were SAAF participants with similar scores. This study indicated that participation at age 11 in a randomized controlled trial designed to enhance supportive parenting ameliorated the association of ACEs with prediabetes at age 25. If substantiated, these findings may provide a strategy for preventing negative health consequences of ACEs.

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1. Introduction

Interest is mounting among pediatrics scientists and practitioners regarding the hypothesis that adverse childhood experiences (ACEs) influence physical health across the lifespan (Miller et al., 2011a; Shonkoff et al., 2009). This interest has been fueled by recent studies showing that people exposed to major psychological stresses in childhood experience elevated morbidity and mortality from the chronic diseases of aging. Adverse childhood experiences include maltreatment, neglect, and household dysfunction before the age of 18 years (Anda et al., 2006; Felitti and Anda, 2010). ACEs are associated with an elevated risk of heart, lung, and liver disease; cancer; and health-related quality of life (Anda et al., 2009; Caspi et al., 2006; Chartier et al., 2010; Dong et al., 2004; Dube et al., 2009; Felitti et al., 1998; Middlebrooks and Audage, 2008; Springer et al., 2007). Individuals who report ACEs also

demonstrate greater use of health care services and higher health care costs (Anda et al., 2008; Chartier et al., 2010). This research reflects a dose-response relationship between numbers of ACEs and health outcomes, with the risk of health problems later in life increasing as exposure to ACEs increases (Felitti, 1993; Felitti et al., 1998).

This study was designed to advance understanding of the association between ACEs and subsequent health status by testing hypotheses involving prediabetes among African American young adults living in the rural southern United States. Prediabetes is characterized by impaired glucose control; it is a precursor to diabetes and a contributor to numerous chronic diseases of aging, including heart disease and stroke (Middlebrooks and Audage, 2008). Although more than 80 million people in the United States are prediabetic, with the prevalence for African Americans being alarmingly high at 39% (Centers for Disease Control and Prevention, 2014), little is known about the link between ACEs and prediabetes. The study hypotheses were tested with a sample of rural African American youths who took part in a randomized prevention trial and were followed from preadolescence (age 11) to young adulthood (age 25). The preventive intervention, the Strong African American Families (SAAF) program, was designed to enhance supportive parenting and reduce harsh parenting (Brody et al., 2004); it

Abbreviations: ACEs, adverse childhood experiences; BMI, body mass index; CI, confidence interval; OR, odds ratio; SAAF, Strong African American Families program.

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will be described in more detail later. To measure prediabetes, an overnight fasting blood sample was assayed. The following sections present the study hypotheses and the rationale for them.

Accumulating evidence suggests that children exposed to ACEs display lasting alterations in the activity of the sympathetic-adrenal-medullary system and the hypothalamic-pituitary-adrenal axis (Garner et al., 2012; Middlebrooks and Audage, 2008; Miller et al., 2011a). Dysregulation of these systems has downstream implications for glucose metabolism, insulin sensitivity, fat accumulation, and inflammatory signaling, all of which are implicated in the pathogenesis of prediabetes and type 2 diabetes (Black, 2006; Hotamisligil, 2006). Thus, exposure to ACEs was hypothesized to predict prediabetes status during young adulthood.

The primary purpose of this study was to determine whether participation in a prevention program that enhances supportive parenting will ameliorate the association between ACEs and prediabetes status. To address this question, secondary analyses were conducted on data from the SAAF randomized, controlled trial. SAAF was designed to mitigate the negative impact of life stress on rural African American youths by increasing supportive parenting processes. Recent observational studies show that a history of receiving supportive parenting has health benefits that help to mitigate some of the hormonal, metabolic, and cardiovascular changes that follow childhood adversity. Supportive parenting buffers the effects of low childhood socioeconomic status (SES) on proinflammatory signaling profiles (Chen et al., 2011), allostatic load (Brody et al., 2014a), and metabolic profiles (Miller et al., 2011b) in adulthood. SAAF has demonstrated stress-buffering capacities for a wide range of psychosocial outcomes. Its results include increases in self-control and decreases in both drug use and conduct problems. These outcomes remained detectable at least 2 years after participation in SAAF (Brody, 2016). SAAF also has favorable effects on several health-relevant biological processes, including inflammation (Miller et al., 2014), catecholamine levels (Brody et al., 2014b), and epigenetic aging (Brody et al., 2015), 8 years after participation in the prevention program. Accordingly, this study tested the hypothesis that exposure to ACEs would be associated with prediabetes status among young adults who had been assigned to the control condition but *not* among those who had been assigned to the SAAF condition.

2. Methods

2.1. Participants

Participants in the SAAF trial included 667 African American families who resided in nine rural counties in Georgia. Details of the original SAAF prevention trial are provided elsewhere (Brody et al., 2004). Briefly, a targeted youth from each family (mean age at pretest = 11.2, $SD = 0.34$) and the parent who had primary responsibility for the youth's care took part in data collections. At pretest, although the primary caregivers in the sample worked an average of 39.4 h per week, 46.3% lived below federal poverty standards. From the original sample of 667 youths, 500 were randomly selected, due to funding constraints, to participate in a collection of biological data at age 19; these data focused on hormonal assessments. At age 25, 408 of the subsample of 500 agreed to participate in a follow-up assessment by completing questionnaires. Of the 408 participants who completed questionnaires, 391 agreed to a blood draw for assaying of fasting blood glucose. One participant was excluded due to missing data on self-reported adverse childhood experiences. The remaining 390 participants constituted the sample in the present study. At age 11, 227 (62% of the original sample) of these participants had been assigned randomly to the SAAF condition and 163 (55% of the original sample) had been assigned randomly to the control condition. The attrition rates in the control and the SAAF conditions did not differ significantly. The original random assignment oversampled participants into the SAAF condition to ensure that the analyses involving the intervention condition would be adequately powered (see Brody

et al., 2004); this accounts for the greater number of 25-year-olds who had been assigned to the SAAF group. At age 11, parents gave written informed consent to their own and their minor youths' participation, and minor youths gave written assent to their own participation. Each family was paid \$100 after the assessment at pretest. At age 25, young adults gave written informed consent to their own participation, and each participant was paid \$160 after the assessment and blood draw. The University of Georgia's Institutional Review Board reviewed and approved all study procedures.

2.2. Intervention implementation

The SAAF prevention program consisted of seven consecutive, 2-hour weekly meetings held at community facilities, with separate parent and youth skill-building curricula and a family curriculum (see Brody et al., 2012 for a complete description, including a summary of efficacy findings). Parents in the prevention condition were taught the consistent provision of instrumental and emotional support, high levels of monitoring and control, adaptive racial socialization strategies, and methods for communicating about sex and alcohol use. Youths learned adaptive behaviors to use when encountering racism, the importance of forming goals for the future and making plans to attain them, and resistance efficacy skills. Approximately 70% of the families attended four or more sessions. During the weeks when the intervention families participated in the prevention sessions, the control families received three leaflets via postal mail that described adolescent development and provided tips for stress management and exercise promotion. Past intervention assessments showed no evidence of control participants' having received information provided to the SAAF participants. To preserve the random nature of the group assignments, the analyses reported here included all families who completed the pretest regardless of the number of prevention sessions that they actually attended (an intent-to-treat analysis). These families were retained in the analysis to preclude the introduction of self-selection bias into the findings.

2.3. Data collection procedures

All data were collected in participants' homes using a standardized protocol. A field researcher who was also a certified phlebotomist went to each participant's home to collect self-report data and to draw a blood sample to be used to assess prediabetes status.

2.4. Measures

2.4.1. Intervention status and gender

Intervention status and gender were dummy coded. SAAF participants were coded 1 and control participants were coded 0; male participants were coded 1 and female participants were coded 0.

2.4.2. Family socioeconomic disadvantage

Six dichotomous variables formed an index of socioeconomic disadvantage at age 11 that was used as a control in the data analyses. A score of 1 was assigned to each of the following: family poverty based on federal guidelines, primary caregiver unemployment, receipt of Temporary Assistance for Needy Families, primary caregiver single parenthood, primary caregiver education level less than high school graduation, and caregiver-reported inadequacy of family income. The scores were summed to form the index.

2.4.3. Adverse childhood experiences

Young adults reported adverse childhood experiences on the Adverse Childhood Experiences (ACEs) questionnaire (Felitti et al., 1998). An ACEs score was calculated by summing dichotomized *yes/no* responses across 10 ACEs categories indicating the presence or absence of particular adversities that participants may have experienced before the age of 18 years: living with someone who was mentally ill or

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